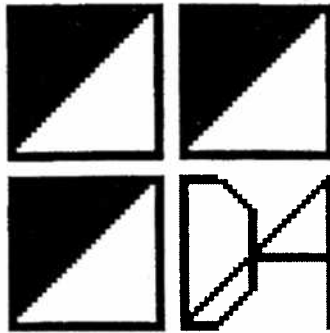


# INTERIM REMEDIAL MEASURES SYSTEM OPERATIONS, MAINTENANCE AND MONITORING MANUAL

Site Name:

Gowanda Day Habilitation Center  
4 Industrial Place  
Gowanda, New York  
Site No. V-00463-9

Prepared for:



Dormitory Authority of the State of New York  
And  
New York State Office of Mental Retardation and Developmental Disabilities



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Attachment 2: Substantive Air Discharge Requirements

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Attachment 6: Air/Summa Air Canister Sampling Procedure

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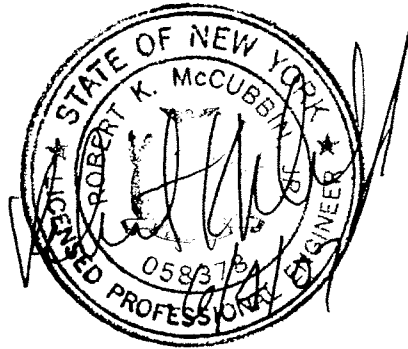
Attachment 10: SVE and GTS – General System Operation and Maintenance

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**Certification**

“I, Robert McCubbin, PE, residing at Bergmann Associates, Rochester, NY certify that at all pertinent times hereinafter mentioned was, a currently registered professional engineer; was the individual who had primary direct responsibility for the implementation of the subject remedial program; and that all requirements of the remedial program have been complied with.”



## **1.0 INTRODUCTION**

### **1.1 General**

The purpose of this Operations, Maintenance and Monitoring (OM&M) Manual is to summary activities necessary to maintain the Interim Remedial Measures (IRM) system at the New York State Office of Mental Retardation and Developmental Disabilities (OMRDD) Gowanda Day Habilitation Center (subject parcel). This IRM OM&M Manual has been prepared by Bergmann Associates (Bergmann) on behalf of OMRDD and the Dormitory Authority State of New York (DASNY). This Manual has been prepared in accordance with the Voluntary Cleanup Agreement signed by OMRDD on August 16, 2001 identified as Site No.V-00463-9.

The OMRDD has completed a Site Investigation (SI) and a Supplemental Site Investigation (SSI) of the subject parcel as part of a Voluntary Cleanup Agreement in accordance with the New York State Voluntary Cleanup Program (VCP) and the New York State Department of Environmental Conservation (NYSDEC).

The OMRDD is eligible to participate in the VCP as the volunteer since OMRDD is the present owner of the subject parcel, and is not known to have contributed to any impacted soil and groundwater at the site.

### **1.2 IRM System Product Specifications Manuals**

A separate set of manuals has been prepared that includes Product Specifications from Environmental Remediation & Recovery, Inc., the IRM system installation contractor. This includes parts lists and schematics on the skid-mounted treatment systems prepared by Bisco Environmental, the IRM system manufacturer.

## **2.0 BACKGROUND**

### **2.1 Site Location**

The Gowanda Day Habilitation subject parcel consists of a 5.94-acre parcel located at 4 Industrial Place in the Village of Gowanda, Cattaraugus County, New York. The location of the subject parcel is shown on Figure 1. The subject parcel was previously developed as the Gowanda Day Habilitation Center building, parking lots, access roads, landscaped yards and a garden. The building, previously used by several manufacturing operations, was built in stages between circa 1948 and 1987 and was renovated in 1987-1988. New York State agencies have occupied the building since 1982. New York State acquired the parcel in 1989. The subject parcel was most recently operated by the Western New York Developmental Disabilities Services Office (WNYDDSO) as a Day Habilitation Center for mental care clients. In April 2001, operations ceased at the facility, and services were relocated to alternate OMRDD locations. The building has been used for storage purposes since 2002, with no personnel assigned to the facility.

Industrial Place is a dead-end street less than a quarter mile in length. Gowanda Electronics, a manufacturing facility, is located on the east side of Industrial Place, across from the subject parcel. Residential properties are located along Torrance Place, north of the subject parcel. Commercial/industrial properties are located along Industrial Place to the east and southeast. Thatcher Creek, a small tributary to Cattaraugus Creek, delineates the western border. A railroad line and vacant land border the subject parcel to the south and southwest.

## **2.2 Site Description**

The Day Habilitation Center building consists of a single story slab-on-grade, approximate 56,000 square foot steel frame structure with aluminum siding expansions. The original building was of concrete block construction. As the facility expanded, slab-on-grade aluminum sided additions were constructed. Utility services (water, heat and electric) have been maintained.

There are parking areas of asphalt pavement on the north and south sides of the building. There is a dock on the northwest end of the building and a gravel/dirt access way from Torrance Place. This dirt drive follows the western border of the subject parcel back to the railroad tracks to the south. To the east is Industrial Place, providing two access ways to the subject parcel property, into the north and south parking areas.

## **3.0 INTERIM REMEDIAL MEASURES SYSTEM**

### **3.1 IRM Objectives**

The objectives of the IRM system are as follows:

- Minimize further migration of contaminated groundwater from underneath the building to down-gradient areas.
- Promote extraction of volatile organic compounds (VOCs) from the groundwater and subsurface soil associated with the site.
- Treat recovered groundwater to allow compliant discharges to the sanitary sewer system owned and operated by the Village of Gowanda.
- Treat extracted soil vapor to allow compliant discharges to the atmosphere as regulated by the New York State Department of Health (NYSDOH) and NYSDEC.
- Lower the VOCs from the indoor air inside the Day Habilitation Center to levels that will allow re-use of the facility.
- Allow for re-use of the facility with minimal disturbance or alterations to the building infrastructure.

Remediation goals are based on contemplated future site use consistent with the Voluntary Cleanup Agreement. In accordance with Paragraph F of Item II of the Voluntary Cleanup Agreement, the NYSDEC will determine, upon approval of the Final Investigation Report, whether further remediation will be required for the contemplated site use.

### **3.2 Applicable Standards, Criteria and Guidelines**

In order to identify potential exposure pathways, applicable standards, criteria and guidance (SCGs) need to be identified. For this review SCGs are categorized as compound specific, location specific and action specific. These categories are defined as the following:

#### **Identified SCGs**

The following SCGs have been identified as applicable to the Gowanda Day Habilitation subject parcel:

#### **Soil SCGs**

- NYSDEC Division of Hazardous Waste Remediation Technical and Administrative Guidance Memorandum (TAGM) 4046 (HWR-94-4046), “Determination of Soil Cleanup Objectives and Cleanup Levels”, Revised January 24, 1994.
- NYCRR Part 371, Identification and Listing of Hazardous Wastes.
- NYSDEC Division of Hazardous Substance Regulation Technical and Administrative Guidance Memorandum (TAGM) 3028, “Contained in Criteria for Environmental Media,” dated November 1992.

#### **Groundwater SCGs**

- NYCRR Part 700-705, Water Quality Regulations for Surface Water and Groundwater.
- NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1, “Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations”, Reissued June 1998, April 2000 Addendum.

#### **Indoor Air SCGs**

- The NYSDOH “Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes” ([http://www.health.state.ny.us/nysdoh/indoor/fuel\\_oil.htm](http://www.health.state.ny.us/nysdoh/indoor/fuel_oil.htm)), February, 2005. This document references petroleum-based aromatic VOCs along with select chlorinated VOCs.
- Draft “Guidance for Evaluating Soil Vapor Intrusion in the State of New York” ([http://www.health.state.ny.us/nysdoh/gas/svi\\_guidance](http://www.health.state.ny.us/nysdoh/gas/svi_guidance)), February, 2005. This document also includes decision matrices for actions to be taken for both petroleum-based aromatic VOCs along with chlorinated VOCs.



- NYSDOH Division of Environmental Health Assessment, Bureau of Toxic Substance Assessment “Indoor Air Sampling & Analysis Guidance”.

### **Waste SCGs**

- NYCRR Part 371, Listing of Hazardous Waste.
- NYSDEC Division of Hazardous Substance Regulation TAGM 3028, “Contained in Criteria for Environmental Media,” dated November 1992.

### **Design Standards**

The IRM system was designed to comply with local and NYS codes and standards, including but not limited to, the NYS mechanical and plumbing codes.

### **3.3 IRM System Description**

A groundwater pump and treat system (GTS) system and a soil vapor extraction (SVE) system are the major components of the IRM. The GTS portion of the system consists of six groundwater recovery wells (four dual phase recovery wells and two groundwater-only wells), an air compressor, a network of controller-less pneumatic pumps, and an air stripper treatment system to process recovered groundwater. The air compressor is located in the Machine Room with the air stripper skid. Each one of the six pneumatic pumps is self-regulating to discharge groundwater only when pump cavities are full. Pneumatic pumps require no electrical power source for operation other than the air compressor which delivers air to the pumps. The self-regulating operation eliminates the need for level controllers. The recovered groundwater is pumped back to the equalization tank to allow for settling of sediment and for transfer to the air stripper using a consistent flow rate. The air discharge from the air stripper is tied into the SVE vapor carbon vessels for treatment prior to discharge to the atmosphere.

The SVE system consists of a blower operated skid and a network of six SVE wells (four dual recovery wells and two SVE-only wells). The entrained vapors return to the SVE skid through a common transmission pipe, pass through a heat exchanger for conditioning and then through two vapor carbon adsorbers in series prior to atmospheric discharge. Typical SVE operation produces minimal condensate; however, the system is equipped with a condensate tank with a high level alarm and a transfer pump.

The IRM system consists of the following components:

- ∞ Interior recovery well network:
  - Four dual phase groundwater and soil vapor extraction wells.
  - Two groundwater only extraction wells.
  - Two soil vapor extraction wells.

- ∞ Soil Vapor Extraction System:
  - Conveyance piping from six wells to the Soil Vapor Extraction Treatment Skid.
  - 12 H.P. blower unit.
  - Condensate Knockout Separator.
  - Condensate removal pump.
  - Heat Exchanger.
  - Discharge silencer.
  
- ∞ Groundwater Treatment System, skid-mounted, consisting of:
  - Conveyance piping from six wells to the air stripper unit.
  - Equalization collection tank.
  - Low profile air stripper.
  - Transfer and discharge pumps.
  
- ∞ Soil Vapor Treatment System, consisting of:
  - Two 2,000 pound activated carbon adsorbers.

The GTS system and SVE system are configured so that they may operate independent of each other. The network of recovery wells and groundwater monitoring wells are shown on Figure 2.

After treatment by the air stripper, the groundwater is discharged to the Village of Gowanda sewage treatment Plant (POTW) via the sanitary sewer in accordance with a Sewer Use Permit. The Sewer Use Permit is provided as Attachment 1. The Village of Gowanda requires that an annual discharge report be submitted, detailing the volume of water collected, treated and discharged to the sewer.

Treated air discharges and the exhaust stack were designed referencing The DEC Policy System Program Guide – DAR-1. The IRM substantive air discharge requirements are provided in Attachment 2.

### **3.4 Design Basis**

- Utilize proven and reliable technologies.
- Pre-fabricated systems to the greatest extent possible.
- Discharge treated groundwater to the building's sanitary sewer system, with approval to discharge from the Gowanda POTW.
- Utilize the facility's existing electrical and HVAC systems, with minimal disturbance.
- Utilize the building's existing mechanical workshop area for location of treatment systems.

### **3.4.1 Groundwater Recovery Radius of Influence**

Modeling for groundwater flow and for off-site containment at the northern property line was determined using the Flowpath II 2-D Groundwater Flow and transport Modeling Software, purchased from and used under license from Waterloo Hydrogeologic, Inc. Version 1.3.2 for Windows® 95 was utilized. Hydraulic containment was determined visually through particle tracking and lines of flow using the output feature of Flowpath II.

Sampling and laboratory analysis on groundwater samples has occurred between 2002 and 2005. A summary of total VOCs detected in previous groundwater sampling events is presented in Table 1. The distribution of detected VOCs from the October 2004 groundwater sampling event is shown on Figure 3.

#### **Flowpath II Model Settings**

Groundwater characteristics were determined using depth to water values obtained on October 19, 2004. Delineation of the local water table surface and groundwater flow pattern was determined using elevations measured at 21 monitoring wells. Measurements were taken prior to activation of the IRM system. Equipotential lines representing areas of equal water table elevation values were prepared. The October 2004 local groundwater mapping shows a local flow pattern similar to the regime observed in 2002 and 2003. The local groundwater is flowing in a northerly direction. Torrance Place is hydraulically down-gradient from the Day Habilitation Center building. In October 2004 depths to groundwater ranged from 2.84 feet below ground surface at MW-10 to 10.93 feet below ground surface at MW-6. The average depth to groundwater was 8 feet below ground surface. The October 2004 water table surface and groundwater flow regime is shown on Figure 4.

Subsurface features beneath the building footprint, possibly building foundations, appear to retard and deflect groundwater movement in the vicinity of interior monitoring wells MW-11 to MW-14. Thatcher Creek appears to affect groundwater movement west of the subject parcel.

The hydraulic conductivity across the site is assumed to be consistent, except that the aquifer thickness decreases to the north. Zones of equal hydraulic conductivity were established based on values determined via slug testing conducted as part of the site investigation. Vertical and horizontal hydraulic conductivity (k) were estimated to be the same within each zone. The following hydraulic conductivity and aquifer characteristics used in the Flowpath II model:

- Site-wide hydraulic conductivity (k) = 3.504 ft/day
- Hydraulic gradient: 0.023 feet/ft based on measurements obtained in December 2002.

Aquifer thickness: The saturated thickness of the aquifer (based on measurements obtained in December 2002) ranges from 3.2 feet to 13.2 feet. Values at MW-12, at the approximate center of the groundwater plume, were used to establish aquifer parameters for the model. The base of the aquifer was set at 761.67 feet, with an approximate saturated thickness of 10.27 feet. The top of the aquifer was set at ground surface at MW-12, approximately 779 feet.

**TABLE 1**  
**SUMMARY OF TOTAL DETECTED VOCs**  
**2002 – 2006 SAMPLING EVENTS**

<b>Monitoring Wells</b>	<b>Oct 2006 Total VOCs PPB</b>	<b>Nov 2005 Total VOCs PPB</b>	<b>Oct 2004 Total VOCs PPB</b>	<b>July 2003 Total VOCs PPB</b>	<b>Aug-Sept 2002 Total VOCs PPB</b>
MW-12	1,082	4,776	6,900	12,146	12,643
MW-11	2,600	1,101	2,355	34,169	4,647
MW-1	1,769	1,128	1,25	2,879	768
MW-17	1,011	1,006	1,155	810	NA
MW-7	420	455.7	508.6	534.2	450
MW-18	392	375	460	158.7	NA
MW-21	NA	495.6	436	NA	NA
MW-15	149.9	271	320	257.5	730
MW-6	173	233	280	333.4	405.8
MW-16	51.2	65.4	82	38	NA
MW-14	293.9	139.9	67.4	140	315.2
MW-20	ND	ND	17	NA	NA
MW-19R	11.4	20.2	14	10*	NA
MW-5	ND	5.13	6.7	7.3	14
MW-3	ND	8.42	5.6	3.1	15
MW-13	ND	ND	ND	31	315.2
MW-2	ND	ND	ND	7.1	22.7
MW-4	ND	ND	ND	1.8	3.8
MW-8	ND	ND	ND	ND	1.4
MW-9	ND	ND	ND	ND	4.2
MW-10	ND	ND	ND	ND	2.6
<b>Recovery Wells</b>	<b>Oct 2005 Total VOCs PPB</b>	<b>Feb 2005 Total VOCs PPB</b>			
DR-1	573.4	8,000	NA	NA	NA
DR-2	549.2	2,003	NA	NA	NA
DR-3	153.5	1,467	NA	NA	NA
DR-4	829	1,760	NA	NA	NA
G-1	201	544	NA	NA	NA
G-2	203.4	385	NA	NA	NA

ND: Not Detected, all VOCs below Method Detection Limit.

NA: Not Applicable. These wells had not been installed or were not sampled.

\* The 2003 value for MW-19R is for well MW-19, removed in July 2003 and replaced with MW-19R

### **Groundwater Recovery Well Network:**

Six groundwater recovery wells were used with the Flowpath II model. The Flowpath II model assumes uniform well efficiencies, and does not include well diameter or screened interval as parameters. The recovery wells are assumed to draw groundwater from the entire aquifer thickness. The locations of the groundwater recovery wells are shown on Figure 2. Recovery Well construction details are provided in Attachment 3.

Pump rates were entered in U.S. gallons per minute (GPM). Hydraulic conductivity values were entered in feet/day. Distances were given in feet. Surveyed locations for all wells, including Northing and Easting, were entered to determine scale and locations.

The elevations for all observation and monitoring wells were entered relative to mean sea level. Actual water table measurements and actual pump rates at each recovery well were entered into the program on a monthly basis.

Initial water table elevations and aquifer thickness parameters were obtained from the December 2002 gauging event, and are to be up-dated monthly.

The average aquifer thickness was estimated to be approximately 9.22 feet thick based on May 2005 values. The model was adjusted to account for a decrease in aquifer thickness observed at the north property line. The local groundwater flowed in a northerly direction.

Figure 5 presents the Flowpath II model of the water table surface and flow nets for the area. Particle tracking was used to indicate radii of influence for each recovery well, and showed an area of influence and sufficient hydraulic containment to capture the plume of impacted groundwater and meet the IRM objectives.

**TABLE 2  
IRM RECOVERY WELL NETWORK SUMMARY**

Recovery Well	Targeted Pump Rate	Elevation, Top of PVC Well Casing	Total Well Depth	Depth to Groundwater May 10, 2005	Water Table Elevation May 10, 2005	Saturated Aquifer thickness, May 2005
DR-1	0.6-1.0 GPM	779.66	16.12	7.08	772.58	9.04
DR-2	0.2-0.5 GPM	779.93	18.06	8.77	771.16	9.29
DR-3	0.3-0.5 GPM	779.78	20.45	11.28	768.50	9.17
DR-4	0.4-0.5 GPM	779.64	19.69	11.72	667.92	7.97
G-1	0.3-0.5 GPM	779.83	22.98	11.98	767.85	11.00
G-2	0.5-1.0 GPM	779.72	20.72	11.88	767.84	8.84
SVE-1	NA	779.66	8.39	n/a	n/a	n/a
SVE-2	NA	779.91	8.63	n/a	n/a	n/a

GPM = gallons per minute

NA = not available: The 2 SVE wells do not extend below the water table surface, except during periods of seasonal high precipitation and a correspondingly high water table surface.

Pump rate modeling was also conducted using higher site-wide hydraulic conductivity values. Using slightly higher hydraulic conductivity values greater than 3.504 ft/day indicated that higher pump rates would be necessary to impact the plume at Gowanda Day Habilitation Center. The increased rates were below the system capacity of 20 GPM.

The air stripper tower was sized to treat a maximum of 20 GPM at the desired efficiency to allow for increased capacity. The EQ tank will hold up to 100 gallons prior to discharge to the air stripper.

The air compressor provides compressed air to operate the groundwater recovery pumps. The air compressor is sized to provide the required air pressure to operate each recovery pump. The compressed air lines are sized to provide the appropriate air pressure to each pump to obtain the scheduled water flow capacity required to lift groundwater into the main header conveyance line. Each ground water pump requires 0.58 SCF/gallon @ 80 psig to discharge an average water flow of 12 GPM. The main header is sized to effectively gravity-convey the groundwater to the groundwater treatment skid via gravity flow once the water is lifted to the main header.

### **Groundwater Treatment System Efficiency**

Based on groundwater concentrations of VOCs detected in 2002 and 2003, the initial VOCs, from the center of the VOC plume were assumed to exceed 10 PPM (10,000 PPB). Overall influent VOCs from the six groundwater extraction wells may be lower due to dilution from VOCs at the northern recovery wells, which are estimated to have lower voc concentrations in the 0.5 PPM TVOC range. The VOCs Trichloroethene (TCE, cis-1,2-Dichloroethene (cis-DCE), trans-1,2-Dichloroethene (trans-DCE) and Vinyl Chloride (VC) will be present. The treatment system was sized to have the capacity to treat influent total VOCs up to 10 PPM.

### **3.4.2 Soil Vapor Extraction System Area of Influence**

The locations of the six Soil Vapor Extraction Wells (4 dual recovery and two soil vapor-only recovery wells) are shown on Figure 2. The SVE conveyance lines are sized to maintain the required vacuum pressure (10" Hg) at each well in order to extract the required amount of vapor (200 CFM /well) from each of the six locations. The area of influence will be determined by the groundwater recovery component being able to depress the water table sufficiently to expose a greater vadose zone in which soil vapor will be recovered. As the IRM system operates on a continuous basis, the soil particles which are exposed above the groundwater table and that reside under the building foundation will be affected by the stripping nature of SVE system.

Area of influence was based on groundwater recovery rates, groundwater elevations and expected flow rates of the SVE system. The locations of the SVE and dual-phase wells were determined to provide coverage across the source area's highest concentration underneath the Day Habilitation Center. The orientation of the wells (in conjunction with the groundwater extraction points, will provide source removal (through the vapor phase) and also a negative gradient of air flow that aids in the prevention of soil gas from seeping into the building.

### **3.5 Support Facilities**

Utility services are available at the Gowanda Day Habilitation Center. Heat, telephone, electrical, HVAC and sanitary sewer services are maintained. Water service is available.

The loading dock on the west side of the building is accessible provides for the storage, shipping and unloading of components and supplies for the IRM system.

## **4.0 IRM SYSTEM OPERATION, MAINTENANCE AND MONITORING**

### **4.1 System Operation**

Summary of IRM System Operation:

- SVE wells – Recording level of vacuum and air leaks.
- Groundwater recovery wells – air supply to the pump, proper cycling of the pump, air leaks and water leaks.
- Dual-phase wells - air supply to the pump, proper cycling of the pump, air leaks, water leaks and level vacuum.
- Conveyance Piping – compressed air, SVE and groundwater piping from the wells to the mechanical room will be evaluated for leaks.
- Air compressor – proper operation, holding tank pressure, supply pressure and cycling per manufacturer’s specifications.
- SVE Skid - proper operation per manufacturer’s specifications, blower operation, condensation accumulation, condensate removal pump operation, noise level, heat exchanger temperature drop and discharge pressure. The discharge vapor going to the carbon adsorbers will be measured with a PID to determine order of magnitude VOC concentrations from the vapor phase.
- Water Treatment Skid - proper operation per manufacturer’s specifications, transfer pump operation, transfer pump discharge pressure, bag filter pressures, AST extraction pump operation, blower operation and blower pressure. The AST efficiency will be evaluated by collecting influent and effluent groundwater samples associated with the AST treatment process. The air discharge from the AST will be evaluated with the use of a PID by measuring the effluent vapor as it exits the AST.
- Carbon adsorbers – operating pressures, condensation accumulation and vapor flow rate to the discharge point.
- Discharge points – visual inspections for integrity and flows at the vapor effluent located on the roof and the treated groundwater discharge at the sanitary sewer connection point inside the building.

- Shutdown conditions – all alarm sequences will be tested for each of the components to assure that the system will shutdown as designed when an operational parameter reaches a defined set point.

## **4.2 Routine System Monitoring**

The Gowanda Day Habilitation Center building is to be checked for security purposes by OMRDD personnel Monday – Friday. Routine system monitoring are to include visual observations for proper operation and leak detection.

Qualified remediation systems operators will perform routine site visitations. This schedule will be evaluated as operation continues. During these site visits, the designated inspector will record operational parameters, perform visual inspections, sample system influent and effluent points at pre-determined frequencies and make system adjustments as necessary. Following the initial three month period, and pending stabilization of system parameters, this frequency will be adjusted to once per month. Copies of site inspection checklists are included in Attachment 5.

The IRM system will be monitored continuously for alarm conditions by a remote monitoring control device. This device will be programmed to call a series of contact phone numbers to annunciate specific alarm conditions. Alarms conditions will be programmed to shutdown various system components via interlocks as required by the specific conditions. The alarms scenarios that will be monitored by the remote device will include:

- SVE Skid High Level.
- SVE Skid High Temperature.
- SVE Skid High Discharge Pressure.
- SVE Skid Low Discharge Pressure.
- Water Treatment Skid EQ Tank High Level.
- Water Treatment Skid ATS Sump High Level.
- Water Treatment Skid General Shutdown.

## **4.3 Maintenance and Alarm Response**

Procedures to be followed for the maintenance and servicing of the Groundwater Treatment System and for the Soil Vapor Extraction System are provided in Attachment 4, which includes:

- Filter Bag Change-Out Procedure.
- Flooded Air Stripper Fan Draining Procedure.
- Air Stripper Tower Cleaning Procedure.

Site checklists to be included with the monthly reports are provided in Attachment 5. Actions to be taken in response to alarms are described on the Verbatim Alarm and Trouble Shooting Matrix, included with Attachment 5.



#### **4.4 IRM Operation Reporting**

A reporting program will be established that will include summaries of system operation site visits; results of influent and effluent sampling and analysis; and results of routine monitoring, sampling and laboratory analysis on groundwater wells.

IRM Progress Reports are to be prepared and submitted monthly.

More detailed operations, maintenance and monitoring is provided in Attachment 10.

### **5.0 SAMPLING AND LABORATORY ANALYSIS**

#### **5.1 Indoor Air Quality Testing Program**

An indoor air quality sampling and testing program will be implemented. The purpose of indoor quality testing is to evaluate the effectiveness of the IRM system in allowing re-use of the building with the reduction of indoor air concentrations of the VOCs detected at the site. The indoor air sampling procedures are provided in Attachment 6, Air/Summa Canister Sampling Procedure. The network of IAQ sampling points is shown on Figure 6.

A network of indoor air quality (IAQ) sampling points has been established. The network consists of 11 points where samples of indoor air are to be collected to evaluate the effectiveness of the IRM in meeting the goal of allowing the facility to be actively used and re-occupied. The 11 IAQ points are consistent with indoor locations sampled in 2000, and sampling at the same locations will allow for consistent data for comparative purposes.

#### **5.2 Groundwater Monitoring and Testing Program**

A network of 21 groundwater monitoring wells have been established at the Day Habilitation Site. The network includes up-gradient wells, down-gradient wells and a series of wells along Industrial Place that serve as "Sentry Wells" to monitor a separate occurrence of contaminated groundwater at the Gowanda Electronics site (NYSDEC Site 905025). The sampling frequency for the wells is summarized in Table 3. The well network is shown on Figure 2, Groundwater Well Location Map. Well construction, elevations for top of well casing and well depths for the monitoring wells are summarized in Table 4. Groundwater Monitoring Forms and Well Development Forms are included in Attachment 5.

Groundwater monitoring and analysis is to include both monitoring well samples and also Groundwater Treatment System influent and effluent samples to allow for tracking of the efficiency of the system.

### 5.3 Groundwater Sampling and Laboratory Analysis

The network of groundwater monitoring wells is used to periodically collect samples for groundwater evaluation of quality. Groundwater Monitoring and Development Forms to be used at the Gowanda project site are provided in Attachment 5.

The Groundwater Sampling Procedures are provided in Attachment 7. Groundwater samples will be collected on a quarterly basis. The annual event (to rotate on a quarterly basis) is to include all 21 groundwater monitoring wells. For the remaining three quarterly sampling events, 19 of the 21 groundwater wells are to be sampled. One of the three designated up-gradient wells (MW-8, MW-9 and MW-10) which historically have not been impacted are to be included in the quarterly events.

For quality control and quality assurance purposes, one duplicate groundwater sample, one field blank – rinse water sample and one trip blank sample are to be collected during the groundwater sampling events.

All samples are to be submitted via chain-of-custody protocol to a NYSDOH certified environmental laboratory for analysis for volatile organic compounds via U.S. EPA Method 8270. Reporting is to be standard deliverable package.

#### Laboratory Analysis

The laboratory analysis on monitoring well samples and groundwater influent and effluent samples is to be via U.S. EPA Method 8260. The following five targeted halogenated VOCs are to be included in the analysis:

- Trichloroethene (TCE).
- 1,1,1 Trichloroethane (TCA).
- Cis-1,2-Dichloroethene (Cis-DCE).
- Trans-1,2-Dichloroethene (Trans- DCE).
- Vinyl Chloride (VC).

**Table 3**  
**Monitoring Well Designation and Sampling Frequency**

<b>Type of Monitoring Well</b>	<b>Monitoring Wells in this Group</b>	<b>Sampling and Analysis Frequency</b>
Up-gradient	MW-8, MW-9, MW-10	Annual (1 well to be sampled quarterly)
On-site, Exterior	MW-1, MW-2, MW-3, MW-5, MW-6, MW-7, MW-16, MW-17, MW-18	Quarterly
On-site, Interior	MW-11, MW-12, MW-13, MW-14, MW-15	Quarterly
Sentry	MW-4, MW-19R, MW-20,	Quarterly

**Table 4  
Groundwater Monitoring Well Construction Summary**

<b>Monitoring Well</b>	<b>Date Installed</b>	<b>Elevation, top of PVC Casing</b>	<b>Total Well Depth, feet</b>
MW-1	07/31/2002	778.23	16.02
MW-2	07/25/2002	778.08	17.15
MW-3	07/12/2002	778.38	16.30
MW-4	07/11/2002	778.43	15.78
MW-5	07/31/2002	778.61	13.95
MW-6	07/30/2002	781.10	22.88
MW-7	07/30/2002	780.94	21.80
MW-8	07/24/2002	781.33	17.65
MW-9	07/11/2002	782.61	20.96
MW-10	07/10/2002	780.02	19.42
MW-11	07/17/2002	778.58	15.48
MW-12	07/16/2002	778.50	17.38
MW-13	07/16/2002	778.39	17.40
MW-14	07/18/2002	778.43	18.15
MW-15	07/19/2002	778.38	19.80
MW-16	07/10/2003	780.43	23.26
MW-17	07/09/2003	779.85	25.18
MW-18	07/10/2003	776.39	25.00
MW-19-R	10/13/2004	774.20	17.67
MW-20	10/14/2004	778.04	14.75
MW-21	10/14/2004	774.76	15.82

Elevations are relative to mean sea level.  
 Total well depths are below top of well casing.  
 All wells are 2" in diameter and are constructed of PVC.

#### **5.4 Groundwater Treatment System Efficiency Sampling and Analysis**

Treated effluent from the groundwater treatment system is discharged to the local sanitary sewer system. This discharge is in accordance with a Village of Gowanda Sewer Use permit. The permit requires that the effluent be sampled for the five targeted VOCs. The Village of Gowanda Permit allows for a Total Toxic Organics (TTO) limit of 1.37 parts per million (1.37 ppm). A copy of the Sewer Use Permit is provided in Attachment 1.

The procedures to be followed for sampling of the GTS influent and post-treatment effluent sampling are described in Attachment 8.

#### **GTS Effluent Sampling and Analysis Frequency**

- Daily for first week of system operation.
- Weekly for Weeks 2 – 5 of system operation.
- Subsequently monthly for first year of operation.

Both untreated influent and post-air stripper effluent samples are to be collected. Samples are to be transported under chain-of-custody protocol to a NYSDOH-certified analytical laboratory for standard deliverable package.

After 12 months of operation, the Village of Gowanda may be petitioned for a reduction in GTS sampling to a quarterly basis.

## **5.5 Sub-Slab Soil Vapor Extraction System Efficiency**

### **Sampling Network**

A network of SVE Sub-Slab vacuum and sampling points has been established to evaluate the effectiveness of the SVE component of the IRM system. Each sub-slab vacuum and sampling point consists of a PVC pipe installed in a small diameter boring that fully penetrates the building floor, extending into the underlying soil. The pipe is sealed at the floor surface. Each sub-slab vacuum and sampling point can be used to determine if a vacuum is present, which is indicative of flow of air beneath the building slab to the nearest SVE extraction point.

The procedure for measuring the sub-slab vacuum to evaluate effectiveness of the SVE system is provided in Attachment 9. The network of sub-slab vacuum and sampling points is shown on Figure 6.

The vacuum at the sub-slab sampling points is to be monitored on a monthly basis. The vacuum is to be recorded using an “Omni-Guard III DPR” differential pressure recorder, with values recorded to 0.01” vacuum of water column.

Samples of recovered SVE will be collected on a regular basis. The initial sampling frequency will be on a monthly basis. After system performance has been determined and operational trends have been determined, sampling may be reduced to a quarterly (once every three months) with the approval of the NYSDEC.

SVE samples will consist of a grab-type instantaneous sample collected at the SVE vacuum pump, and at the post-carbon effluent sampling point.

Both samples will be submitted for laboratory analysis for the list of targeted chlorinated volatile organic compounds, via U.S. EPA Method TO-15.

## **6.0 CONTINGENCY MEASURES**

### **6.1 IRM System Efficiency Evaluation**

A program of regular monitoring and sampling of system influent and effluent along with regular groundwater sampling/analysis and also interior ambient air quality analysis will be conducted for on-going evaluation of the efficiency of the IRM System in meeting required goals.

Data will continue to be gathered to evaluate the existing IRM as the final remedial action. This evaluation will require monitoring and testing as part of the OM&M program. To demonstrate that the IRM satisfies requirements of a final remedial remedy, the following items need to be evaluated or demonstrated:

1. Indoor Air Quality (IAQ) levels within the building maintain acceptable levels for re-use. This requires sampling and analysis.
2. Laboratory analysis on groundwater samples at the north property perimeter and at down-gradient wells consistently show decreasing levels of VOCs. This requires quarterly sampling, which may be reduced in frequency with the concurrence of the NYSDEC and NYSDOH.
3. Demonstrate consistent decrease in the size of the plume beneath the building. This requires sampling and laboratory analysis.
4. Site monitoring and modeling shows that hydraulic containment of the highest area of impacted groundwater is consistently maintained.

### **6.2 IRM System Contingency Options**

Data will be gathered to evaluate the existing IRM as the final remedial action. If the existing IRM System does not meet the objectives as serving the final remedy, additional actions may be required to improve system performance. Modifications may include:

- Increased groundwater extraction rates from existing groundwater wells. The rate of groundwater recovery and water table depression at existing wells will be maximized. The GTS system may require modifications to treat groundwater beyond the original design of 20 gallons per minute. This may require installation of a larger equalization tank; larger or additional sediment filters; additional trays added to the air stripper; or installation of a larger blower.
- Installation of additional groundwater extraction wells. Additional wells can be installed at targeted locations either within the building or, focusing on down-gradient locations, such as the north property line or along the western access road, extending south from Torrance Avenue. Installation of additional recovery wells will require some trenching to install below-grade pneumatic lines (assuming pneumatic recovery pumps) and recovered groundwater conveyance lines.

- If necessary the SVE component of the IRM system can be operated at an increased vacuum to impact IAQ at a greater level. However, higher vacuums may result in up-take of groundwater and sediment into the system, which may require up-grades to the GTS, including additional sediment filters.
- Additional SVE extraction wells could be installed inside the building. Additional SVE wells, however, would need to be connected to the existing network of vacuum lines. Up-grades to the SVE skid may also be required, such as installing a blower with greater horsepower or capable of generating greater air flow and vacuum.

## **7.0 SITE MANAGEMENT PROGRAM**

### **7.1 Soils Management Program**

Subsurface contaminated soils exist at the subject property, limited to areas beneath the building slab (center portion of the building) and limited areas beneath the asphalt parking driveway south and north of the building. The subsurface soil at these areas has been impacted from past releases of the site-specific chlorinated solvents (south area near MW-1) or have become impacted by migration of impacted groundwater and subsequent volatilization and accumulation of VOCs into the soil (areas beneath the building slab and north driveway).

Areas of impacted subsurface soil are to be remediated through operation of the SVE system which is intended to remove VOCs from the soil for on-site recovery.

The purpose of the Soils Management Plan is to provide procedures for the screening, handling and disposal of subsurface contaminated soil that may be encountered during the operational life of the active treatment systems, when levels of residual VOCs in the soil may present unacceptable levels of exposure to workers or may require disposal criteria.

The Contaminated Soil Management Plan is provided as Attachment 11.

#### **Areas of Concern**

The three areas of impacted subsurface soil at the subject property consist of:

- Impacted areas directly beneath the building slab.
- Area of impacted soil at monitoring well MW-1, immediately south of the building, extending beneath the asphalt driveway to the south. This area terminates prior to the south property line/MW-2 area.
- The area immediately north of the building extending beneath the asphalt driveway and grass strip between MW-6 and MW-7. Areas east of MW-6 and west of MW-7 have been determined to meet applicable cleanup SCGs. The area of impacted subsurface soil extends north to the property line.

#### **Cleanup Objectives**

The NYSDEC has established recommended cleanup objectives for petroleum compounds and volatile organic compounds (VOCs) present in gasoline, and for semi-volatile organic (SVOCs) present in diesel fuel, fuel oil and lube oil. Recommended soil cleanup objectives for VOCs are listed in Table 1 of the NYSDEC Technical and Administrative Guidance (TAGM) HWR-4046, Determination of Soil Cleanup Objectives and Cleanup Levels<sup>1</sup>.

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<sup>1</sup> "Determination of Soil Cleanup Objectives and Cleanup Levels", New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation, Division of Technical and Administrative Guidance Memorandum HWR-92-4046, Revised January 24, 1994.

The cleanup objectives listed in HWR-94-4046 provide a basis to determine soil cleanup objectives at Federal Superfund, State Superfund and/or other responsible party sites at which a remediation program is warranted. The values listed in HWR 94-4046 are used to establish cleanup objectives at petroleum spill sites and unlisted waste sites. Actual site cleanup objectives are based on site specific criteria including impact to the environment, site use, remedial actions or institutional controls.

In June 2006 the NYSDEC issued Part 375 Remedial Program Soil Cleanup Objectives for public review. The draft contained revised cleanup objectives as part of changes to New York remedial programs<sup>2</sup>. Sub Part 375-6 contains Soil Cleanup Objectives for several tracks or categories, including unrestricted and several restricted use categories: Residential, Restricted-Residential, Commercial and Industrial. Lower cleanup objectives have been proposed for protection of ecological resources and protection of groundwater.

Each track contains detailed requirements for appropriate remedial programs, and corresponding tables for soil cleanup objectives based on protection of public health and protection of ecological resources. These scenarios take into account site-specific soil data and conditions.

The draft Regulations include Multi-Track Remedial Programs and Use-Based Soil Cleanup Objectives and explain how to calculate soil clean up objectives for the four Cleanup Tracks based on the intended use of the site:

Track 1: Unrestricted Use.

Track 2: Restricted use with generic soil cleanup standard.

Track 3: Restricted use with modified soil cleanup objective.

Track 4: Restricted use with site-specific soil cleanup objectives.

As of October 2006 the draft 375-6 Remedial Program Soil Cleanup Objectives had not been formally accepted or implemented but do provide guidance supplemental to the existing HWR TAGM 4046 Cleanup Objectives useful for evaluating potential contamination and re-use or cleanup objectives.

## **7.2 Institutional Controls**

Institutional controls have been established at the Gowanda Habilitation Center and will continue to be applicable while the facility is subject to oversight by the NYSDEC Voluntary Cleanup Program. These institutional controls include:

- Limited site access. The building is to remain vacant until an approved sub-slab depressurization system has been established or remediation activities achieve cleanup levels acceptable for site close-out.

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<sup>2</sup> NYSDEC Sub Part 375-6 Remedial Program Soil Cleanup Objectives, Revised Public Review Draft, June 14, 2006.



- The building will remain secure with active utilities and security alarms.
- Routine site visits will be conducted by OMRDD or authorized consultants/representatives on a regular basis.
- Filing and adhering to the environmental easement for the property.

### **7.3 Environmental Easement and Deed Restriction**

The intent of the environmental easement is to establish deed restrictions to allow for permanent tracking of the environmental conditions at the subject property, and to limit future site use and development. A draft Environmental Easement attached as Attachment 12.

Components of the environmental easement include:

- No need for installation of a sub-slab depressurization system as long as building remains vacant.
- Operation of a sub-slab depressurization system in the event the building is re-occupied and to operate until remedial conditions for site close-out have been achieved.
- Restricting future site use to commercial or industrial use.
- Summary of past environmental conditions at the subject property and remediation actions.
- Operate remediation systems until site close-out criteria have been achieved.

The conditions of the environmental easement are to be permanent, transferable to future property owners and applicable to future tenants or occupants at the property.

### **7.4 Engineering Controls**

Active engineering controls consist of remediation treatment systems located within the building. The active engineering controls consist of:

- Isolation and separate ventilation of the treatment room.
- Soil Vapor Extraction System.
- Groundwater Treatment System.
- Carbon treatment on air stream effluent prior to atmospheric discharge.

The treatment room within the building will be physically isolated to the remainder of the building. An independent ventilation system within the treatment room will prevent migration of fugitive VOCs from the Soil Vapor Extraction System and Groundwater Treatment System from migrating or accumulating in the Day Habilitation Center building.

On-going practices related to operation of the remediation systems include:

- Field Screening
- Monitoring for VOCs
- On-Site Staging and Covering
- Sampling and Testing
- No On-Site Re-use of contaminated soil above cleanup objectives
- Off-Site Disposal Criteria
- Prevent contact with contaminated soil adjacent to the building (MW-1 area, immediately north of the building, at beneath the building slab). Establish a Soils Management Program to include:
  - Field Screening for on-site excavation beneath or adjacent to the building.
  - Monitoring for VOCs.
  - On-Site Staging and Covering of any excavated, impacted soil.
  - Sampling and Testing.
  - No On-Site Re-use of contaminated soil above cleanup objectives.
  - Off-Site Disposal Criteria.

## **7.5 Site Closeout Criteria**

The active engineering controls consisting of the groundwater and treatment systems will continue to operate until site conditions meet conditions where a petition for site close-out and termination of remediation systems have been achieved. Criteria for petition for site close out would be based on several factors.

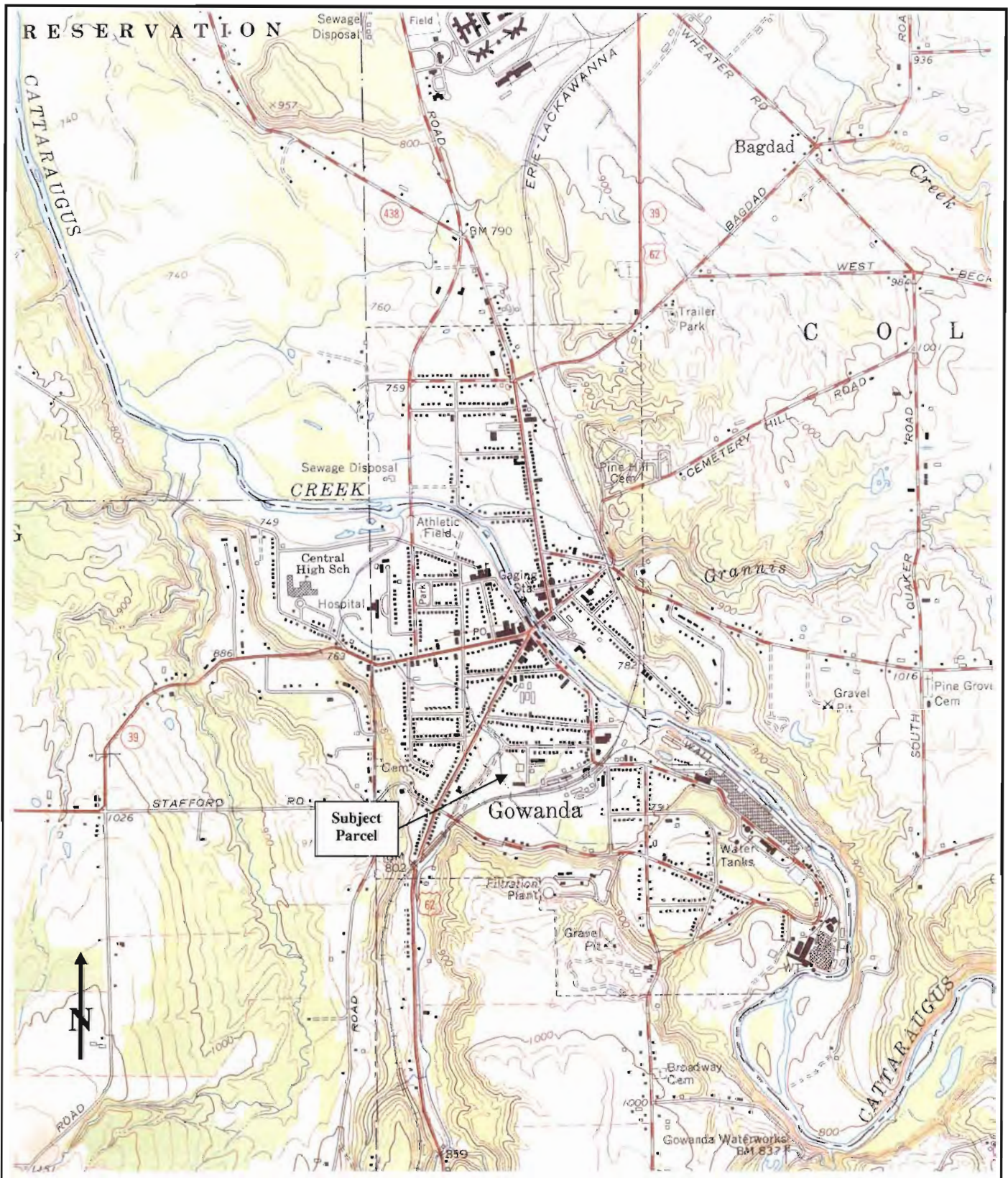
Applicable Standards, Guidance and Criteria (SCGs) have been reached for all impacted media for proposed industrial or commercial use.

- Groundwater quality achieves acceptable levels.
- Subsurface soil levels meet cleanup levels.
- Indoor vapors meet acceptable NYSDOH levels and migration of sub-slab vapors no longer result in vapor intrusion impact.

Continual operations of active treatment systems no longer obtain measurable reductions in residual contaminants in groundwater, subsurface soil or soil vapor. Residual contaminant levels approach asymptotic conditions. In such conditions the cost to operate treatment systems may no longer achieve improvements in residual contaminant levels,

Changes in site conditions no longer require operation of active systems. These would include

- Demolition of the building.
- Completion of targeted subsurface soil and/or groundwater removal.
- Implementation of institutional controls that limit site use and access.



**BERGMANN**  
associates

**GOWANDA DAY HABILITATION CENTER**  
**Gowanda, Cattaraugus County, New York**  
**Site Location Map**

USGS 7.5 Minute Topographic Map, Gowanda, NY Quadrangle, 1976  
 Scale: 1 inch = 2,000 feet

Date  
 January 2006

Figure  
**1**

**DASNY**  
**GOWANDA DAY**  
 HABILITATION CENTER  
 4 INDUSTRIAL PLACE  
 GOWANDA, NY



Engineers / Architects / Surveyors  
 200 First Federal Plaza  
 28 East Main Street, Rochester, New York 14614  
 585.232.5135 / 585.232.4652 fax

REVISIONS			
NO.	DATE	DESCRIPTION	REV. CKD

NOTE:  
 Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 145, Section 7209.



**MONITORING WELL AND RECOVERY WELL LOCATION MAP**

Project Manager:  
**G. FLISHNIK**  
 Designed by:  
**E. JONES**  
 Drawn by:  
**T. NAIM**  
 Checked by:  
**G. FLISHNIK**  
 Date Issued:  
**FEBRUARY 27, 2008**  
 Scale:  
**1"=80'**

Project Number: **5394.28** File Name: **I:\DASNY\5394.28 GOWANDA05-06\FIG02.DWG**  
 Drawing Number: **FIG-2**

**MONITORING WELLS & BORING LOCATIONS**

SAMPLE	NORTH	EAST	ELEVATION	DESCRIPTION
MW-1	10005.75	9770.81	778.51 778.52 778.23	ASPH. RIM PVC
MW-2	9983.26	9795.25	778.36 778.38 778.08	ASPH. RIM PVC
MW-3	10036.20	9859.98	778.59 778.61 778.38	ASPH. RIM PVC
MW-4	10085.20	9967.62	778.66 778.77 778.43	GRD. RIM PVC
MW-5	10243.23	9880.34	778.80 778.85 778.61	ASPH. RIM PVC
MW-6	10249.86	9795.88	778.93 781.35 781.10	GRD CASE PVC
MW-7	10249.65	9650.24	778.77 781.17 780.94	GRD CASE PVC
MW-8	10038.09	9649.08	778.49 781.75 781.33	GRD CASE PVC
MW-9	9945.36	9430.13	780.56 782.84 782.61	GRD CASE PVC
MW-10	9909.53	9724.56	777.46 780.10 780.02	GRD CASE PVC
MW-11	10041.23	9767.54	778.82 778.81 778.58	FLOOR RIM PVC
MW-12	10082.02	9799.74	778.84 778.85 778.50	FLOOR RIM PVC
MW-13	10082.09	9864.35	778.88 778.87 778.39	FLOOR RIM PVC
MW-14	10130.64	9734.67	778.80 778.82 778.43	FLOOR RIM PVC
MW-15	10190.80	9795.30	778.78 778.76 778.38	FLOOR RIM PVC
MW-16	10256.48	9607.09	778.17 781.05 780.43	GRD CASE PVC
MW-17	10250.56	9734.35	778.67 781.10 779.85	GRD CASE PVC
MW-18	10406.65	9675.18	776.73 776.65 776.39	GRD RIM PVC
MW-19	10436.35	9912.63	775.04 775.10 774.82	GRD RIM PVC
MW-19R	10432.32	10009.16	774.56 774.55 774.20	ASPH RIM PVC
MW-20	10248.05	9962.73	778.47 778.45 778.04	ASPH RIM PVC
MW-21	10493.88	9609.90	775.47 775.45 774.76	ASPH RIM PVC
B-16	9736.69	9324.99	782.23	GRD.
B-17	9795.99	9475.17	780.40	GRD.
B-18	9925.09	9623.75	777.55	ASPH.
B-19	9989.66	9965.74	778.30	ASPH.
B-20	10249.88	9964.03	778.36	ASPH.
B-21	10139.46	9644.31	774.51	GRD.
B-22	9853.67	9725.31	776.69	GRD.
B-23	9983.81	9724.83	778.50	ASPH.
B-24	10249.26	9732.76	778.88	GRD.
B-25	10079.30	9714.32	778.79	FLOOR
B-26	10154.35	9821.64	778.84	FLOOR
B-27	10187.79	9726.14	778.80	FLOOR
B-28	10196.32	9917.18	778.83	FLOOR

**RECOVERY WELL LOCATIONS**

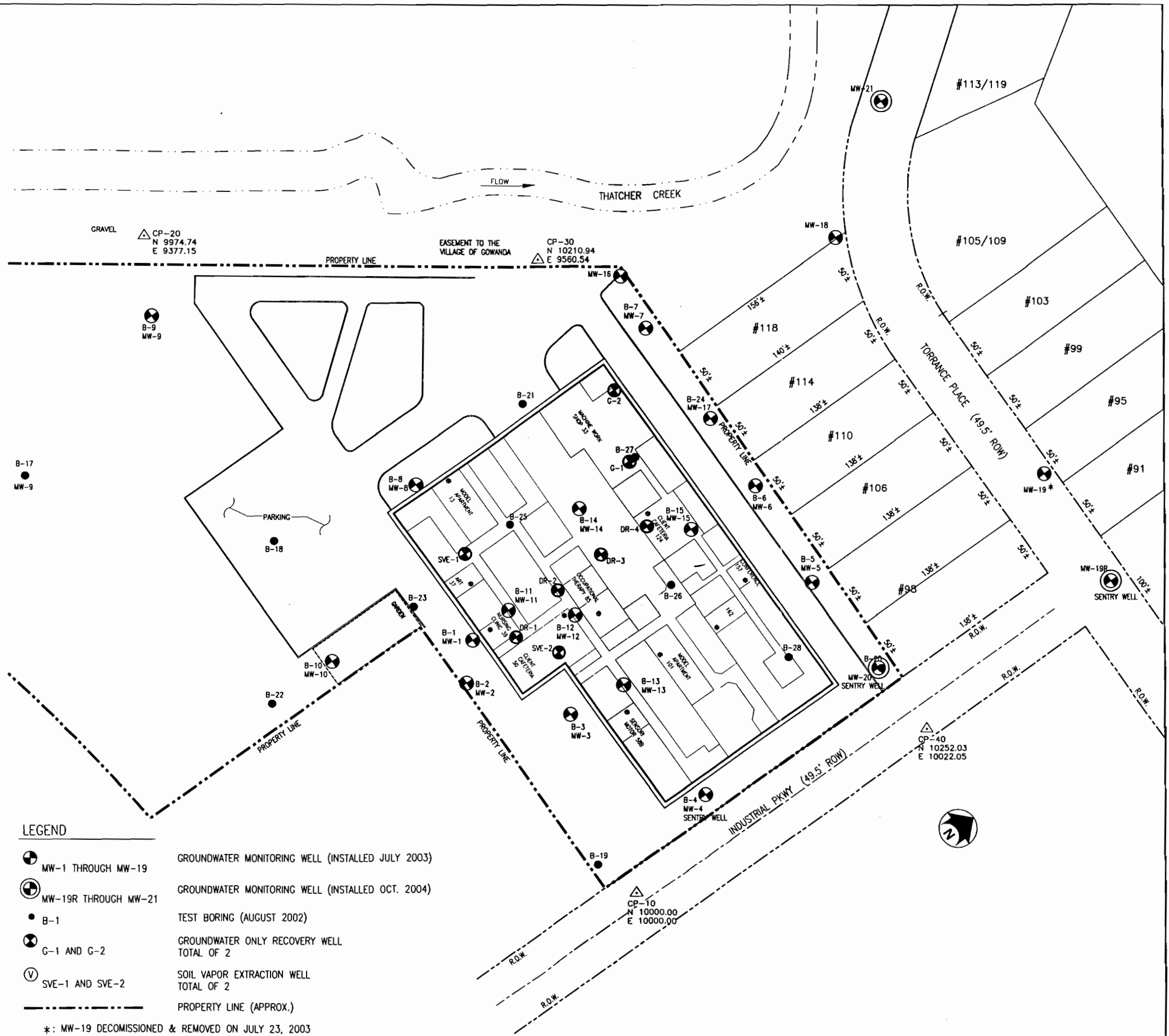
SAMPLE	NORTH	EAST	ELEVATION	DESCRIPTION
DR-1	10034.54	9787.80	778.81 779.66 779.69	FLOOR PVC RISER PVC CAP
DR-2	10081.63	9776.80	778.87 779.93 779.96	FLOOR PVC RISER PVC CAP
DR-3	10124.45	9773.02	778.83 779.78 779.81	FLOOR PVC RISER PVC CAP
DR-4	10164.98	9774.65	778.80 779.64 779.67	FLOOR PVC RISER PVC CAP
G-1	10182.25	9726.78	778.80 779.83 779.86	FLOOR PVC RISER PVC CAP
G-2	10203.62	9675.79	778.86 779.72 779.76	FLOOR PVC RISER PVC CAP
SVE-1	10038.31	9713.33	778.77 779.66 N/A	FLOOR PVC RISER PVC CAP
SVE-2	10055.47	9816.17	778.86 779.91 N/A	FLOOR PVC RISER PVC CAP

**LEGEND**

- MW-1 THROUGH MW-19 GROUNDWATER MONITORING WELL (INSTALLED JULY 2003)
- MW-19R THROUGH MW-21 GROUNDWATER MONITORING WELL (INSTALLED OCT. 2004)
- B-1 TEST BORING (AUGUST 2002)
- G-1 AND G-2 GROUNDWATER ONLY RECOVERY WELL TOTAL OF 2
- SVE-1 AND SVE-2 SOIL VAPOR EXTRACTION WELL TOTAL OF 2
- PROPERTY LINE (APPROX.)

\*: MW-19 DECOMMISSIONED & REMOVED ON JULY 23, 2003

NOTE:  
 BASEMAP INFORMATION FROM MAP ENTITLED "SURVEY OF PART OF LOT 27, TOWNSHIP 6, RANGE 8-VILLAGE OF GOWANDA, CATTARAUGUS COUNTY, NEW YORK" PREPARED BY KREHBIEL ASSOCIATES, DWG# D-2297, DATED 6-16-92



# DASNY

GOWANDA DAY  
HABILITATION CENTER  
4 INDUSTRIAL PLACE  
GOWANDA, NY



**BERGMANN**  
associates  
Engineers / Architects / Surveyors

DRAWING TITLE:  
**OCTOBER 2004  
GROUNDWATER  
ANALYTICAL RESULTS  
SUMMARY POSTING**

BY:  
**J. JEFFERS**

CHK'D BY:  
**E. JONES**

DRAWING DATE:  
**JANUARY, 2006**

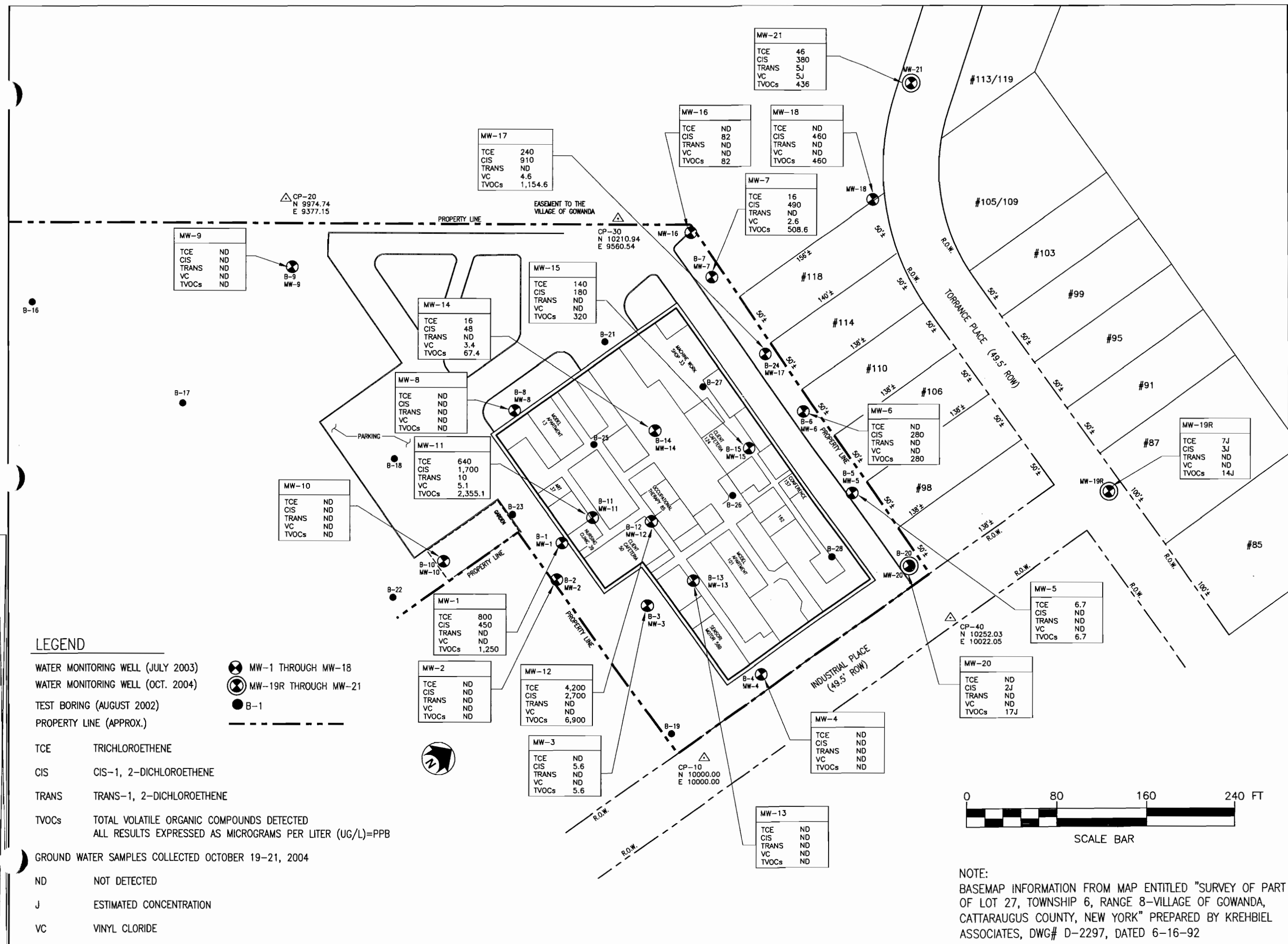
JOB #:  
**5596.28**

SHEET #:  
**FIGURE 3**

C:\ENVIRONMENTAL\4996.01\DRAWINGS\OCTOBER2004\FIG3.DWG

SCALE: 1" = 80'

# FIG-3



NOTE:  
BASEMAP INFORMATION FROM MAP ENTITLED "SURVEY OF PART OF LOT 27, TOWNSHIP 6, RANGE 8-VILLAGE OF GOWANDA, CATTARAUGUS COUNTY, NEW YORK" PREPARED BY KREHBIEL ASSOCIATES, DWG# D-2297, DATED 6-16-92



DRAWING TITLE:

**WATER TABLE SURFACE  
& GROUNDWATER FLOW  
MAP, OCTOBER 2004**

BY:  
**J. JEFFERS**

CHK'D BY:  
**E. JONES**

DRAWING DATE:  
**JANUARY, 2006**

JOB #:  
**5596.28**

SHEET #:  
**FIGURE 4**

I:\ENVIRONMENTAL\4696.01\DRAWINGS\OCTOBER04\FIG4.DWG

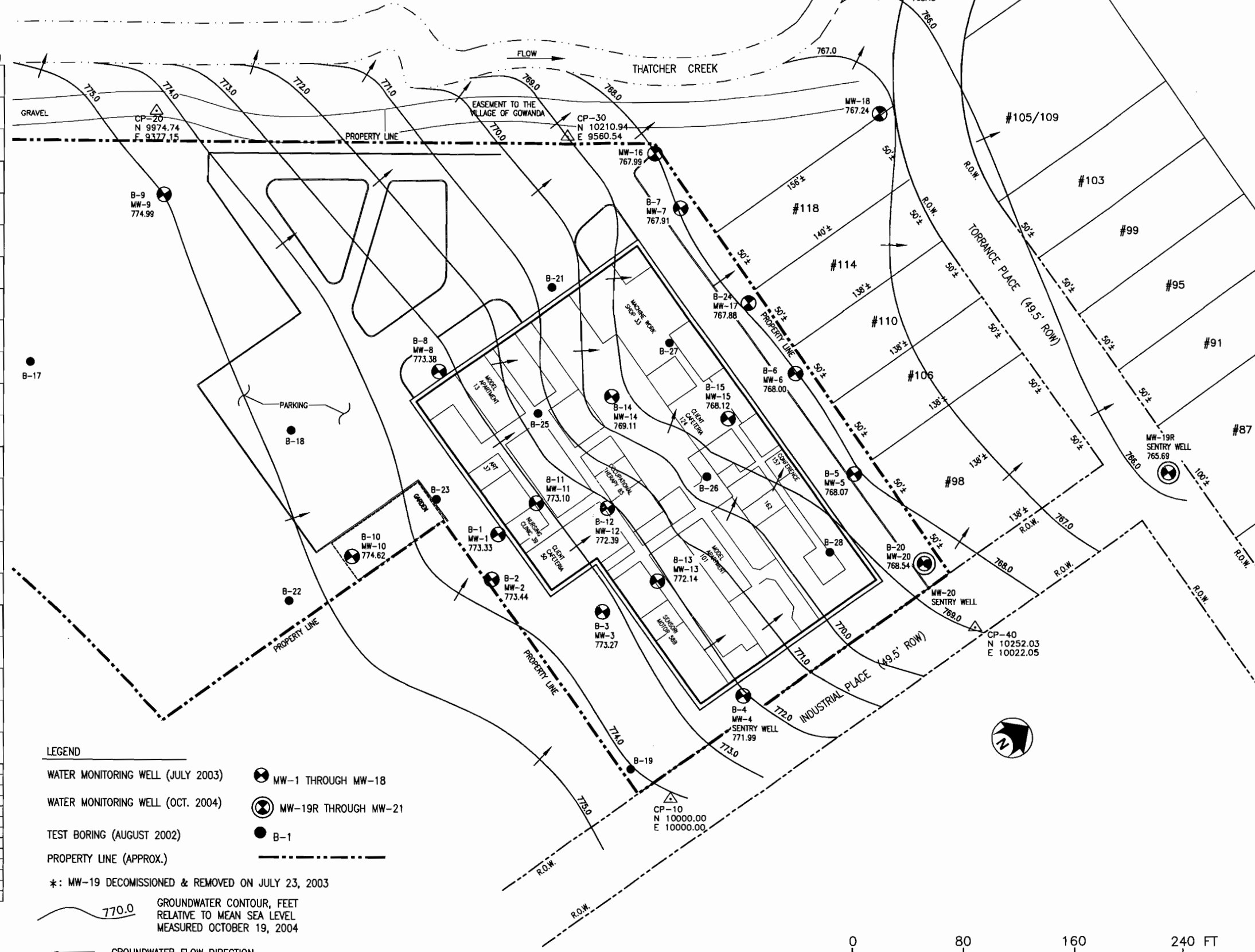
SCALE: 1" = 80'

**MONITORING WELLS & BORING LOCATIONS**

SAMPLE	NORTH	EAST	ELEVATION*	DESCRIPTION
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MW-4	10085.20	9967.62	778.66 778.77 778.43	GRD. RIM PVC
MW-5	10243.23	9880.34	778.80 778.85 778.61	ASPH. RIM PVC
MW-6	10249.86	9795.88	778.93 781.35 781.10	GRD CASE PVC
MW-7 B-17	10249.65	9650.24	778.77 781.17 780.94	GRD CASE PVC
MW-8	10038.09	9649.08	778.49 781.75 781.33	GRD CASE PVC
MW-9	9945.36	9430.13	780.56 782.84 782.61	GRD CASE PVC
MW-10	9909.53	9724.56	777.46 780.10 780.02	GRD CASE PVC
MW-11	10041.23	9767.54	778.82 778.81 778.58	FLOOR RIM PVC
MW-12	10082.02	9799.74	778.84 778.85 778.50	FLOOR RIM PVC
MW-13	10082.09	9864.35	778.88 778.87 778.39	FLOOR RIM PVC
MW-14	10130.64	9734.67	778.80 778.82 778.43	FLOOR RIM PVC
MW-15	10190.80	9795.30	778.78 778.76 778.38	FLOOR RIM PVC
MW-16	10256.48	9607.09	778.17 781.05 780.43	GRD CASE PVC
MW-17	10250.56	9734.35	778.67 781.10 779.85	GRD CASE PVC
MW-18	10406.65	9675.18	776.73 776.65 776.39	GRD RIM PVC
MW-19	10436.35	9912.63	775.04 775.10 774.82	GRD RIM PVC
MW-19R	10432.32	10009.16	774.56 774.55 774.20	ASPH RIM PVC
MW-20	10248.05	9962.73	778.47 778.45 778.04	ASPH RIM PVC
MW-21	10493.88	9609.90	775.47 775.45 774.76	ASPH RIM PVC
B-16	9736.69	9324.99	782.23	GRD.
B-17	9795.99	9475.17	780.40	GRD.
B-18	9925.09	9623.75	777.55	ASPH.
B-19	9988.66	9965.74	778.30	ASPH.
B-20	10249.88	9964.03	778.36	ASPH.
B-21	10139.46	9644.31	774.51	GRAV.
B-22	9853.67	9725.31	776.69	GRD.
B-23	9983.81	9724.83	778.50	ASPH.
B-24	10249.26	9732.76	778.88	GRD.
B-25	10079.30	9714.32	778.79	FLOOR
B-26	10154.35	9821.64	778.84	FLOOR
B-27	10187.79	9726.14	778.80	FLOOR
B-28	10196.32	9917.18	778.83	FLOOR

\* ELEVATIONS ARE BASED ON MEAN SEA LEVEL

NOTE:  
BASEMAP INFORMATION FROM MAP ENTITLED "SURVEY OF PART  
OF LOT 27, TOWNSHIP 6, RANGE 8-VILLAGE OF GOWANDA,  
CATTARAUGUS COUNTY, NEW YORK" PREPARED BY KREHBIEL  
ASSOCIATES, DWG# D-2297, DATED 6-16-92



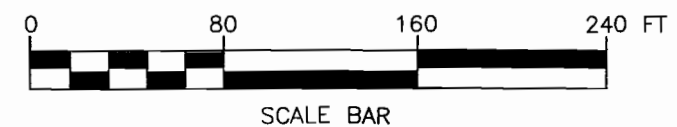
**LEGEND**

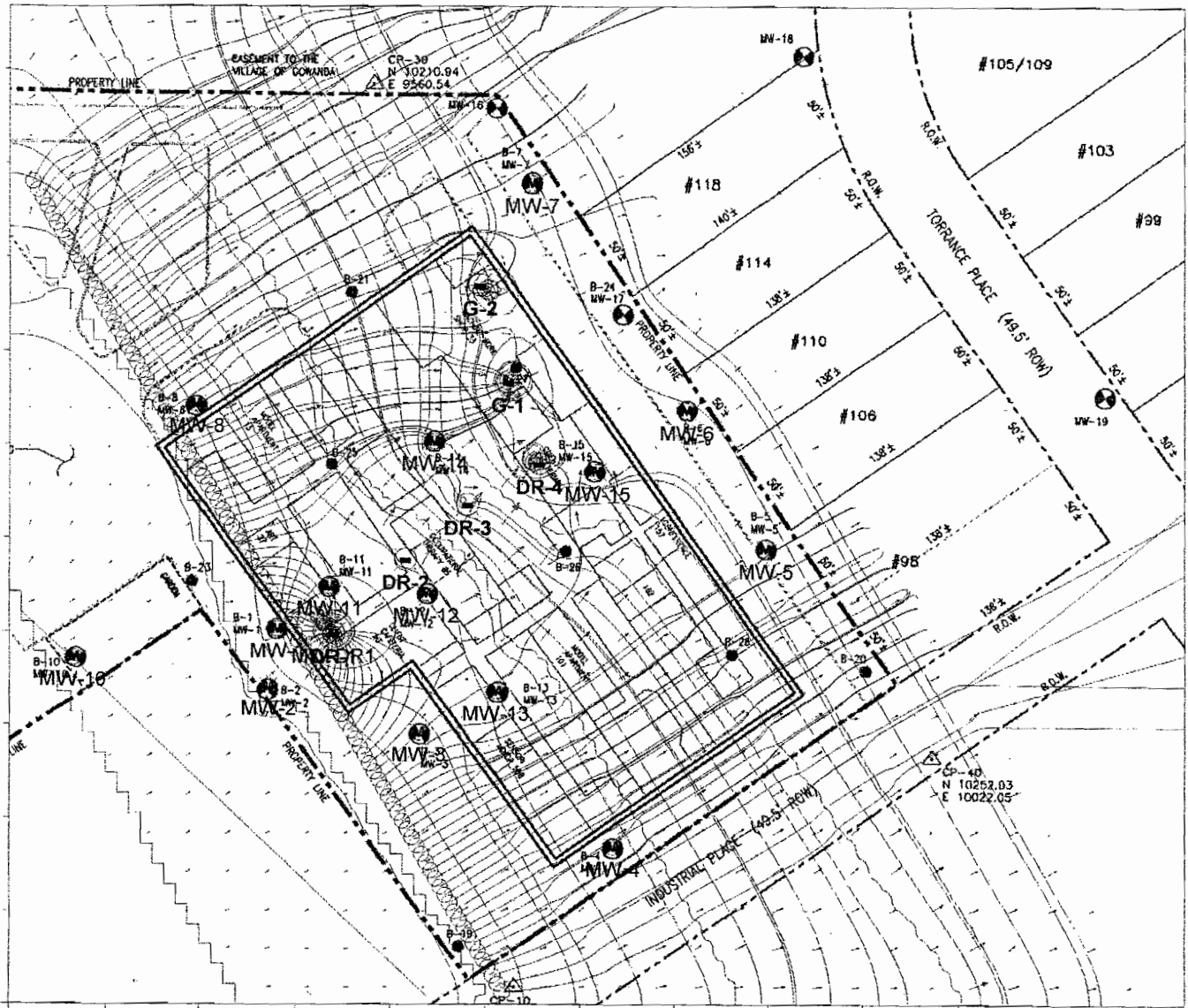
- WATER MONITORING WELL (JULY 2003) MW-1 THROUGH MW-18
- WATER MONITORING WELL (OCT. 2004) MW-19R THROUGH MW-21
- TEST BORING (AUGUST 2002) B-1
- PROPERTY LINE (APPROX.)

\*: MW-19 DECOMMISSIONED & REMOVED ON JULY 23, 2003

770.0 GROUNDWATER CONTOUR, FEET  
RELATIVE TO MEAN SEA LEVEL  
MEASURED OCTOBER 19, 2004

GROUNDWATER FLOW DIRECTION





**GOWANDA DAY HABILITATION CENTER**  
 Gowanda, Cattaraugus County, New York  
 Interim Remedial Measures Program  
 FlowPath II Version 1.1  
 Water Table Surface, Flow Net and Particle Tracking Model  
 System flow of 3.0 gallons per minute  
 Site wide hydraulic conductivity equal to 3.504 ft/day

Date  
 November 2005  
 Figure  
**5**  
 Job # 5596.28



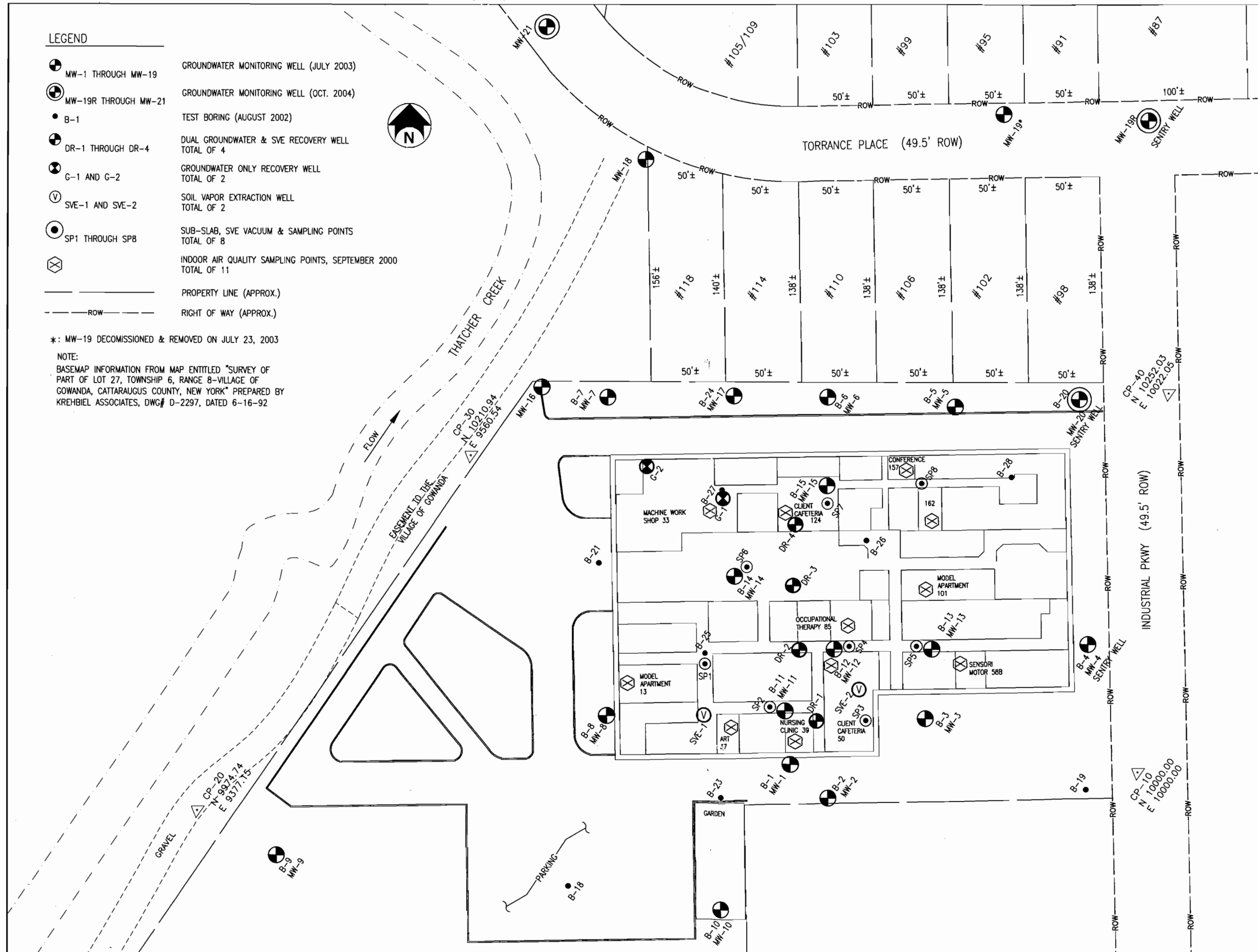
**LEGEND**

- GROUNDWATER MONITORING WELL (JULY 2003)
- GROUNDWATER MONITORING WELL (OCT. 2004)
- TEST BORING (AUGUST 2002)
- DUAL GROUNDWATER & SVE RECOVERY WELL TOTAL OF 4
- GROUNDWATER ONLY RECOVERY WELL TOTAL OF 2
- SOIL VAPOR EXTRACTION WELL TOTAL OF 2
- SUB-SLAB, SVE VACUUM & SAMPLING POINTS TOTAL OF 8
- INDOOR AIR QUALITY SAMPLING POINTS, SEPTEMBER 2000 TOTAL OF 11
- PROPERTY LINE (APPROX.)
- RIGHT OF WAY (APPROX.)

\*: MW-19 DECOMMISSIONED & REMOVED ON JULY 23, 2003

**NOTE:**

BASEMAP INFORMATION FROM MAP ENTITLED "SURVEY OF PART OF LOT 27, TOWNSHIP 6, RANGE 8-VILLAGE OF GOWANDA, CATTARAUGUS COUNTY, NEW YORK" PREPARED BY KREHBIEL ASSOCIATES, DWG# D-2297, DATED 6-16-92



**DASNY**  
**GOWANDA DAY**  
 HABILITATION CENTER  
 4 INDUSTRIAL PLACE  
 GOWANDA, NY

**B**  
**BERGMANN**  
 associates  
 Engineers / Architects / Surveyors

200 First Federal Plaza  
 28 East Main Street, Rochester, New York 14614  
 585.232.5135 / 585.232.4652 fax

REVISIONS			
NO.	DATE	DESCRIPTION	REV. CKD

**NOTE:**  
 Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 145, Section 7209.



**INDOOR AIR QUALITY AND SVE SUB-SLAB SAMPLING POINTS**

Project Manager: G. FLISNIK  
 Designed by: E. JOWE  
 Drawn by: J. JEFFERS  
 Checked by: G. FLISNIK  
 Date Issued: JANUARY, 2008  
 Scale: AS SHOWN

Project Number: 5596.28  
 File Name: \\ODIN:ENY\4696.01\JUNEDS\AIR QUAL  
 Drawing Number:

**FIG-6**

**Attachment 1**

**Village of Gowanda Sewer Use Permit**

**VOC GROUND WATER TREATMENT AGREEMENT**

This Agreement made this 24 day of March, 2005,<sup>OLD DATE</sup> by and between the following parties:

**VILLAGE OF GOWANDA, NEW YORK**

A Municipal Corporation with its principal place  
Of business located at 27 East Main Street  
Gowanda, New York 14070  
Hereinafter sometimes called "**Village**",  
Party of the First Part

AND

**New York State**

**Office of Mental Retardation and Developmental Disabilities**

With Offices located at 1200 East & West Roads  
West Seneca, New York 14224

Hereinafter sometimes called "**OMRDD**"

Party of the Second Part

**WHEREAS**, the **Village** has offered to treat in an environmentally sound manner the VOC Ground Water Extraction effluent generated in connection with a system installed by **OMRDD** to recover contaminated groundwater that is underground on the property owned by **OMRDD** as part of a voluntary clean-up Agreement with the New York State Department of Environmental Conservation; and

**WHEREAS**, the Village Board of Trustees of the Village of Gowanda has authorized a municipal Agreement for the treatment of the treated ground water at the Gowanda Sewage Treatment Plant pursuant to a resolution passed on March 22, 2005

**NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:**

1. **Service** The **Village** shall accept, treat, and dispose of in an environmentally sound manner Treated Ground Water generated at the **OMRDD** Facility owned and operated on 4 Industrial Place in the Village of Gowanda, provided:

- a) That the treated ground water is not regular sanitary waste water from the **OMRDD** Building;
- b) The treated groundwater discharge does not violate any requirements of the user permit or any type of regulations either from the New York State Department of Environmental Conservation or from the Environmental Protection Agency;
- c) That the gallons shall not exceed ten thousand (20,000) gallons per day;
- d) The discharge meets the limit set in the **OMRDD** User Permit dated March 24, 2005 or any future limits set by the **Village** or any other agency having jurisdiction.

**OMRDD** shall be responsible for any necessary testing. It will be the **OMRDD's** sole responsibility To safely deliver the leachate to the point where it enters the Gowanda Sewer Treatment System. **OMRDD** shall deliver no leachate to the Village Sewer lines which is hazardous waste, as now or hereinafter defined or listed by Federal, State or Local laws or regulations or would pose a threat to the Village employees or to the physical integrity of the **Village's** facility or in a way interfere with the operations of the sewage treatment plant. The **Village** has the right to test any discharge and reject any discharge which has any characteristics which render it untreatable at its facilities or might cause its discharge permit to be violated or which exceeds the parameters set by the Village, State or Federal Regulations. The failure of the **Village** to reject any such leachate shall not in any way relieve or diminish **OMRDD's** liabilities to the **Village** for any damages the **Village** may incur as a result of the discharge being in violation of any provisions of this paragraph.

2. **Payment** During this Agreement, the treatment rate shall be 1.95 per thousand gallons for the discharge from underground sources, which is the source of a voluntary clean-up agreement with the New York State Department of Environmental Conservation by the **OMRDD**. The rate of 1.95 per thousand may be changed on thirty (30) days notice to **OMRDD**.

Payment for the ground water treatment will be made by **OMRDD** on a quarterly billing by the Village of Gowanda Any future rate increases will be based on increased operation and maintenance expenses incurred by the **Village** to treat the leachate.

3. **Term.** This Agreement shall commence on March 24, 2005 and shall terminate on March 24, 2007 with the 1.95 per thousand gallons rate becoming the cost of treatment of the treated ground water provided the **Village** of Gowanda does not notify the customer, **OMRDD**, that a higher rate will apply. The **Village** of Gowanda reserves the right to terminate this Agreement in the event that there are any violations of any Village, State or Federal regulations. This Agreement is renewable for additional five (5) year periods, as long as **OMRDD** is subject to a referenced voluntary cleanup agreement with the Department of Environmental Conservation.

4. Reports/Monitoring.

4.1 **OMRDD** agrees to monitor its discharge as outlined in the permit at **OMRDD's** expense, issued by the **Village** of Gowanda. All monitoring expenses are to be paid by **OMRDD**.

4.2 Reports shall be submitted to the **Village** as required in the User Permit in a form suitable for direct submittal to any Regulatory Agency requiring report from the **Village** on **OMRDD's** ground water treatment discharge, (NYSDEC FROSI report form).

4.3 **OMRDD** shall monitor for all parameters required by DEC, EPA or the **Village**, and at the frequency requested by any of the above mentioned agencies or any other agency having jurisdiction over **OMRDD's** discharge. After one year of satisfactory operation **OMRDD** may petition the village for permit modifications.

4.4 If, as a result of **OMRDD's** discharge, the Village is required to do additional monitoring or reporting on the **Village** WWTP Discharge, **OMRDD** shall reimburse the Village for all cost required to do so.

5. **Indemnification** OMRDD shall indemnify and hold harmless the **Village** from any liability, claim, demand or judgment, including the cost of defense, arising from or relating to the **Village's** treatment of the discharge generated by OMRDD as described above, except to the extent any such liability, claim, demand or judgment is arising from or relating to the **Village's** acts or omissions.

Any responsibility for indemnification arising from any events occurring during the term of this Agreement that may be subject to indemnification under this paragraph shall not be affected by the termination of this Agreement.

6. **Statutory Compliance** OMRDD shall obtain all necessary State and/or Federal permits for the treatment and disposal of such discharge and any other permits or licenses for the proper performance of this Agreement. All statutory provisions applicable to this Agreement are hereby incorporated by reference.

If OMRDD's discharge does not meet limits set by the **Village**, EPA, DEC, or any other Regulatory Agency having jurisdiction over OMRDD's discharge, the **Village** may initiate enforcement actions, prohibit discharge, or impose a penalty of up to One Thousand (\$1,000.00) Dollars per day if OMRDD is determined to be in significant Non-Compliance in accordance with 40 CFR part 403.8 as follows:

- A) Chronic violations of waste-water discharge limit, when sixty-six (66%) percent or more of all measurements taken during a six (6) month period exceed the permit limit. For TTO, OMRDD would have to exceed the daily maximum of 1.37 mg/l more than one hundred twenty (120) days in a six (6) month period to be considered in SNC.
- B) Technical Review Criteria (TRC) violations, when thirty-three (33%) percent or more of all measurements taken during six (6) month period equal or exceed the permit limit multiplied by the applicable TRC factor (viz. 1.2 for TTO). For TTO, OMRDD would have to exceed 1.64 mg/l (1.37 x 1.2) more than sixty (60) days in a six (6) month period to be considered in SNC.
- C) Any violation that is determined to have caused POTW interference or pass through (including endangering the health of POTW's personnel or general public).
- D) Any discharge that causes imminent endangerment of human health, welfare or the environment or has resulted in the POTW's exercise of its emergency authority to halt or prevent such a discharge.
- E) Failure to meet within ninety (90) days after the schedule, a compliance schedule milestone required due to events, subject to Paragraph 6.

7. **Non-Discrimination**. The **Village** will not discriminate or permit discrimination against any individual or group on the grounds of age, race, creed, color, national origin, sex, religion, disability or marital status.

8. **Assignment**. This Agreement and the User Permit shall not be assignable to any other individual or agency without the explicit consent of the **Village** of Gowanda

9. **Amendments.** No waiver, modification or amendment of this Agreement or any part thereof shall be valid unless in writing and duly executed by both parties. A waiver of any breach hereof shall not prevent a forfeiture for any succeeding breach.

10. **Entire Agreement:** This Agreement contains the sole and entire agreement between the parties relating to the services provided hereunder and shall supersede any and all other agreements between the parties except user permits and attachment A dated March 24, 2005, or subsequent user permits. Any other statements or representations made by either party are void and have no force or effect.

11. **Binding Agreement** This Agreement shall apply to the current OMRDD operation as it is defined in the Gowanda Municipal Code Section 46.112E.

**IN WITNESS WHEREOF**, the parties have executed this Agreement as of the date first set forth above.

**VILLAGE OF GOWANDA**

BY: \_\_\_\_\_  
Richard L. Klancer / Mayor

DATED: \_\_\_\_\_

OMRDD

BY: \_\_\_\_\_  
Agency Representative

DATED: \_\_\_\_\_

State of New York)  
County of Cattaraugus) ss:

On this \_\_\_\_\_ day of \_\_\_\_\_, 2005, before me personally came RICHARD L. KLANCER, to me known who being by me duly sworn did depose and say that he resides in Gowanda, New York; that he is the Mayor of the Village of Gowanda, the corporation described in and which executed the within instrument; that he knows the seal of said corporation; that the seal affixed to said Instrument is such corporate seal; that it was so affixed by order of the Board of Trustees of said corporation and that he signed his name by like order.

---

Notary Public

State of New York)  
County of Cattaraugus) ss:

On this \_\_\_\_\_ day of \_\_\_\_\_, 2005, before me personally came BRUCE KOROTKIN, to me known who being by me duly sworn did depose and say that he resides at \_\_\_\_\_, and that he is \_\_\_\_\_ of OMRDD, the corporation which executed the within Instrument; that he knows the seal of said corporation; that the seal affixed to said Instrument is such corporate seal; that it was so affixed by Order of the Board of Directors of said corporation; and that he signed his name hereto by like order.

---

Notary Public

**SCHEDULE A**

**Specific And General Conditions to  
Industrial Discharge Permit #**

**Issued By**

**VILLAGE OF GOWANDA SEWER DEPARTMENT**

**To**

**NEW YORK STATE  
OFFICE OF MENTAL RETARDATION AND DEVELOPMENTAL DISABILITIES**



In accordance with the provisions in Chapter 46, Articles 4 & 5, of the Village of Gowanda Municipal Code, New York State Office Of Mental Retardation And Developmental Disabilities, hereinafter referred to as permittee, located at 4 Industrial Place, Village of Gowanda, New York, is hereby authorized to discharge Pretreated ground water from a remedial ground water treatment process from the above identified facility only through the outfall(s) identified herein into the Village of Gowanda's sewer system in accordance with the effluent limitations, monitoring requirements, and other conditions set forth in Section 1 (Specific) and Section 2 (General) and Section 3 (Enforcement) attached hereto and incorporated by reference herein as part of this permit.

Compliance with this permit does not relieve the permittee of its obligation to comply with all pretreatment regulations, standards or requirements under local, State and Federal laws, including any such laws, regulations, standards, or requirements that may become effective during the term of this permit.

Noncompliance with the terms and conditions of this permit shall constitute a violation of the Village of Gowanda Municipal Code.

This permit shall become effective March 23, 2005 and shall expire at midnight on March 23, 2007.

The permittee shall not discharge after the date of expiration. If the permittee wishes to continue to discharge after this expiration date, an application must be filed for reissue of this permit in accordance with the requirements of Chapter 46, Articles 4 & 5, of the Village of Gowanda Municipal Code, a minimum of 90 days prior to the expiration date.

#### ABBREVIATIONS

BOD	Biological Oxygen Demand
CFR	Code of Federal Regulations
COD	Chemical Oxygen Demand
Code	Village of Ocala Code of Ordinances
Superintendent	Superintendent of Public Works
EPA	Environmental Protection Agency (Federal)
mg/L	milligrams per liter (equivalent to ppm, or parts per million)
SNC	Significant Noncompliance
SOP	Standard Operating Procedures
TRC	Technical Review Criteria
TSS	Total Suspended Solids
TTO	Total Toxic Organics
WDP	Wastewater Discharge Permit
WWF	Wastewater Facility

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## SECTION 1. SPECIFIC CONDITIONS

### Part 1. Operation and effluent origins

#### a. Description and regulation of operation

New York State Office Of Mental Retardation And Developmental Disabilities with Offices located at 1200 East & West Roads, West Seneca, New York 14224 ("OMRDD") will operate a VOC Ground Water Extraction treatment system which will generate effluent in connection with such system installed by OMRDD to recover contaminated groundwater that is underground on the property owned by OMRDD located at 4 Industrial Place Gowanda, New York 14070 as part of a voluntary clean-up Agreement with the New York State Department of Environmental Conservation.

### Part 2. Effluent limitations

#### a. Outfall

1. During the permit period permittee is authorized to discharge treated ground water to the Village of Gowanda sewer system from the outfall(s) listed below.

Description of outfall 001:

Outfalls

Description

Building Sewer

At 4 Industrial Place Gowanda, N.Y.

2. The permittee shall apply in writing to the Superintendent for permission to discharge treated groundwater to any other outfall than indicated above. Reasons for the change and detailed plans and drawings of the proposed new outfall(s) must accompany the request.

#### b. Effluent limitations:

During the permit period the discharge from the outfall listed above shall not exceed the following effluent limitations. Effluent from outfall 001 consists of all origins listed in Section 1 of this WDP. Effluent from this outfall consists of treated groundwater.

Flow 20,000 GPD peak flow  
1.37 mg/l TTO

#### c. Modification of local limits

In accordance with the Municipal Code, the established local limits are subject to change and shall be modified as needed based on regulatory requirements and standards, WWF operation, performance and processes, the industrial user base, potable water quality and domestic wastewater characteristics. Modifications to the established local limits must be reviewed and approved prior to implementation. Implementation shall be effective 30 days from notice of acceptance of the modified limits. New local limits will be issued as an addendum to this wastewater discharge permit.

### Part 3. Operation and maintenance of pollution controls

#### a. Proper operation and maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the terms of this WDP. Proper operation and maintenance includes but is not limited to: effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the WDP.

b. Duty to halt or reduce activity

Upon reduction of efficiency of operation, or loss or failure of all or part of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with this WDP, control its production or discharges (or both) until operation of the treatment facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance of the WDP.

c. Bypass of treatment facilities

1. Bypass is prohibited unless it is unavoidable to prevent loss of life, personal injury or severe property damage or no feasible alternative exist.

2. Bypass not exceeding limitations. The permittee may allow bypass to occur which does not cause effluent limitations to be exceeded.

d. Notification of bypass

1. Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior written notice, at least ten days before the date of the bypass, to the Superintendent.

2. Unanticipated bypass. The permittee shall immediately notify the Superintendent and submit a written notice to the WWF within 5 days. This report shall specify:

- (i) A description of the bypass, and its cause and duration;
- (ii) Whether the bypass has been corrected; and
- (iii) The steps being taken or to be taken to reduce, eliminate or prevent a recurrence of the bypass.

Part 4. Sampling and monitoring requirements

a. Sample points

During the permit period the permittee shall collect samples and monitor the treated ground water discharge from the following sample points:

Outfall 001 described in Section 1 in this WDP.

This is the only sampling point that is approved by the Superintendent for the permittee's collection of samples.

b. Sampling and analysis; notification of sample collection

The samples collected by the permittee or its authorized representative shall be analyzed for the parameters listed in Section 1. Frequency and types of samples to be taken are indicated below:

Table I: Frequency and sampling type

Parameter	Sampling Location	Frequency	Sample Type
1,1,2 Trichloroethane	treatment system discharge	Note 1	grab
Trichloroethane	treatment system discharge	Note 1	grab
2,3 Dichloroethane	treatment syatem discharge	Note 1	grab
Vinyl Chloride	treatment system discharge	Note 1	grab
Flow			Continuous

1. Sampling shall occur daily for the first week. All samples taken during the initial system performance demonstration period shall be 6 hr. grab. After commencement of operation of the treatment system, sampling shall occur on a weekly basis for 4 consecutive weeks and thereafter on a monthly basis for the duration of this permit unless modified by the Village of Gowanda. After one year of acceptable system operations OMRDD may petition the village for monitoring modifications. Any monitoring modifications will require the concurrence of the NYS DEC.

2. Types of samples collected by the permittee or its authorized representative shall be as representative as possible of the volume and nature of the permittee's discharge throughout the daily period of system operation. All handling and preservation of collected samples shall be performed in accordance with 40 CFR Part 136 and any amendments thereto. The Village reserves the right to spot check sampling procedures by the permittee or the permittee's contract laboratory at any time.

c. Permittee's analytical laboratory

The permittee shall utilize a State of New York certified laboratory of its choosing for the purposes of complying with the requirements of this WDP. Certification must be current during the performance of a required analysis for each parameter measured. The permittee is directly responsible for ensuring the validity of all analytical measurements received from its laboratory as required by this WDP.

The Village will only accept analytical results that are performed by a laboratory certified by the State of New York for environmental analysis. Analytical measurements submitted by non certified laboratories or resulting from analysis of samples during periods of non certification for the analyte will be considered null and void and the facility will be considered as not having monitored for these parameters.

d. Sampling procedures

All sampling procedures shall comply with the requirements contained in 40 CFR Part 136.

If the permittee performs its own sampling, the permittee shall prepare a written description of its procedures and shall submitted such document to the Village. The Village may, at its option, observe the collection of the required

samples by the permittee to ensure that approved sampling methods are complied with in full. Failure to follow sampling procedures will result in the Village's rejection of the sample and any resulting analytical results that may be submitted by the permittee.

If the permittee's chosen laboratory performs the sampling for the permittee, the Village may, at its option, observe the collection of the required samples to ensure that approved sampling methods are complied with in full by the laboratory concerned. Failure to follow sampling procedures will result in the Village's rejection of the sample and any resulting analytical results that may be submitted by the permittee or its laboratory.

#### PART 5. Reporting requirements

##### a. Periodic compliance reports (PCR)

Annual compliance reports must be submitted to the Village by February 1 of each year.

- Annual compliance report information is to be submitted to the village on NYSDEC FROSI report forms.
- A copy of the original contracting laboratory's analysis, including all chain of custody forms.

The due date for submission of the PCR report and attachments is thirty days after the last day of the month in which the samples are required to be taken. If a report is submitted more than 30 days after the due date, the facility will be deemed to be in significant noncompliance (SNC) and appropriate enforcement proceedings will be initiated by the Village.

A report shall be considered incomplete and in violation of reporting requirements if it does not contain the above required information and attachments. Incomplete reports will be returned to sender.

##### b. Extra monitoring

If the permittee monitors its discharge for any pollutant more frequently than required by this WDP, using test procedures prescribed in 40 CFR Part 136 or any New York State regulation or amendments thereto, or otherwise approved by EPA or as specified in this WPD, the results of such monitoring shall be included in the calculation and results shall be reported in the PCR reports and submitted to the Superintendent.

##### c. Automatic re-sampling

If the results of the permittee's discharge analysis indicate a violation has occurred, the permittee must:

1. Inform the Superintendent within 24 hours of becoming aware of the violation, as defined in Section 3 of this WDP; and
2. Repeat the sampling and pollutant analysis for the parameter in violation and submit the results of the second analysis in writing to the Village within 30 days after becoming aware of the violation.

##### d. Accidental discharge report

The permittee shall notify the Superintendent immediately upon the occurrence of an accidental discharge of substances prohibited by the Municipal Code or any slug loads or spills that may enter the public sewer. During normal business hours, the Superintendent should be notified by telephone at 717-532-5931. At all other times, the

Superintendent should be notified by telephone at 716-913-1455 or 716-532-4077 after 4:30 p.m. Monday - Friday or weekends and holidays. The permittee shall inform the Superintendent of the location of discharge, date and time, type of waste, including concentration and volume, and corrective actions taken. The permittee's notification of accidental release in accordance with this section does not relieve it of other reporting requirements that arise under local, State, or Federal laws. Within five (5) days following an accidental discharge, the permittee shall submit to the Superintendent a detailed written report. The report shall specify:

1. Description and cause of the upset, slug or accidental discharge, the cause thereof and the impact on the permittee's compliance status. The description should also include location of discharge, type, concentration and volume of waste.
2. Duration of noncompliance, including exact dates and times of noncompliance, and if the noncompliance continues, the time by which compliance is reasonably expected to occur.
3. All steps taken or to be taken to reduce, eliminate, and prevent recurrence of such an upset, slug, accidental discharge, or other conditions of noncompliance.

e. Report Submission

The permittee shall submit all reports required by this WDP to the Superintendent at the following address:

Village of Gowanda  
27 East Main Street  
Gowanda, New York 14070

PART 6. Demand monitoring costs

Any required demand monitoring, inspections and surveillance deemed to be necessary as a result of a violation will be carried out by the Village and charged directly to the permittee at the Village's cost.

**SECTION 2. GENERAL REQUIREMENTS AND CONDITIONS**

PART 1. Compliance with applicable pretreatment standards and requirements

Compliance with this permit does not relieve the permittee from its obligations regarding compliance with any and all applicable local, State and Federal pretreatment standards, regulations, laws, and requirements including any that become effective during the term of this permit. This WDP shall be expressly subject to all provisions of the Municipal Code, as amended, and all other applicable codes and regulations.

PART 2. Duty to reapply

The permittee shall apply for permit re-issuance at least ninety (90) days, but no more than one hundred and eighty (180) days prior to the expiration of the permittee's permit. The permittee shall be informed of any proposed changes to the permit at least thirty (30) days prior to the effective date of change. Any changes or new conditions in the permit shall include a reasonable time schedule for compliance.

PART 3. Continuation of expired WDP

An expired WDP will continue to be effective and enforceable until the WDP is reissued if:

- a. The permittee has submitted a complete WDP application at least ninety (90) days prior to the expiration date of the permittee's existing WDP.



- b. The failure to reissue the WDP, prior to expiration of the previous WDP, is not due to any act or failure to act on the part of the permittee.

#### PART 4. Signatory requirements

All applications, reports, or information submitted to the Village of Gowanda must contain the following certification statement:

" I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

All reports required by this permit shall contain the name/title of a principal executive officer of the permittee, and shall be signed by the principal executive officer or his/her authorized representative. FAC 62-625.600(11)

#### PART 5. Right of entry

The permittee shall allow the Village or its representatives, exhibiting proper credentials and identification, to enter upon the premises of the permittee, at all reasonable hours for the purposes of inspection, sampling, or records inspection and duplication. Reasonable hours in the context of inspection and sampling includes any time the permittee is operating any process which results in a process wastewater discharge to the Village's WWF.

#### PART 6. Limitation on permit transfer

Discharge permits are issued to a specific permittee for a specific operation. They shall not be reassigned, or transferred, or sold to a new owner, new significant permittee, or transferred to a different premises without Village approval.

#### PART 7. Changed conditions

The permittee shall report to the Village prior to the introduction of new discharge any substantial change in the volume or characteristics of the wastewater being discharged into the WWF from the permittee's processes.

#### PART 8. Records retention

- a. The permittee shall retain and preserve for no less than three (3) years, any records, books, and documents, memoranda, reports, correspondence and any and all summaries thereof, relating to monitoring, sampling and chemical analyses made by or on behalf of the permittee in connection with its discharge.

- b. All records that pertain to matters that are the subject of special orders or any other enforcement or litigation activities brought by the Village shall be retained and preserved by the permittee until all enforcement activities have concluded and all periods of limitation with respect to any and all appeals have expired.

#### PART 9. Sample type and notification of sample collection

All samples shall be 24-hour (flow-proportioned or time-proportioned) composite samples where feasible, except VOC analysis, which are 6hr grab samples.

- a TTO Monthly Average:

The monthly average concentration is the sum of the concentrations of all daily discharges sampled and/or measured during a calendar month, divided by the number of daily discharges sampled and) or

measured during such month (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day.

- a. Daily Maximum: The daily maximum concentration is the highest value recorded

during the reporting period. PART 11. Recording results

For each measurement or sample taken pursuant to the requirements of this permit, the following information shall be recorded:

- a. The exact place, date and time of sampling;
- b. The dates the analysis were performed;
- c. The person responsible for performing the sampling or measurement.
- d. The person(s) who performed the analyses;
- e. The analytical techniques or methods used, and
- f. The results of all required analyses.

PART 11. Violation of notification and resample requirement

If sampling performed by permittee indicates a violation of any part of this Permit or Village Code, as amended, the permittee shall notify the Superintendent within 24 hours of becoming aware of the violation. The permittee shall repeat the sampling and analysis and submit both results of the analysis to the Superintendent within 30 days after becoming aware of the violation.

PART 12. Dilution

No permittee shall increase the use of potable or process water or in any way attempt to dilute a discharge as a partial or complete substitute for adequate treatment to achieve compliance with the limitations contained in the permit

PART 13. General prohibitive standards

The permittee shall not discharge wastewater to the sewer system:

- a. Any point source wastewater having a temperature greater than 65° Celsius (C) (150° Fahrenheit (F)) or which will inhibit biological activity in the treatment plant resulting in interference.
- b. Containing any gasoline, benzene, naphtha, fuel oil or other flammable or explosive liquids, solids or gases; and in no case pollutants with a closed cup flashpoint of less than 60° C (140 °F), or pollutants which cause an exceedance of 10 percent of the Lower Explosive Limit (LEL) at any point within the WWF.
- c. Any water having a pH less than 5.5 or greater than 10.5, or wastewater having any other corrosive property capable of causing damage or hazard to structures or equipment, or endangering Village personnel.
- d. Solids or viscous substances in amounts which will cause obstruction of the flow in the wastewater treatment facility resulting in interference, but in no case solids greater than one-half inch in any dimension.
- e. Any wastewater containing pollutants, including oxygen-demanding pollutants (BOD, etc.), released in a discharge at a flow rate and/or pollutant concentration which, either singly or by interaction with other pollutants, will cause interference with either the WWF, the collection system, or any wastewater treatment or sludge process, or which will constitute a hazard to humans or animals.
- f. Any wastewater in mixture which causes the temperature at the introduction into the WWF to exceed 40° C (104° F).
- g. Petroleum oil, nonbioderadable cutting oil or products of mineral oil origin in amounts which will cause interference or pass-through.
- h. Any pollutants which result in the presence of toxic gases, vapors or fumes within the WWF in a quantity which may cause acute worker health and safety problems.

- i. Any noxious or malodorous liquids, gases, solids or other wastewater which, either singly or by interaction with other wastes, are sufficient to create a public nuisance or a hazard to life, or prevent entry into the sewers for maintenance and repair.
- j. Any wastewater containing any radioactive wastes or isotopes.
- k. Stormwater, surface water, groundwater, artesian well water, roof runoff, subsurface drainage, swimming pool drainage, condensate, deionized water, non-contact cooling water, and unpolluted industrial wastewater, unless specifically authorized by the Superintendent.
- l. Any sludges, screenings or other residues from the pretreatment of industrial wastes.
- m. Any wastewater causing the treatment plant's effluent to fail a Village requirements.  
Any wastes containing detergents, surface active agents or other substances which may cause excessive foaming in the WWTP.
- n. Any discharge of chemicals used to dissolve grease.
- o. Any wastewater which imparts color which cannot be removed by the treatment process, such as but not limited to dye wastes and vegetable tanning solutions, which consequently imparts color to the treatment plant's effluent thereby violating the Village's operating permit.

#### PART 14. Flow measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitoring discharges. The devices shall be installed, calibrated, and maintained by the permittee to insure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than +1- 10% from the true discharge rates throughout the range of expected discharge volumes.

#### PART 15. Suspension/termination of service and/or permit

The Village may suspend discharge treatment service and/or the WDP when such suspension is necessary to stop an actual or threatened discharge which would endanger the health or welfare of persons or the environment, cause interference with WWF operations, cause sludge quality degradation, or cause the Village to violate any conditions of its operating permit. Conditions for termination of this permit include but are not limited to the following:

- a. Falsifying self-monitoring reports
- b. Tampering with monitoring equipment
- c. Refusing to allow timely access to the permittee's premises and records
- d. Failure to meet effluent limitations
- e. Failure to pay fines
- f. Failure to pay sewer charges, and
- g. Failure to meet compliance schedules.

#### PART 16. Duty to comply with permit conditions, falsifying information or tampering with monitoring equipment

The permittee must comply with all conditions of this permit. Any permittee who willfully or negligently fails to comply with provisions of this permit shall be subject to the imposition of penalties and appropriate recovery of costs by the Village. Any person who knowingly makes any false statements, representation or correction in any record, report, plan or other document filed pursuant to this permit, or who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required under this permit shall, upon conviction, be subject to the imposition of penalties prescribed by the Code or any other applicable local, State or Federal law.

#### PART 17. Modification or revision of the permit

The Superintendent may modify a WDP for good cause, including, but not limited to, the following reasons:

- a. To incorporate any new or revised Federal, State or local pretreatment standards or requirements;
- b. To address significant alterations or additions to the permittee's operation, processes, or discharge volume or character since the time of the WDP issuance;
- c. A change in the WWF that requires either a temporary or permanent reduction or elimination of the

- authorized discharge;
- d. Information indicating that the permitted discharge poses a threat to the Village's WWF, personnel, or the receiving waters;
- e. Violation of any term or condition of the permit;
- f. Misrepresentation or failure to fully disclose all relevant facts in the wastewater discharge permit application or in any required reporting;
- g. To correct typographical or other errors in the permit; or
- h. To reflect a transfer of the facility ownership or operation to a new owner or operator.

#### PART 18. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

### SECTION 3. ENFORCEMENT

#### PART 1. Notice of violation

Any violation of requirements including, but not limited to, discharge limits, sampling, analysis, meeting compliance schedules and regulatory deadlines, and reporting shall be considered as noncompliance for which the permittee is liable for enforcement, including penalties. The permittee shall respond to any notice of violation in writing within 30 days of the notice. This written notification shall include the reason for the violation(s), the actions taken to correct the violation(s) and what steps will be taken to prevent the violation(s) from occurring in the future.

#### PART 2. Significant noncompliance (SNC)

Violations shall be identified as those violations or patterns of violations by the permittee that are instances of Significant Noncompliance (SNC). The determination of SNC is patterned after criteria used in the EPA program (40 CFR 123.45). Instances of SNC are permittee violations which meet one or more of the following criteria:

##### 1. Violation of wastewater discharge limits:

- a) Chronic Violations: If 66% or more of the measurements obtained from the testing described in this permit exceed the permit limits in a 6 month period (any magnitude of exceedance), then chronic violations will have occurred. For TTO, **OMRDD** would have to exceed the daily maximum of 1.37 mg/l more than one hundred twenty (120) days in a six (6) month period to be considered in SNC.
- b) Technical Review Criteria (TRC) violations, when thirty-three (33%) percent or more of all measurements taken during six (6) month period equal or exceed the permit limit multiplied by the applicable TRC factor (viz. 1.2 for TTO). For TTO, **OMRDD** would have to exceed 1.64 mg/l (1.37 x 1.2) more than sixty (60) days in a six (6) month period to be considered in SNC.
- c) Any other violation(s) of an effluent limit (average or daily maximum) that the Village believes has caused, alone, or in combination with other discharges, interference (e.g. slug loads or pass through) or endangered the health of the WWF personnel or the public.
- d) Any discharge of a pollutant that has caused imminent endangerment to human welfare, or to the environment, and has resulted in the Village's exercise of its emergency authority to halt or prevent such a discharge.
- e) Failure to meet within ninety (90) days after the schedule, a compliance schedule milestone required.

2. Failure to provide reports as stipulated in this permit within thirty (30) days from the due date.
3. Failure to accurately report non-compliance.
4. Any other violation or group of violations that the Village considers to be significant.

As part of its enforcement action, the Village shall notify the permittee of each incidence of SNC, and each notice shall include an *order for* the permittee to come into compliance immediately, or to enter into a compliance agreement with the Village.

#### PART 3. Civil penalties

A permittee who has violated or continues to violate any provision of the Municipal Code, a WDP or other order issued, or any other pretreatment standard or requirement shall be liable to the Village for a maximum civil penalty of \$1,000.00 per violation, per day.

The Village may recover reasonable attorney's fees, court costs and other expenses associated with enforcement activities, including sampling and monitoring expenses and the cost of actual damage incurred by the Village.

In determining the amount of the civil liability, the court shall take into account all relevant circumstances including, but not limited to, the extent of harm caused by the violation, any economic benefit gained through the permittee's violation, corrective actions by the permittee, the compliance history of the permittee and any other factor as justice requires.

Filing a suit for civil penalties shall not be a bar against or a prerequisite for taking any other action against the permittee.

#### PART 4. Emergency actions

The Superintendent shall have authority and procedures to immediately and effectively halt any discharge to the WWF which endangers public health or welfare. The Superintendent shall also have the authority and procedures to prevent any discharge to the WWF which endangers the environment or which threatens to interfere with the operations of the WWF. Notice shall be provided to the permittee prior to such action. If public health or welfare are not endangered, the permittee shall be given an opportunity to respond to the notice.

#### PART 5. Duty to mitigate

The permittee shall take all reasonable steps to minimize or correct any adverse impact to the public treatment plant or the environment resulting from noncompliance with this WDP, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncompliant discharge.

#### PART 6. Recovery of costs incurred

In addition to civil liability, the permittee violating *any* of the provisions of this WDP, of the Municipal Code or causing damage to or otherwise inhibiting the Village of Gowanda wastewater disposal system shall be liable to the Village of Gowanda for any expense, or damage caused by such violation or discharge. The Superintendent shall bill the permittee for the costs incurred by the Village of Ocala for any demand monitoring, analysis, cleaning, repair, or replacement work caused by the violation or discharge.

**Attachment 2**

**Substantive Air Discharge Requirements**



Engineers / Architects / Planners / Surveyors

February 1, 2005

Mr. Maurice Moore  
NYSDEC Region 9  
Division of Environmental Remediation  
270 Michigan Avenue  
Buffalo NY 14203-2999

**Substantive Air Requirements Information  
Gowanda Day Habilitation Center – Interim Remedial System Installation  
Voluntary Cleanup Agreement V-00463.9**

Dear Mr. Moore:

Attached is the information required to be submitted to the New York State Department of Environmental Conservation (NYSDEC) for the Interim Remedial Measures System being installed at the former Gowanda Day Habilitation Center. The site is located on 4 Industrial Place in Gowanda, New York. Bergmann Associates is transmitting this information on behalf of the facility owner New York State Office of Mental Retardation and Developmental Disabilities (NYSOMRDD) and the Dormitory Authority of New York State (DASNY). If you have any questions regarding this correspondence, contact me at (585) 232-5137, x 346.

Remediation being conducted under the Division of Environmental Remediation (DER) oversight is exempt from obtaining an air discharge permit. However, the remedial project must demonstrate compliance with substantive requirements. The IRM being installed at the facility is a combination groundwater pump & treat system with a soil vapor extraction system. All subsurface soil vapor recovered by the system, off gas from a low profile air stripper and off gas from the groundwater treatment system equalization tank will be routed through two granular activated carbon vessels (in series) prior to discharge. The identified chemicals of concern are trichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene and vinyl chloride.

The IRM is scheduled to be installed by February 25, 2005. Included in this correspondence is a copy of the final IRM Work Plan dated March 15, 2004 and transmitted to the NYSDEC on April 7, 2004.

Sincerely,  
**BERGMANN ASSOCIATES**

A handwritten signature in black ink that reads 'Gary A. Flisnik'.

Gary A. Flisnik  
Project Manager  
enc

cc: Joe Sciascia, NYSDEC and Richard Buckey, DASNY

200 First Federal Plaza, 28 East Main Street / Rochester, New York 14614-1909  
585.232.5135 / 585.232.4652 fax

Buffalo, NY / Philadelphia, PA / Pittsburgh, PA / Hoboken, NJ / Toledo, OH / Lansing, MI / Ft. Lauderdale, FL / Jacksonville, FL

An Equal Opportunity Employer



## Information for Determination of Compliance with Substantive Air Requirements

Site Name: Gowanda Day Habilitation Center

Site Address: 4 Industrial Place, Gowanda, New York 14070

Name and Affiliation of Person Submitting Information: Gary A. Flisnik, Project Manager – Bergmann Associates – Engineering Consultant for DASNY.

### Description of Process and Control Equipment:

A groundwater pump and treat (P&T) system will be used in conjunction with a soil vapor extraction (SVE) system as the major components of the IRM. The P&T portion of the system will consist of an air compressor, a network of controller-less pneumatic pumps, and an air stripper treatment system to process recovered groundwater. The recovered groundwater will be pumped back to the equalization tank for solids settling and transfer to the air stripper using a consistent flow rate. After treatment by the air stripper, the groundwater will be discharged to the local POTW via the sanitary sewer. The air discharge from the air stripper will be tied into the SVE vapor carbon vessels for treatment prior to discharge to the atmosphere.

The SVE system will consist of a blower operated skid and a network of SVE wells and combination SVE/groundwater recovery wells. The skid will have a vacuum capability of 12 to 14 inches of Mercury. The entrained vapors will return to the SVE skid through a common transmission pipe, pass through a heat exchanger for conditioning and then through two vapor carbon adsorbers in series prior to atmospheric discharge. Typical SVE operation is expected to produce minimal condensate; however, the system will be equipped with a condensate tank servicing the heat exchanger, high level alarm and a manual drain.

Treated air discharges and the exhaust stack were designed referencing The DEC Policy System Program Guide – DAR-1.

The IRM will consist of the following components:

- Two Groundwater Recovery Wells
- Two Soil Vapor Extraction Wells
- Four Dual-Phase Recovery Wells
- SVE Skid: Blower, Heat Exchanger, Condensate Tank, Silencer
- Air Stripper Skid: Equalization Tank, Transfer Pump, Low Profile-Shallow Tray Air Stripper, Extraction Pump
- Air Compressor
- Two 2,000 pound Carbon Adsorbers

Description of Continuous Air Monitors: Air flow will be measured continuously with an Omega Flow monitoring system. There will be no continuous monitoring of air quality from the emission point. Air samples to monitor influent concentrations to the carbon treatment system, efficiency of the carbon treatment and effluent from the carbon treatment system will be collected once month.





These samples will be grab samples collected from existing sample ports in the conveyance piping by filling Tedlar bags. The bags will be transported to an ELAP certified laboratory for analysis of the four chemicals of concern.

Stack Information:

Ground Elevation (feet)	778.80 AMSL
Stack Height (feet)	800.70 AMSL (point of emission)
Height above Structures (feet)	6.0
Inside Dimensions (inches)	6.2
Exit Temperature (° Fahrenheit)	Less than 95 ° F
Exit Velocity (cubic feet per second)	3.33
Exit Flow (ACFM)	242

Emissions Information:

These calculations are based on known concentrations of each constituent present in groundwater at the subject site. The values presented are estimates with **no treatment**.

Contaminant	CAS Number	Hourly Emissions (pounds per hour)	Annual Emissions (tons per year)
Trichloroethene	79-01-6	0.003	0.014
Cis-1,2-Dichloroethene	540-59-0	0.003	0.014
Trans-1,2-Dichloroethene	540-59-0		
Vinyl Chloride	75-01-4	0.001	0.005

These calculations are based on known concentrations of each constituent present in soil vapor at the subject site. The values presented are estimates with **no treatment**.

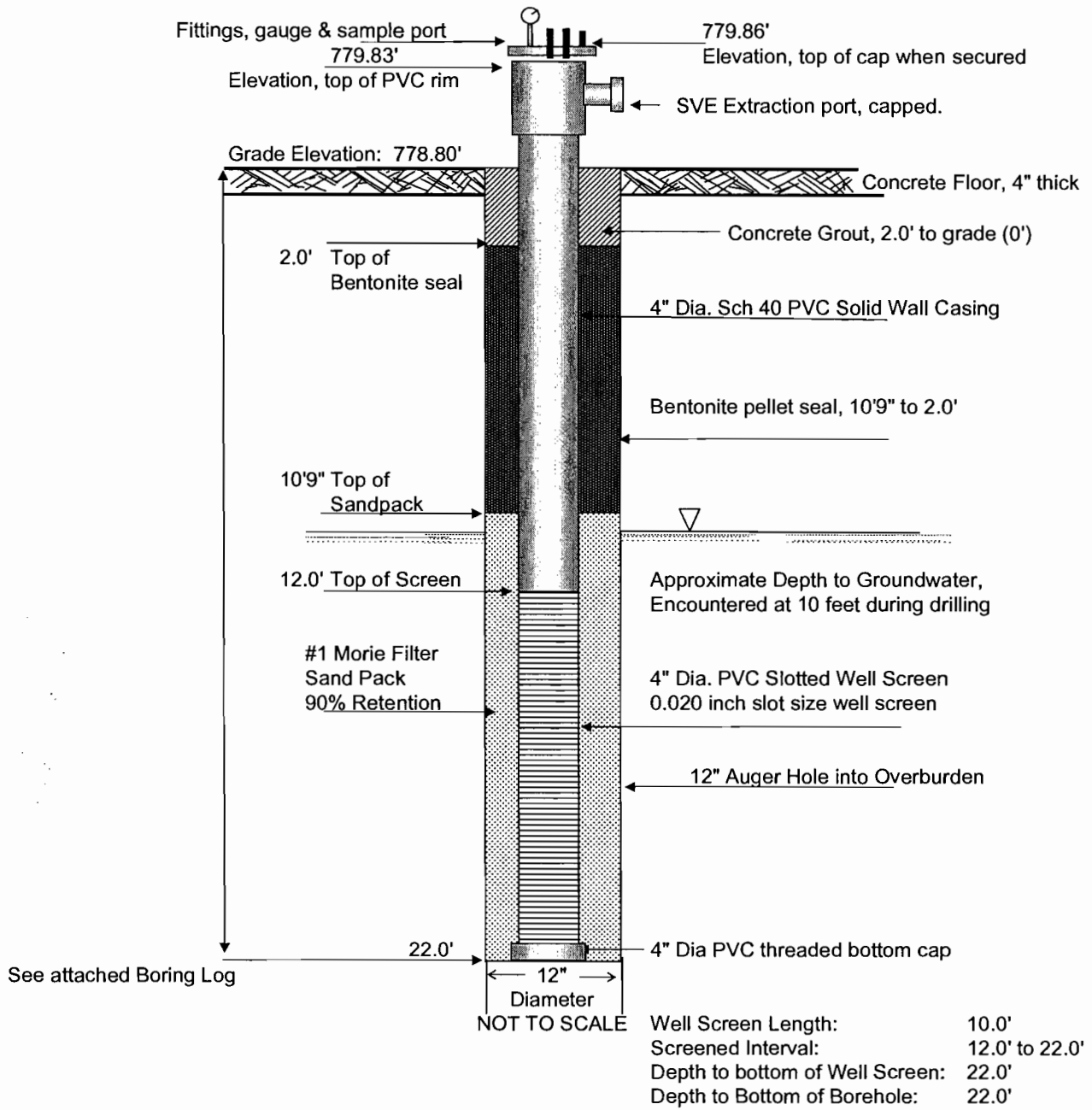
Contaminant	CAS Number	Hourly Emissions (pounds per hour)	Annual Emissions (tons per year)
Trichloroethene	79-01-6	0.034	0.14
Cis-1,2-Dichloroethene	540-59-0	0.034	0.14
Trans-1,2-Dichloroethene	540-59-0		
Vinyl Chloride	75-01-4	0.010	0.05

These values are targeted to be reduced by the treatment efficiency of the carbon adsorbers to reduce effluent concentrations by 99%.

**Attachment 3**

**Groundwater Recovery Well Boring Logs and Well Details**

## RECOVERY WELL G-1



Elevation including top of PVC well rim, cap and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**Date Installed:  
Jan. 12, 2005**

**RECOVERY WELL CONSTRUCTION DETAIL  
G-1**

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Recovery Well G-1

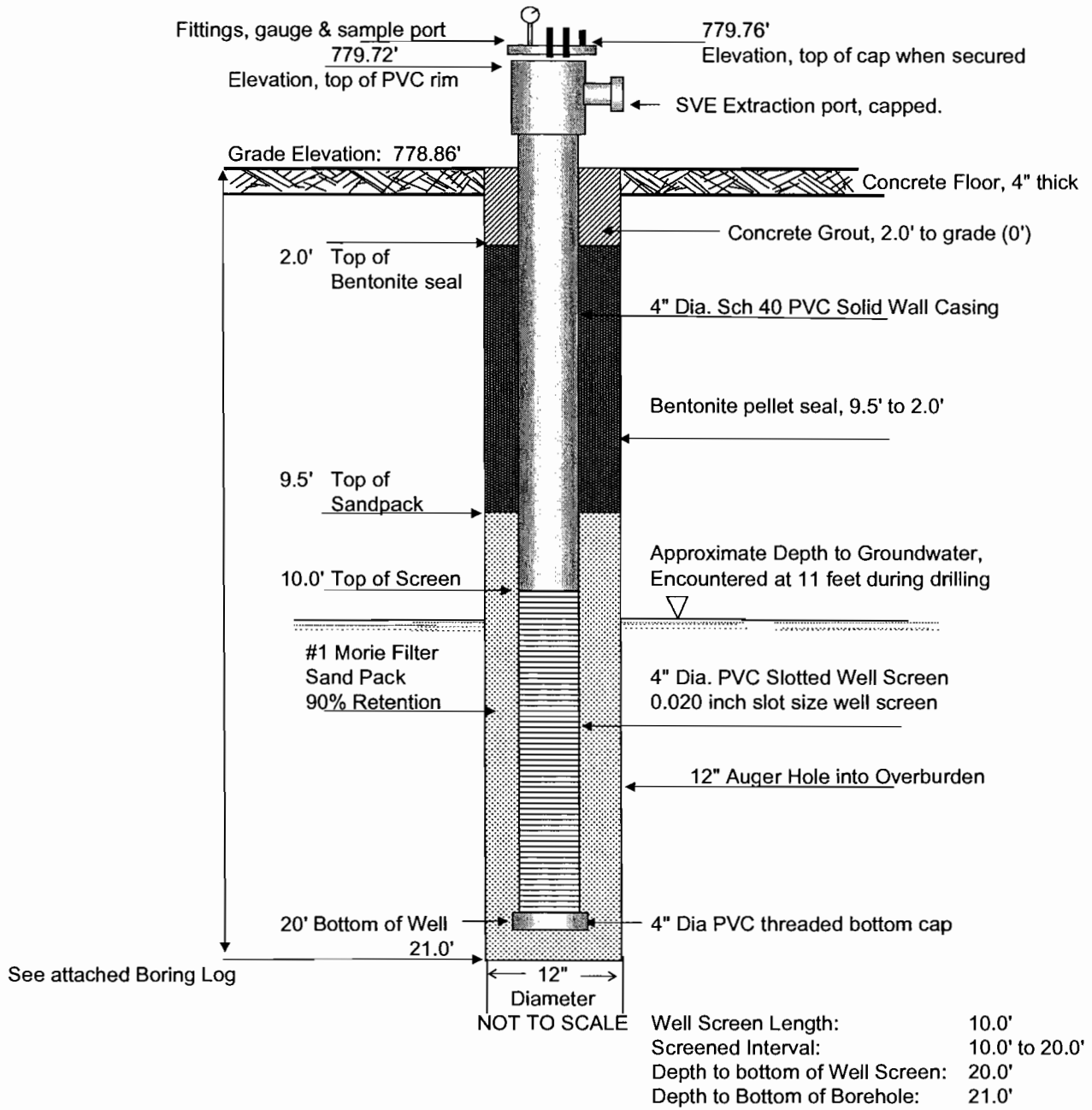
PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 01/12/2005 Finish Date: 01/12/2005 Top of Well: N/A Boring No: G-1  
 Driller: Steve Laramie, Geologic NY Boring Location: Inside the Machine Shop  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 10 feet  
 Drilling Method: 6-1/4 inch HAS Augers, Electric Skid Rig Water Level (Post Drilling): Approx. 10 feet below grade  
 Remarks: Advanced boring via 6 1/4" Hollow Stem Augers. Recovery well installed through augers via pull back method.  
 Screened Interval: 12.0 ft. to 22.0 ft. Slot Size: 0.020 inch Well Type: 4" dia. PVC Sandpack: 22 ft to 10'9" ft  
 Seal: 10 feet, 9 inches to 1.5 feet Weather Conditions: Cool, 60 degrees,

No curb box or stand pipe: Recovery well to be connected directly to piping for the treatment system

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID			
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery	
0										4" Concrete floor  No samples collected until 20'	VOCs not measured	
5												
10												
15												Soil cuttings and drilling rod wet 10' Water table ~10'
20												
25	18	56/6"				1	20'-22'	soil		Wet F-M GRAVEL and F-C Sand  Auger refusal at 22': Till 22'		
	50/1"					2	22'-22.5'	soil				
25												
30										Boring terminated at 22.0 feet 4" diameter recovery well installed in boring All cuttings placed in drums.		

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

## RECOVERY WELL G-2



Elevation including top of PVC well rim, cap and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**Date Installed:  
Jan. 13, 2005**

**RECOVERY WELL CONSTRUCTION DETAIL  
G-2**

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Recovery Well G-2

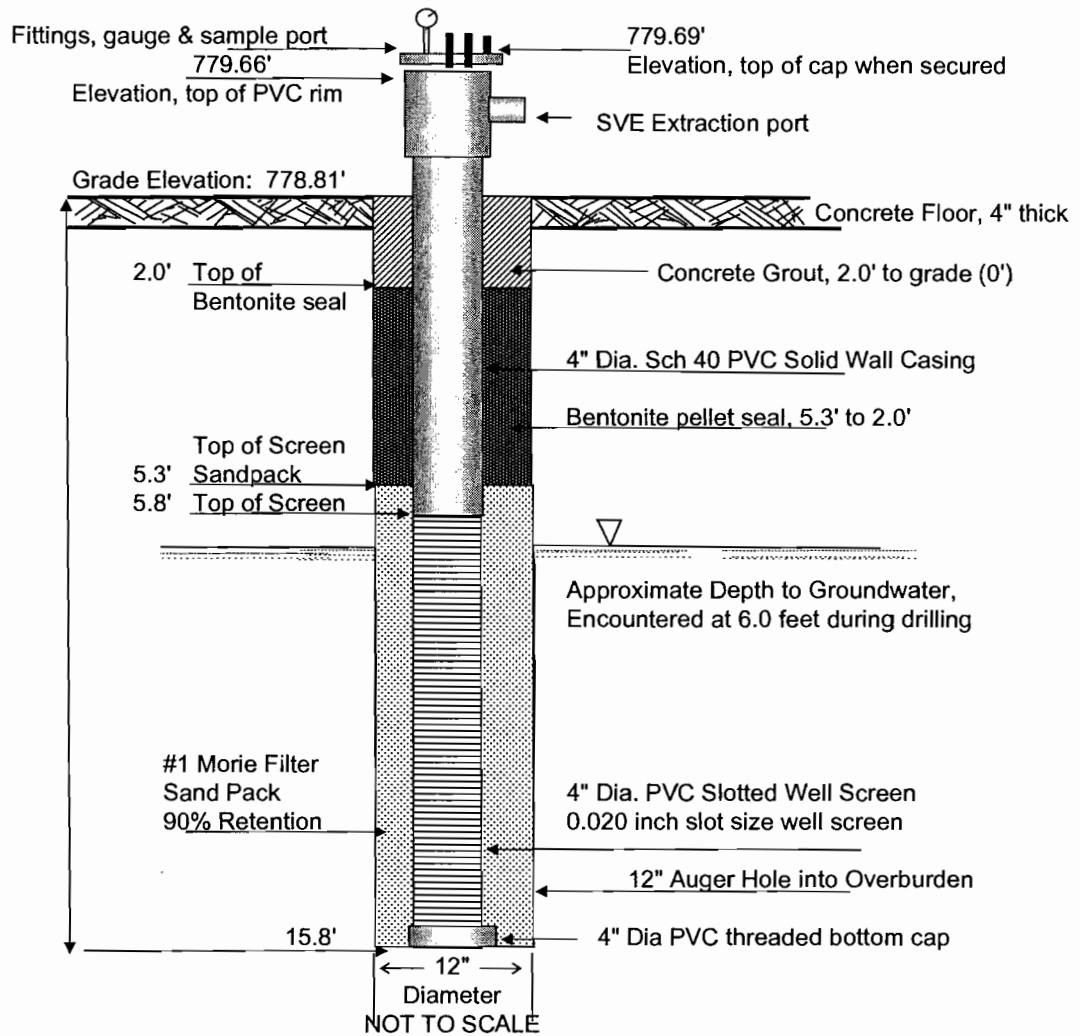
PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 01/13/2005 Finish Date: 01/13/2005 Top of Well: N/A Boring No: G-2  
 Driller: Steve Laramie, Geologic NY Boring Location: Inside the Machine Shop  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 11 feet  
 Drilling Method: 6-1/4 inch HAS Augers, Electric Skid Rig Water Level (Post Drilling): Approx. 11 feet below grade  
 Remarks: Advanced boring via 6 1/4" Hollow Stem Augers. Recovery well installed through augers via pull back method.  
 Screened Interval: 10.0 ft. to 20.0 ft. Slot Size: 0.020 inch Well Type: 4" dia. PVC Sandpack: 21 ft to 9.5" ft  
 Seal: 10 feet, 9 inches to 1.5 feet Weather Conditions: Inside the building, cool

No curb box or stand pipe: Recovery well to be connected directly to piping for the treatment system

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID			
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery	
0										4" Concrete floor  No samples collected until 20'	VOCs not measured	
5												
10												
15												Soil cuttings and drilling rod wet 13'
20												
25	49	52	50/3"		100	1	20'-22'	soil		Wet F. GRAVEL and F-C Sand 21' Damp Grey SILT and Clay Till  Boring terminated at 21.0 feet 4" diameter recovery well installed in boring All cuttings placed in drums.		
30												
30												

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

## RECOVERY WELL DR-1



See attached Boring Log

Well Screen Length:	10.0'
Screened Interval:	5.8' to 15.8'
Depth to bottom of Well Screen:	15.8'
Depth to Bottom of Borehole:	15.8'

NOT TO SCALE

Elevation including top of PVC well rim, cap and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**RECOVERY WELL CONSTRUCTION DETAIL  
DR-1**

Date Installed:  
Jan. 14, 2005

# DRILLING LOG



**BORING/WELL NUMBER:** Recovery Well DR-1

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 01/14/2005 Finish Date: 01/14/2005 Top of Well: N/A Boring No: DR-1  
 Driller: Steve Laramie, Geologic NY Boring Location: Inside south hallway, by south kitchen  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 6 feet  
 Drilling Method: 6-1/4 inch HAS Augers, Electric Skid Rig Water Level (Post Drilling): Approx. 6 feet below grade  
 Remarks: Advanced boring via 6 1/4" Hollow Stem Augers. Recovery well installed through augers via pull back method.  
 Screened Interval: 15.8 ft. to 5.8 ft. Slot Size: 0.020 inch Well Type: 4" dia. PVC Sandpack: 15.8 ft to 5.3 ft  
 Seal: 5.3 feet to 2.0 feet Weather Conditions: Cool, 50 degrees inside the building

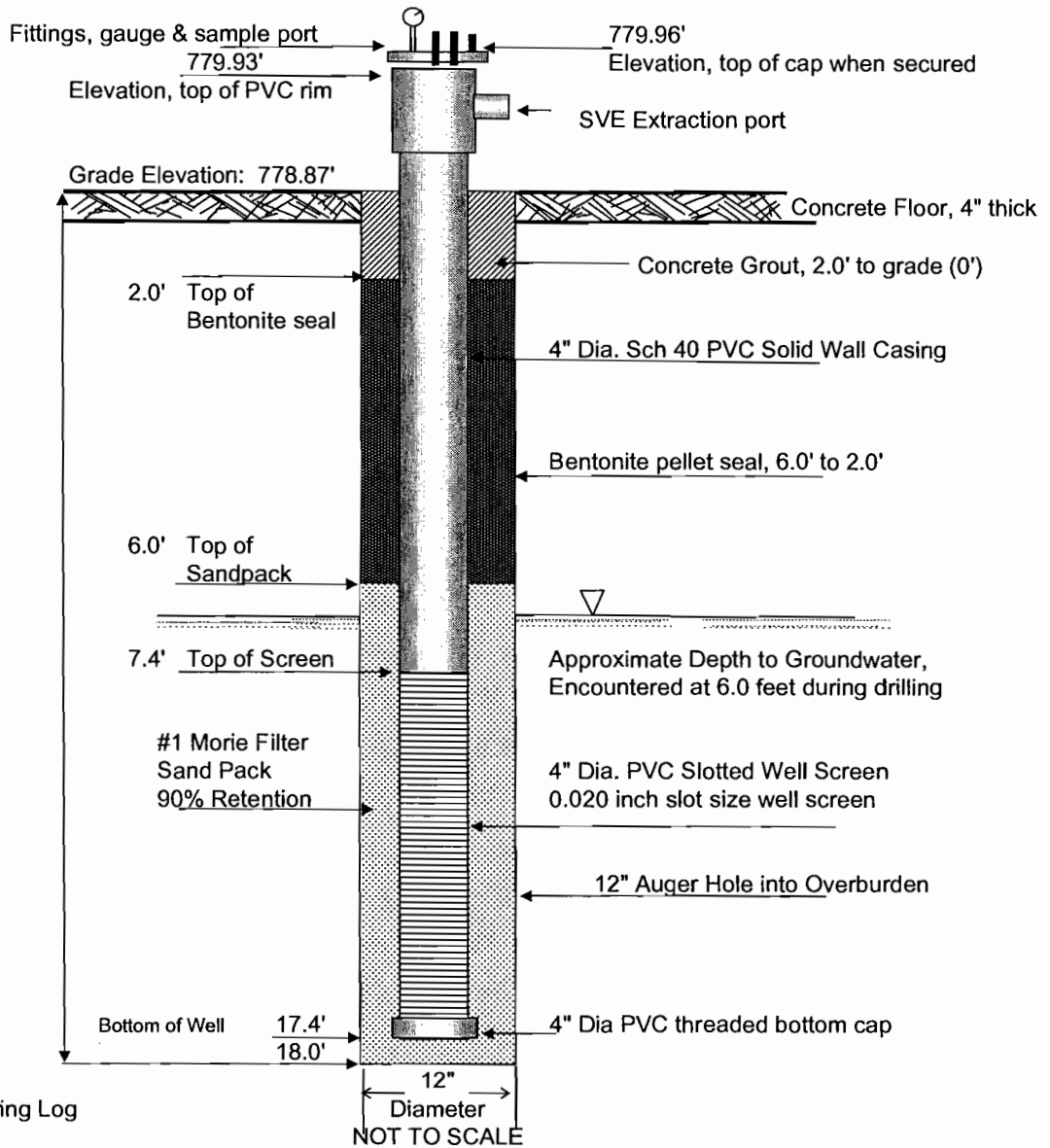
No curb box or stand pipe: Recovery well to be connected directly to piping for the treatment system

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0										4" Concrete floor	VOCs not measured
										No samples collected	
5											
										Encountered cobbles in cuttings at 7 feet	
10											
										Cobbles and gravel encountered to 15 feet	
15										Cuttings indicate till at 15.0 feet	
										Boring terminated at 16.0 feet	
20										4" diameter recovery well installed in boring	
										All cuttings placed in drums.	
25											
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow



## RECOVERY WELL DR-2



Well Screen Length:	10.0'
Screened Interval:	7.4' to 17.4'
Depth to bottom of Well Screen:	17.4'
Depth to Bottom of Borehole:	18.0'

NOT TO SCALE

Elevation including top of PVC well rim, cap and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**Date Installed:  
Jan. 19, 2005**

**RECOVERY WELL CONSTRUCTION DETAIL  
DR-2**

# DRILLING LOG



**B E R G M A N N**  
associates

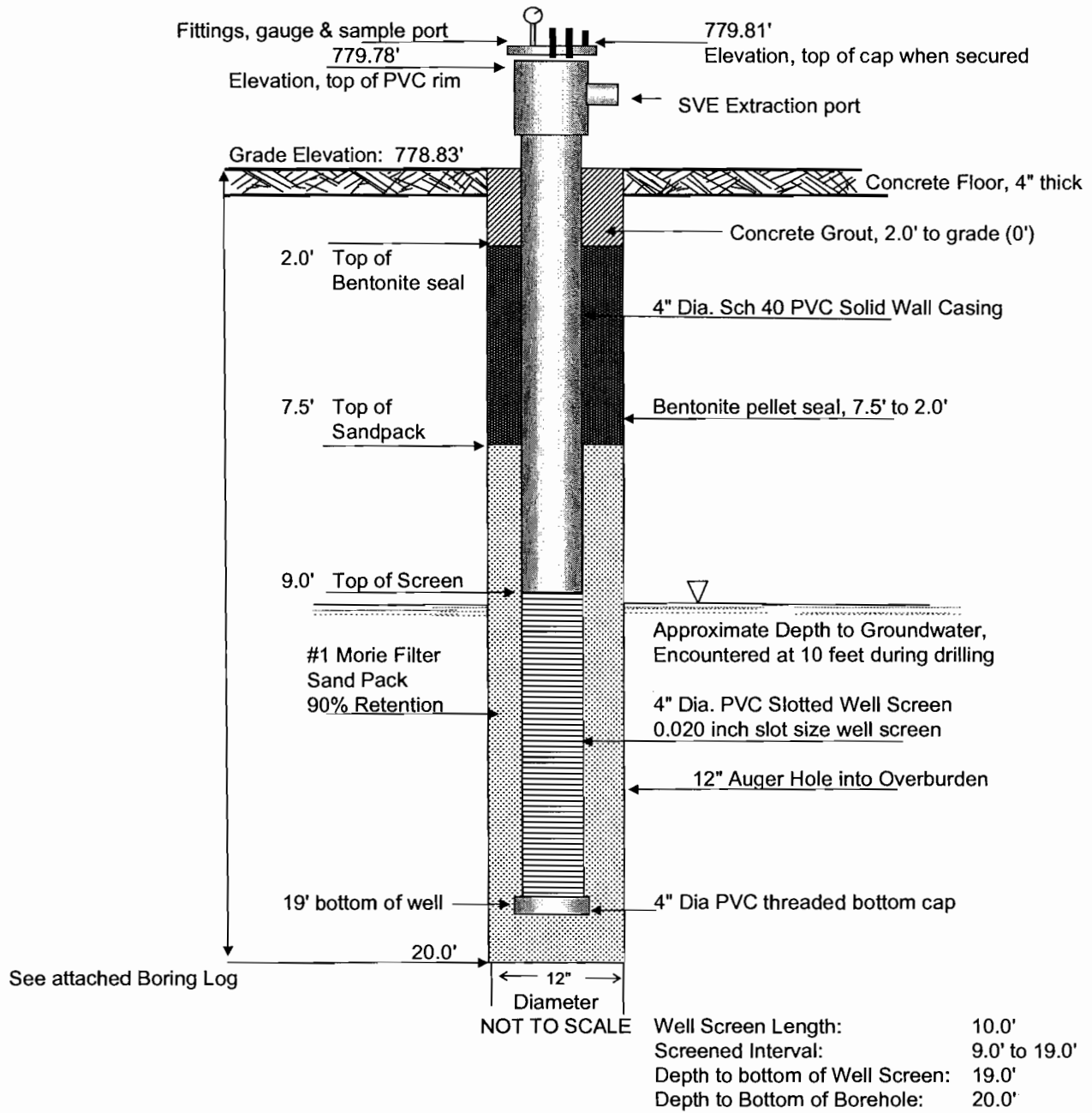
**BORING/WELL NUMBER:** Recovery Well DR-2

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 01/17/2005 Finish Date: 01/19/2005 Top of Well: N/A Boring No: DR-2  
 Driller: Steve Laramie, Geologic NY Boring Location: Inside hallway, north of the kitchen  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 6 feet  
 Drilling Method: 6-1/4 inch HAS Augers, Electric Skid Rig Water Level (Post Drilling): Approx. 6 feet below grade  
 Remarks: Advanced boring via 6 1/4" Hollow Stem Augers. Recovery well installed through augers via pull back method.  
 Screened Interval: 17.4 ft. to 7.4 ft. Slot Size: 0.020 inch Well Type: 4" dia. PVC Sandpack: 18.0 ft to 6.0 ft  
 Seal: 6.0 feet to 2.0 feet Weather Conditions: Cool, 50 degrees inside the building  
 No curb box or stand pipe: Recovery well to be connected directly to piping for the treatment system

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0										4" Concrete floor	VOCs not measured
										No samples collected	
5											
										Cobbles encountered in cuttings at 7 feet	
10											
15											
										Boring terminated at 18.0 feet 4" diameter recovery well installed in boring All cuttings placed in drums.	
20											
25											
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**RECOVERY WELL DR-3**



See attached Boring Log

NOT TO SCALE

Well Screen Length: 10.0'  
 Screened Interval: 9.0' to 19.0'  
 Depth to bottom of Well Screen: 19.0'  
 Depth to Bottom of Borehole: 20.0'

NOT TO SCALE

Elevation including top of PVC well rim, cap and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
 4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**RECOVERY WELL CONSTRUCTION DETAIL  
 DR-3**

Date Installed:  
 Jan. 20, 2005

# DRILLING LOG



**B E R G M A N N**  
associates

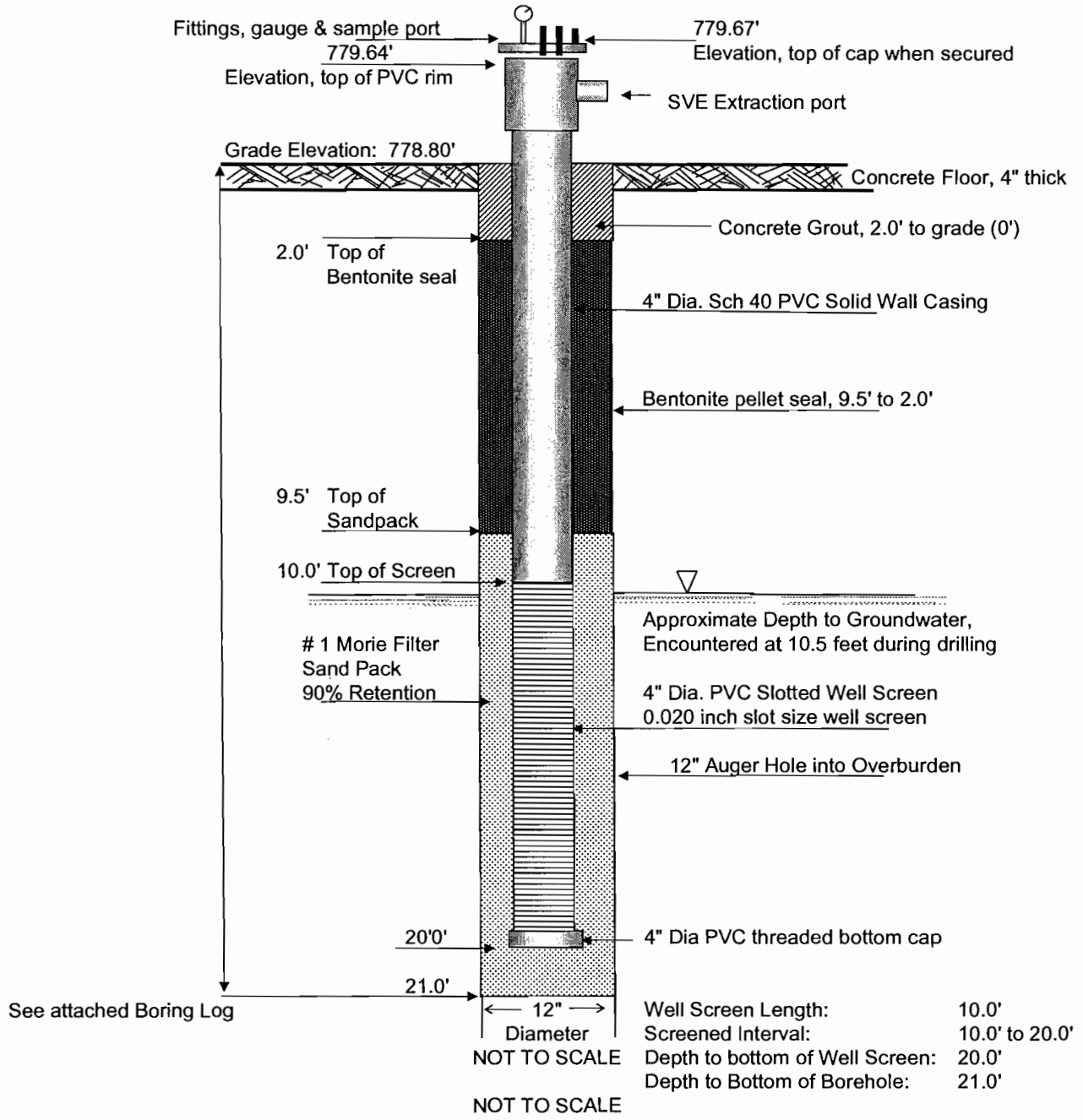
**BORING/WELL NUMBER:** Recovery Well DR-3

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 01/19/2005 Finish Date: 01/20/2005 Top of Well: N/A Boring No: DR-3  
 Driller: Steve Laramie, Geologic NY Boring Location: Inside the former Gym Room  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 10 feet  
 Drilling Method: 6-1/4 inch HAS Augers, Electric Skid Rig Water Level (Post Drilling): Approx. 10 feet below grade  
 Remarks: Advanced boring via 6 1/4" Hollow Stem Augers. Recovery well installed through augers via pull back method.  
 Screened Interval: 19.0 ft. to 9.0 ft. Slot Size: 0.020 inch Well Type: 4" dia. PVC Sandpack: 19.0 ft to 7.5 ft  
 Seal: 7.5 feet to 2.0 feet Weather Conditions: Cool, 50 degrees inside the building  
 No curb box or stand pipe: Recovery well to be connected directly to piping for the treatment system

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0										4" Concrete floor  No samples collected	VOCs not measured
5											
10										Cobbles encountered in cuttings at 11 feet	
15											
20										Change in drilling, till at 19 feet Boring terminated at 20.0 feet 4" diameter recovery well installed in boring All cuttings placed in drums.	
25											
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

### RECOVERY WELL DR-4



See attached Boring Log

Well Screen Length:	10.0'
Screened Interval:	10.0' to 20.0'
Depth to bottom of Well Screen:	20.0'
Depth to Bottom of Borehole:	21.0'

Elevation including top of PVC well rim, cap and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**RECOVERY WELL CONSTRUCTION DETAIL  
DR-4**

Date Installed:  
Jan. 21, 2005

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Recovery Well DR-4

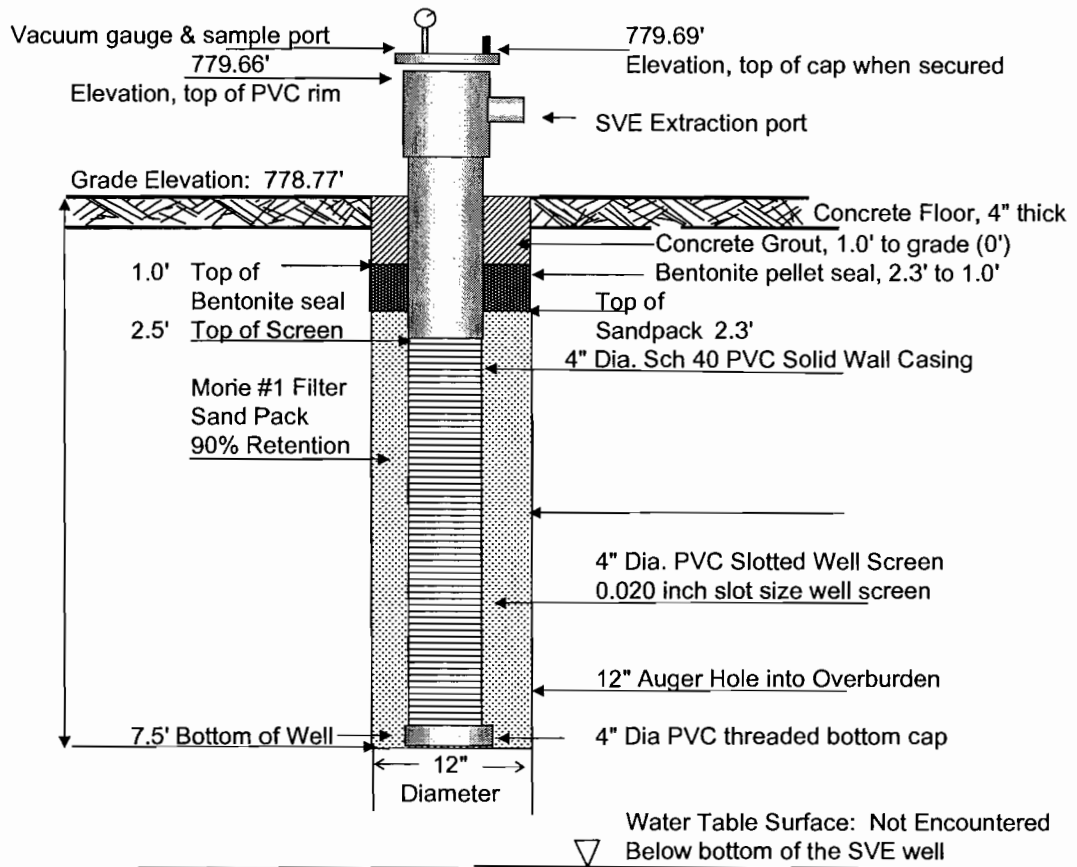
PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 01/20/2005 Finish Date: 01/20/2005 Top of Well: N/A Boring No: DR-4  
 Driller: Steve Laramie, Geologic NY Boring Location: Inside the north kitchen  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 10.5 feet  
 Drilling Method: 6-1/4 inch HAS Augers, Electric Skid Rig Water Level (Post Drilling): Approx. 10.5 feet below grade  
 Remarks: Advanced boring via 6 1/4" Hollow Stem Augers. Recovery well installed through augers via pull back method.  
 Screened Interval: 20.0 ft. to 10.0 ft. Slot Size: 0.020 inch Well Type: 4" dia. PVC Sandpack: 21.0 ft to 9.5 ft  
 Seal: 9.5 feet to 2.0 feet Weather Conditions: Cool, 50 degrees inside the building

No curb box or stand pipe: Recovery well to be connected directly to piping for the treatment system

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0										4" Concrete floor  No samples collected	VOCs not measured
5											
10										Cobbles encountered in cuttings at 12 feet	
15											
20										Change in drilling, till at 19 feet	
25											
30										Boring terminated at 21.0 feet 4" diameter recovery well installed in boring All cuttings placed in drums.	
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

### SOIL VAPOR EXTRACTION WELL SVE-1



See attached Boring Log

NOT TO SCALE

Well Screen Length:	5.0'
Screened Interval:	2.5' to 7.5'
Depth to bottom of Well Screen:	7.5'
Depth to Bottom of Borehole:	7.5'

NOT TO SCALE  
Elevation including top of PVC well rim, cap and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER**  
**4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**SVE EXTRACTION WELL CONSTRUCTION DETAIL**  
**SVE-1**

**Date Installed:**  
**Jan. 14, 2005**

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** SVE Extraction Well SVE-1

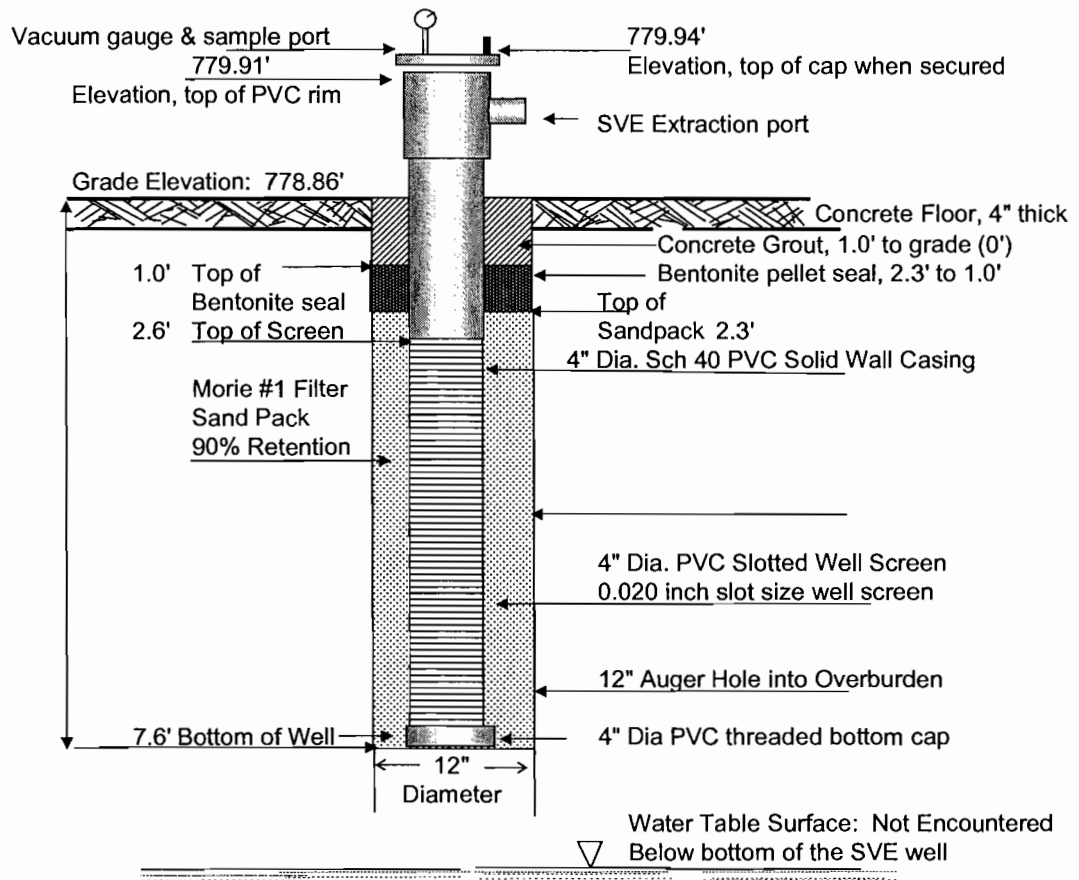
PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 01/13/2005 Finish Date: 01/14/2005 Top of Well: N/A Boring No: SVE-1  
 Driller: Steve Laramie, Geologic NY Boring Location: In hallway inside the building  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Not encountered  
 Drilling Method: 6-1/4 inch HAS Augers, Electric Skid Rig Water Level (Post Drilling): Not encountered  
 Remarks: Advanced boring via 6 1/4" Hollow Stem Augers. Recovery well installed through augers via pull back method.  
 Screened Interval: 2.5 ft. to 7.5 ft. Slot Size: 0.020 inch Well Type: 4" dia. PVC Sandpack: 7.5 ft to 2.3 ft  
 Seal: 2.3 feet to 1.0 feet Weather Conditions: Inside the building, cool  
 No curb box or stand pipe: SVE extraction well to be connected directly to piping for the treatment system

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0										4" Concrete floor	VOCs not measured
										No samples collected	
5											
10										Boring terminated at 7.5 feet	
										4" diameter SVE Extraction Well installed in boring	
15										All cuttings placed in drums.	
20											
25											
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow



## SOIL VAPOR EXTRACTION WELL SVE-2



See attached Boring Log

NOT TO SCALE

Well Screen Length:	5.0'
Screened Interval:	2.6' to 7.6'
Depth to bottom of Well Screen:	7.6'
Depth to Bottom of Borehole:	7.6'

NOT TO SCALE

Elevation including top of PVC well rim, cap and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**Date Installed:  
Jan. 17, 2005**

**SVE EXTRACTION WELL CONSTRUCTION DETAIL  
SVE-2**

# DRILLING LOG



**B E R G M A N N**  
associates

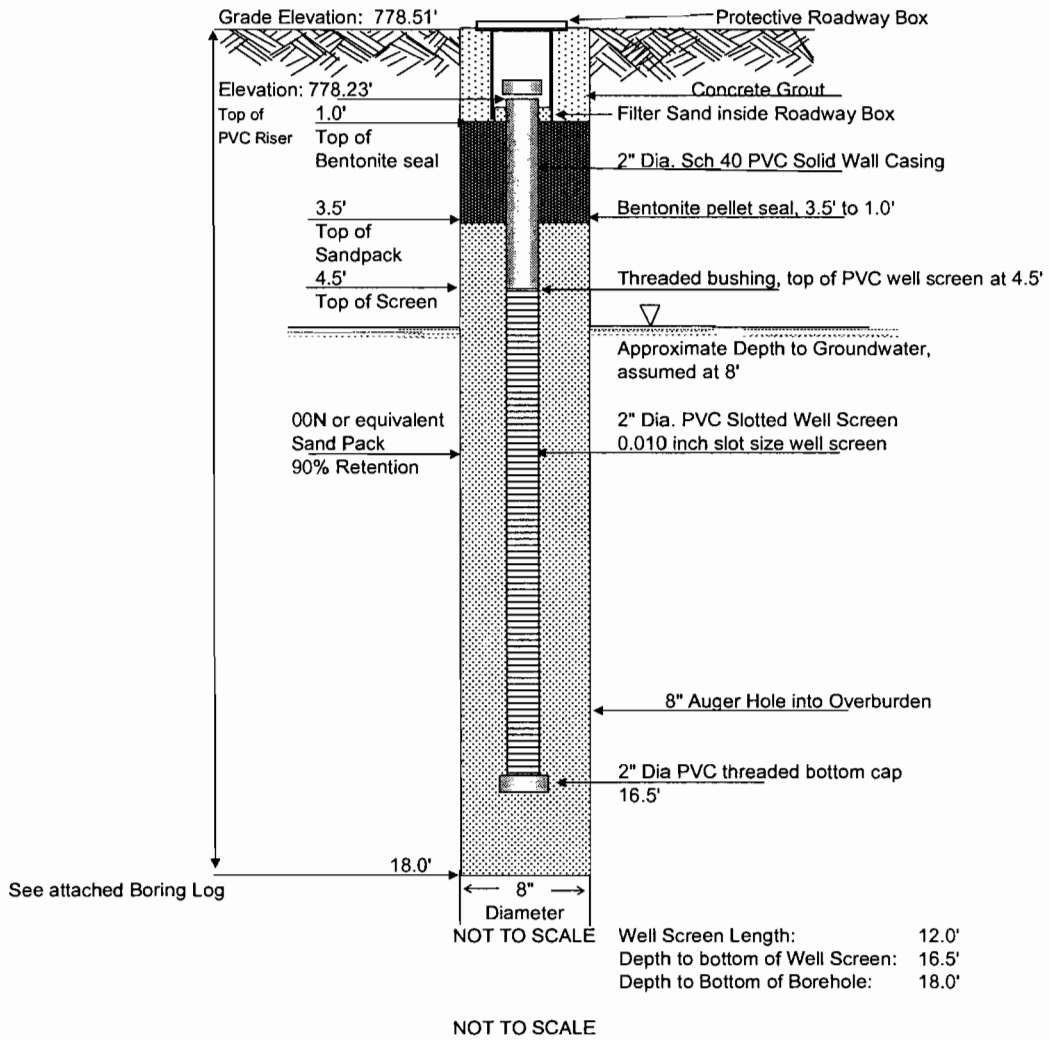
**BORING/WELL NUMBER:** SVE Extraction Well SVE-2

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 01/17/2005 Finish Date: 01/17/2005 Top of Well: N/A Boring No: SVE-2  
 Driller: Steve Laramie, Geologic NY Boring Location: In south kitchen  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Not encountered  
 Drilling Method: 6-1/4 inch HAS Augers, Electric Skid Rig Water Level (Post Drilling): Not encountered  
 Remarks: Advanced boring via 6 1/4" Hollow Stem Augers. Recovery well installed through augers via pull back method.  
 Screened Interval: 2.6 ft. to 7.6 ft. Slot Size: 0.020 inch Well Type: 4" dia. PVC Sandpack: 7.6 ft to 2.3 ft  
 Seal: 2.3 feet to 1.0 feet Weather Conditions: Inside the building, cool  
 No curb box or stand pipe: SVE extraction well to be connected directly to piping for the treatment system

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0										4" Concrete floor  No samples collected          Boring terminated at 7.6 feet 4" diameter SVE Extraction Well installed in boring All cuttings placed in drums.	VOCs not measured
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
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26											
27											
28											
29											
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-1/MW-1**



Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

Date Installed:  
31-Jul-02

**MONITORING WELL CONSTRUCTION DETAIL  
MW-1**

# DRILLING LOG



**B E R G M A N N**  
associates

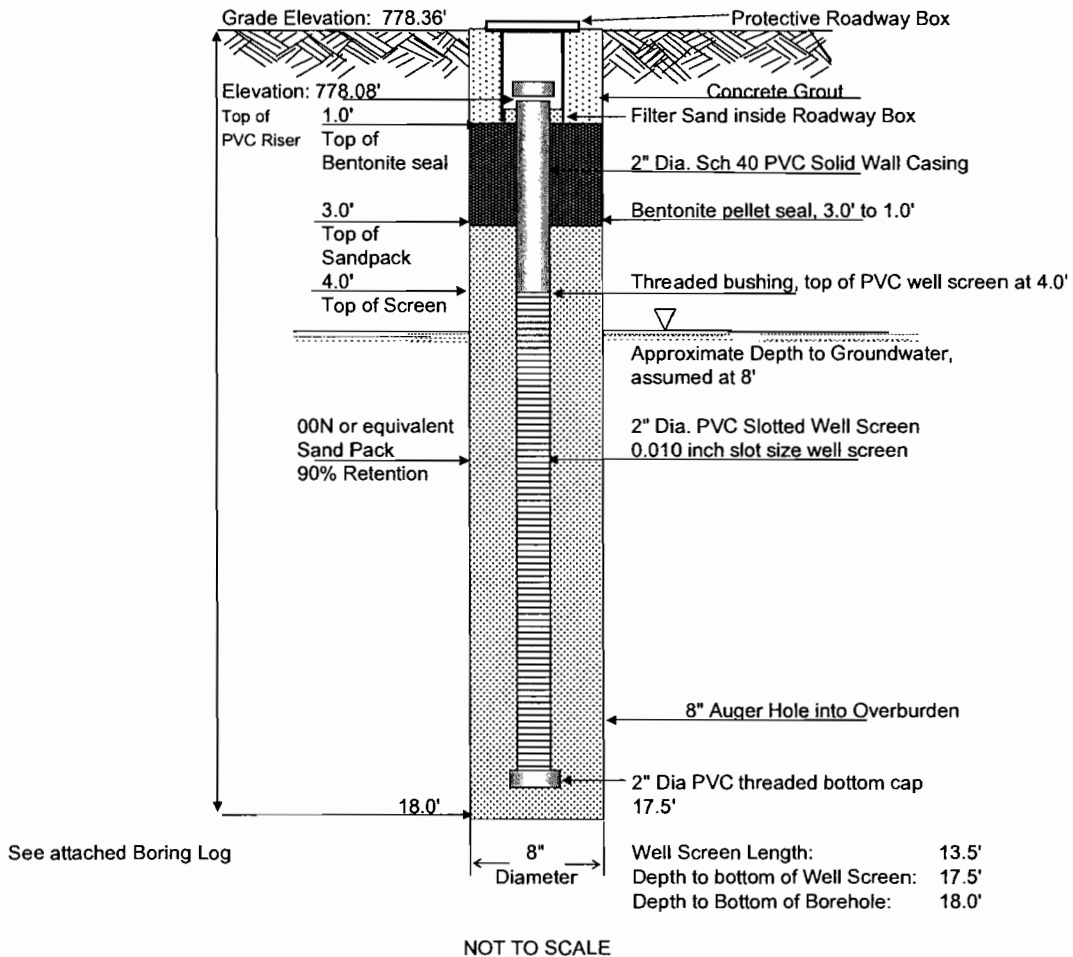
**BORING/WELL NUMBER:** Test Boring B-1/MW-1

PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/31/02 Finish Date: 07/31/02 Top of Well: N/A Boring No: B-1/MW-1  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In asphalt adjacent to south side of the building.  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 8.0 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 8 feet  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 16.5 ft. to 4.5 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 18.0 ft to 3.5 ft  
 Seal: 3.5 to 1.0 feet Weather Conditions: Overcast, humid, 75 degrees in morning  
Flush to grade roadway box installed over the monitoring well. Warmer & scattered rain in the afternoon

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION		Field Screening for VOCs, ppm, using PID
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			
0	23	9			16	1	0-2'	soil	42%	Asphalt Surface 0.5'
			7	5						GRAVEL and F-C Sand Fill to 2' 2.0'
	6	2			5	2	2'-4'	soil	75%	Damp Br. Mottled M. Stiff SILT, Some F. Sand. Partings evident
5			3	3						176 ppm
	5	4			7	3	4'-6'	soil	83%	Same SILT, some F. Sand. M. Stiff.
10			3	4						131 ppm
	1	WH			1	4	6'-8'	soil	13%	Roots encountered. moist at 6' same Silt & F. Sand 7', then Gravel 7.0'
			1	WH						19.6 ppm
15	2	4			8	5	8'-10'	soil	75%	Brown F-M GRAVEL Some F-C Sand Damp Br. Loose F-M GRAVEL, some F-C Sand, tr. Silt WT ~8'
			4	14						31.0 ppm
	5	7			15	6	10'-12'	soil	67%	Same, M. Dense, Trace Silt, Wet at 8'
20			8	15						6.5 ppm
	22	18			30	7	12'-14'	soil	67%	Same Gravel, becomes Dense Grayish brown at 13'
			12	11						2.1 ppm
25	29	22			36	8	14'-16'	soil	25%	Same Gray-Brown Gravel, some Sand
			14	17						2.8 ppm
	18	25			57	9	16'-18'	soil	100%	Same gravel to 16'2", then Clay 16'2"
30			32	40						16.0 ppm
										3.5 ppm
										Boring terminated at 18.0 feet 2" diameter monitoring well installed in test boring All cuttings placed in drums.
										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-2/MW-2**



Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**MONITORING WELL CONSTRUCTION DETAIL  
MW-2**

Date Installed:  
25-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

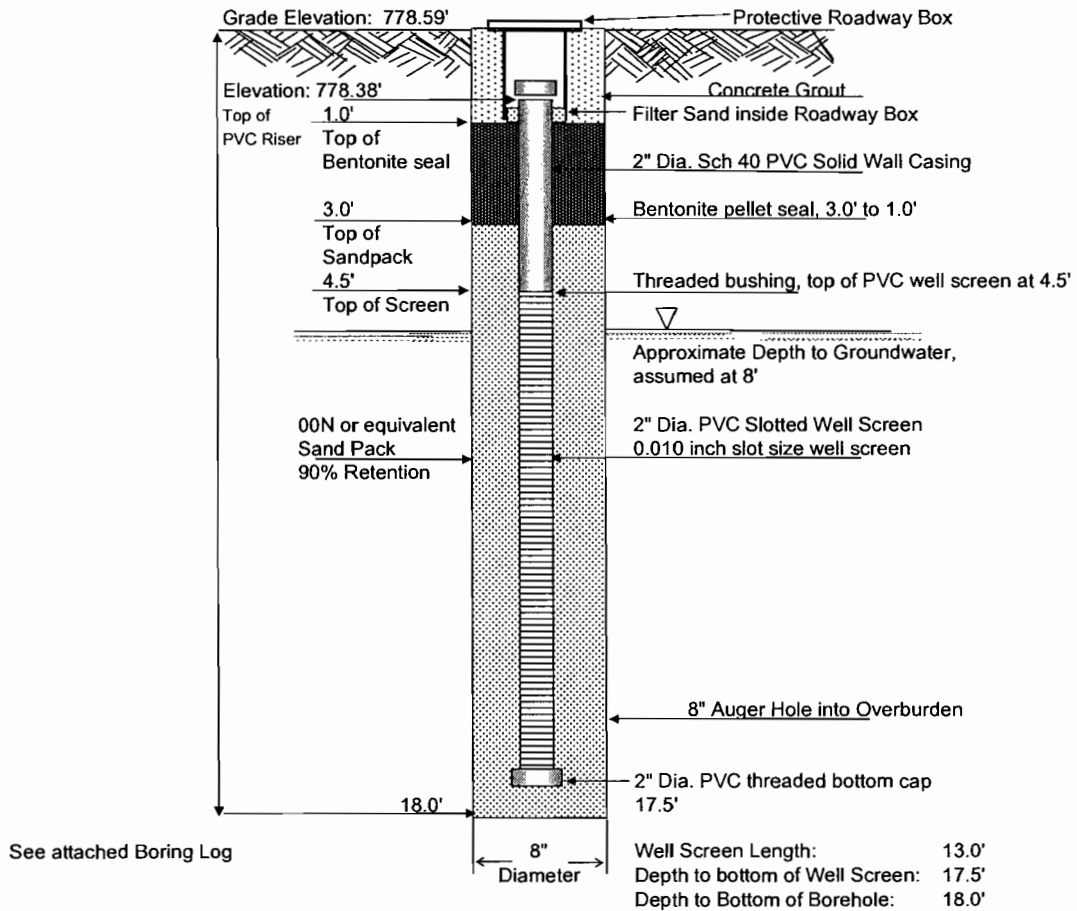
**BORING/WELL NUMBER:** Test Boring B-2/MW-2

PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/25/02 Finish Date: 07/25/02 Top of Well: N/A Boring No: B-2/MW-2  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In asphalt lot south side building, at property line.  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 8.0 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 8 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 17.5 ft. to 4.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 18.0 ft to 3.0 ft  
 Seal: 3.0 to 1.0 feet Weather Conditions: Sunny, 60 degree F in the morning  
 Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID	
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type
0	28	10			20	1	0-2'	soil	42%	Asphalt surface 6'
			10	5			2'-4'	soil	92%	GRAVEL and F- C Sand. Fill 2'6"
	3	4			8	2				Damp Mottled BR & GR M. Stiff SILT, Some F. Sand
5			4	4			4'-6'	soil	58%	Same, M. Stiff
	3	3			7	3				Same, becomes v. moist at 6'
10			4	3			6'-8'	soil	96%	Same mottled SILT, some F. Sand becomes Wet at 8', V. Soft 8.0'
	WH	WH			1	4				Wet Brown Loose F-M GRAVEL, Some F-C Sand, Tr. Silt
			6	9			8'-10'	soil	21%	
15	12	8			16	6	10'-12'	soil	50%	Same, grayish-brown, M. Dense Gravel is angular
			8	15			12'-14'	soil	79%	Same, saturated, Dense
	18	14			32	7				Identical, Loose
20			18	14			14'-16'	soil	50%	Same to 17', Dense 17'
	1	2			10	8				Damp Gray Hard Silty-CLAY, Trace Gravel. Laminated. TILL 18'
			8	11						Boring terminated at 18.0 feet
25							16'-18'	soil	100%	2" diameter monitoring well installed in test boring.
	23	22			59	9				All cuttings placed in drums.
			37	50						
30										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-3/MW-3**



NOT TO SCALE

Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER**  
**4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**  
**MONITORING WELL CONSTRUCTION DETAIL**  
**MW-3**

Date Installed:  
 12-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-3/MW-3

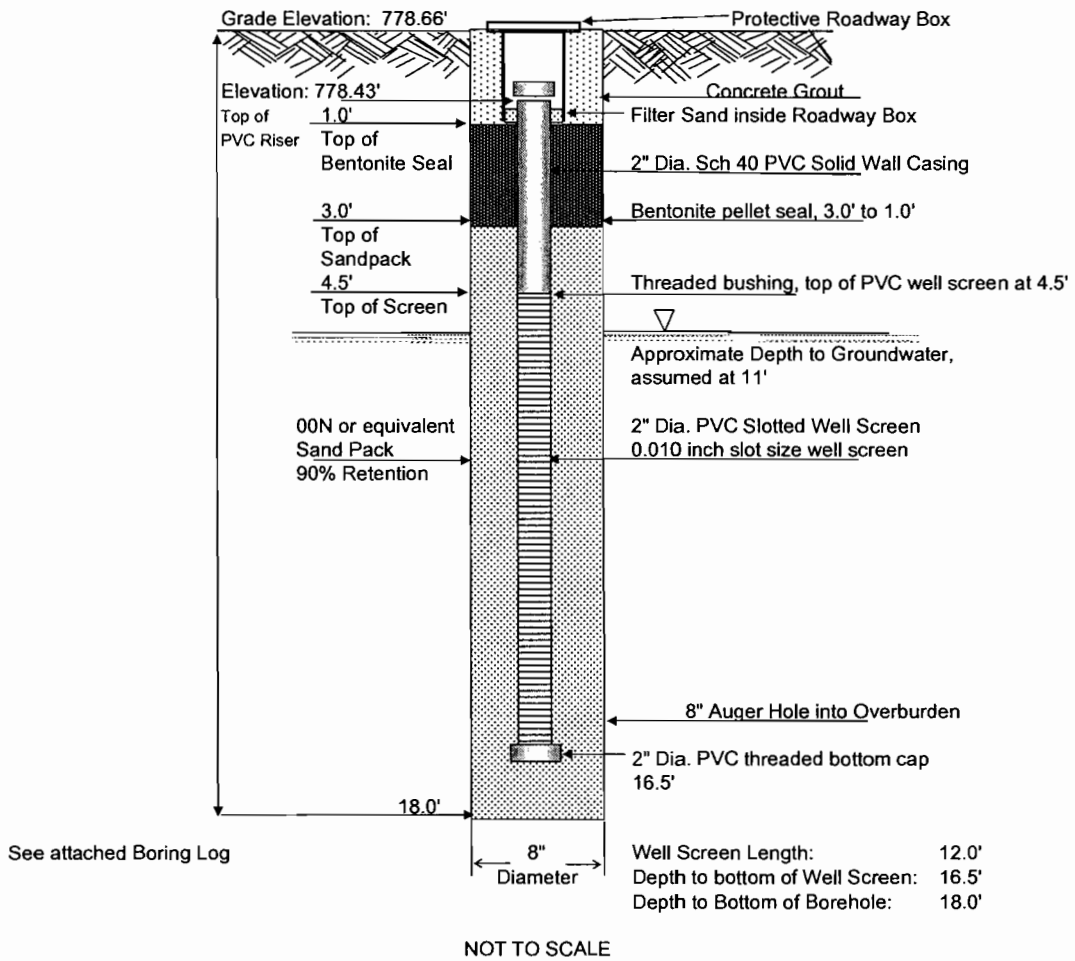
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/12/02 Finish Date: 07/12/02 Top of Well: N/A Boring No: B-3/MW-3  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In asphalt parking lot, southeast side of the building  
 Inspector: Jim Marschner, Bergmann Associates Water Level (During Drilling): Approximately 8.0 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 8 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 17.5 ft. to 4.5 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 18.0 ft to 3.0 ft  
 Seal: 3.0 to 1.0 feet Weather Conditions: Sunny, 60 degree F in the morning  
Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION		Field Screening for VOCs, ppm, using PID
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth	Type	Recovery	
0	27	7			16	1	0-2'	soil	29%	Asphalt surface, Fill to 2'2" 6.0'
			9	12						F-C Sand, F. Gravel, Concrete 2'2" 14.1 ppm
5	11	11			43	2	2'-4'	soil	46%	Damp Tan Dense F-M SAND with Silt, Trace Gravel 2.2 ppm
			32	21						Same, M. Dense 8.0 ppm
10	28	14			22	3	4'-6'	soil	8%	
			8	10						Moist Gr.-Br. Stiff SILT, inter-layered with Fine Sand. Wet at 8' 8.0' 21.0 ppm
15	3	5			14	4	6'-8'	soil	88%	
			9	8						Wet Br to Gr. M. Dense F-M GRAVEL, some F-M Sand, Some silt 27.0 ppm
20	6	9			16	5	8'-10'	soil	33%	
			7	8						Same wet M. Dense Gravel, but Gray 25.0 ppm
25	7	8			15	6	10'-12'	soil	46%	
			7	4						Same, becomes Dense 24.0 ppm
30	12	14			35	7	12'-14'	soil	50%	
			21	23						Dame Dense Gravel, some F. Sand 22.0 ppm
35	11	19			33	8	14'-16'	soil	29%	
			14	14						Same Gravel & Sand to 17' 17' 7.7 ppm
40	14	23			58	9	16'-18'	soil	58%	
			35	47						Damp Gray Hard Silty-CLAY, Trace Gravel. Laminated. TILL 18' 7.7 ppm
45										Boring terminated at 18.0 feet 2" diameter monitoring well installed in test boring.
										All cuttings placed in drums.
50										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs

N=No. of Blows to Drive 2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow



**MONITORING WELL B-4/MW-4**



Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**MONITORING WELL CONSTRUCTION DETAIL  
MW-4**

Date Installed:  
11-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

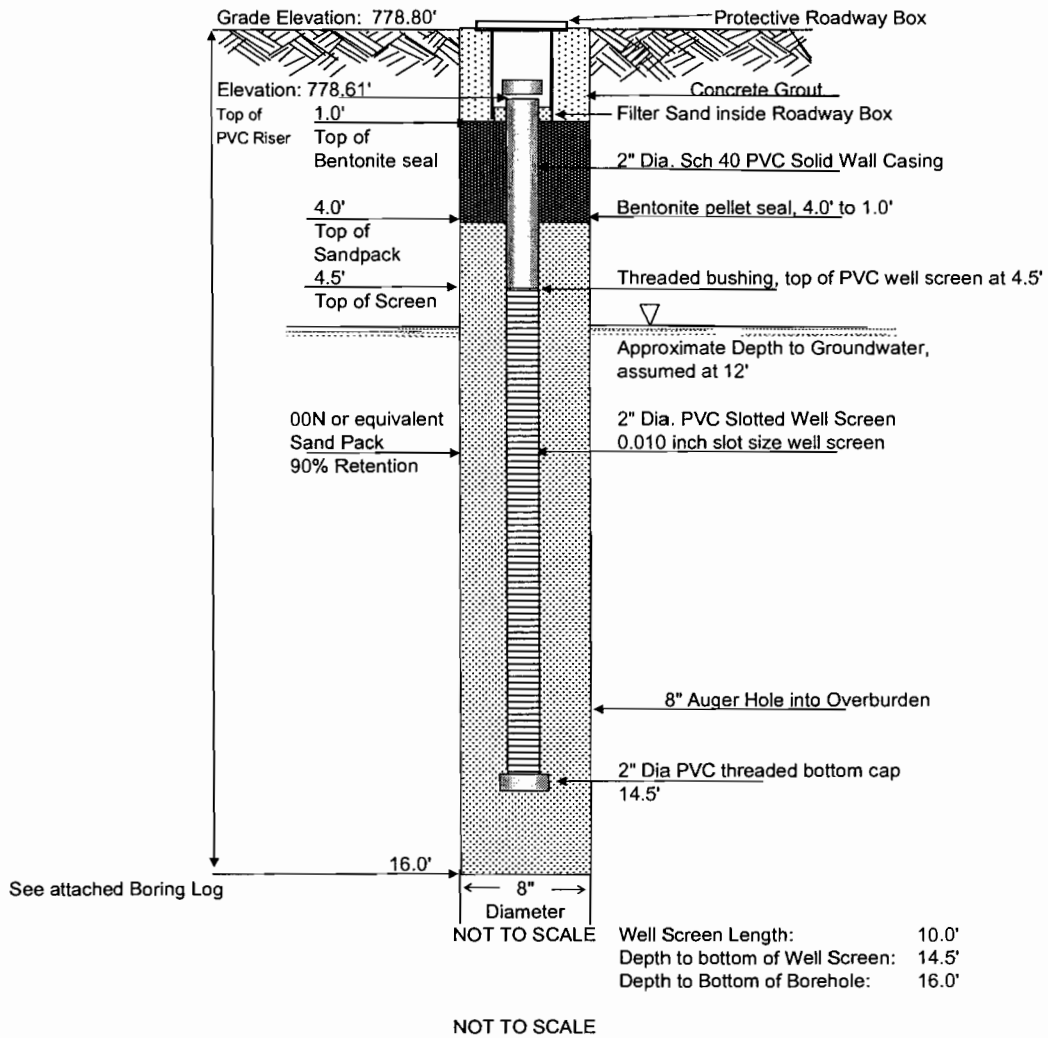
**BORING/WELL NUMBER:** Test Boring B-4/MW-4

PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/11/02 Finish Date: 07/11/02 Top of Well: N/A Boring No: B-4/MW-4  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In asphalt parking lot, east side of the building  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 11" feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 6 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 16.5 ft. to 4.6 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 18.0 ft to 3.0 ft  
 Seal: 3.0 to 1.0 feet Weather Conditions: Sunny, 75 degree F in the morning  
Flush to grade roadway box installed over the monitoring well.


DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0	22	8			12	1	0-2'	soil	21%	Asphalt Surface 0.5'	ND
			4	4						Damp Grown F-C SAND and Gravel	
5	4	2			6	2	2'-4'	soil	21%	Fill to 3.5'	ND
			4	5						Fill to 3.5' 3.5'	
10	2	3			6	3	4'-6'	soil	42%	Damp Gr-Br. Loose Fine SAND and Silt	ND
			3	4						Damp Br. M. Stiff SILT, some F. Sand 7'	
15	3	5			13	4	6'-8'	soil	38%	Damp Brown M. Dense F-M GRAVEL, some F-C Sand, Trace Silt	ND
			8	8						Same, M. Dense, V. Moist to wet	
20	6	10			18	5	8'-10'	soil	25%	Dame, M. Dense, Wet at 11'10"	ND
			8	5						Same, Gray and Brown, M. Dense	
25	12	10			24	6	10'-12'	soil	50%	Same, saturated, M. Dense	ND
			14	10						Same Gravel to 15'10" 15'10"	
30	9	9			25	7	12'-14'	soil	100%	Damp Gray Hard Silty-CLAY, Trace Gravel. Laminated. TILL 18'	ND
			16	14						Boring terminated at 18.0 feet 2" diameter monitoring well installed in test boring.	
35	2	14			22	8	14'-16'	soil	92%	All cuttings placed in drums.	ND
			8	14						Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	
40	15	21			47	9	16'-18'	soil	83%		ND
			26	43							

N = The number of blows to advance a 2" Split Spoon 12" with a 140 lb. Hammer dropped 30" each blow.

**MONITORING WELL B-5/MW-5**



Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level

	<b>GOWANDA DAY HABILITATION CENTER</b> <b>4 INDUSTRIAL PLACE, GOWANDA, NEW YORK</b>	Date Installed: 31-Jul-02
	<b>MONITORING WELL CONSTRUCTION DETAIL</b> <b>MW-5</b>	

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-5/MW-5

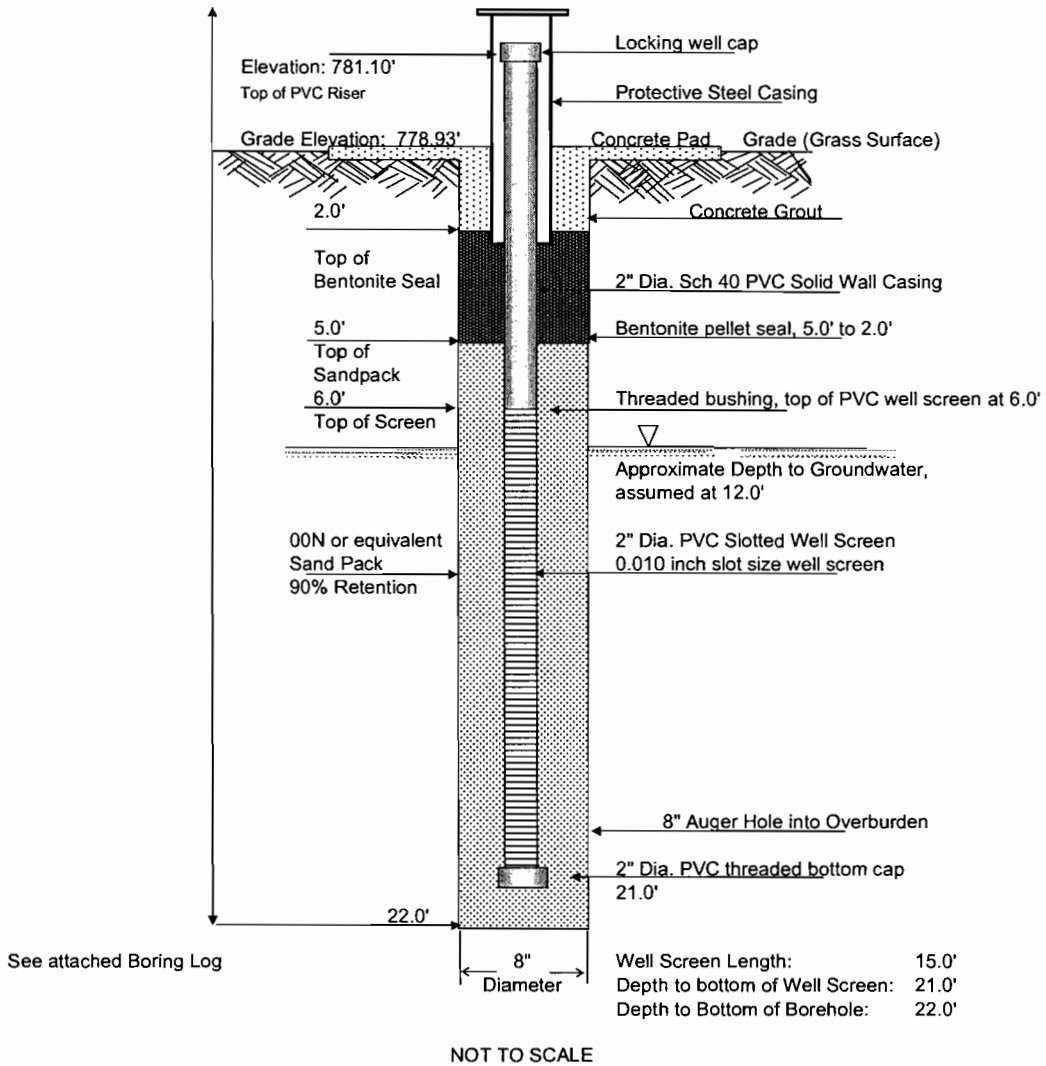
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/30/02 Finish Date: 07/31/02 Top of Well: N/A Boring No: B-5/MW-5  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In grass strip north of building , near property line  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 12.0' feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Not recorded  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 14.5 ft. to 4.5 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 16.0 ft to 4.0 ft  
 Seal: 4.0 to 1.0 feet Weather Conditions: Overcast, humid, 75 degrees in morning

Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION		Field Screening for VOCs, ppm, using PID
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth	Type	Recovery	
0	10	4			11	1	0-2'	soil	17%	Asphalt Surface 0.5'
			7	10						F. GRAVEL and F-C Sand Fill, 2' 2.0'
	4	3			6	2	2'-4'	soil	71%	Damp Br. Mottled M. Stiff SILT, Some F. Sand 18.0 ppm
5			3	3						Same damp M. Stiff SILT, some F. Sand 36.0 ppm
	2	4			7	3	4'-6'	soil	88%	
10			3	4						Same to 7'10" 56.0 ppm
	2	3			6	4	6'-8'	soil	100%	Start Brown Gravel 7'10'
	15	35			69	5	8'-10'	soil	54%	Damp Br. V. Dense F-M GRAVEL, some F-C Sand, tr. Silt 37.0 ppm
15			34	18						Same F-M GRAVEL, Some F-C Sand Becomes M. Dense, Wet at 12.0' WT~12' 3.0 ppm
	10	16			27	6	10'-12'	soil	58%	
	11	6			15	7	12'-14'	soil	13%	Same, wet to 14.'0, then Clay 14.0' 2.0 ppm
20	39	21			42	8	14'-16'	soil	58%	Damp Gray hard CLAY and Silt 1.6 ppm
			21	36						Trace Pebbles. Glacial Till 16.0'
25										Boring terminated at 16.0 feet 2" diameter monitoring well installed in test boring All cuttings placed in drums.
										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs
30										

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-6/MW-6**



Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**MONITORING WELL CONSTRUCTION DETAIL  
MW-6**

Date Installed:  
30-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

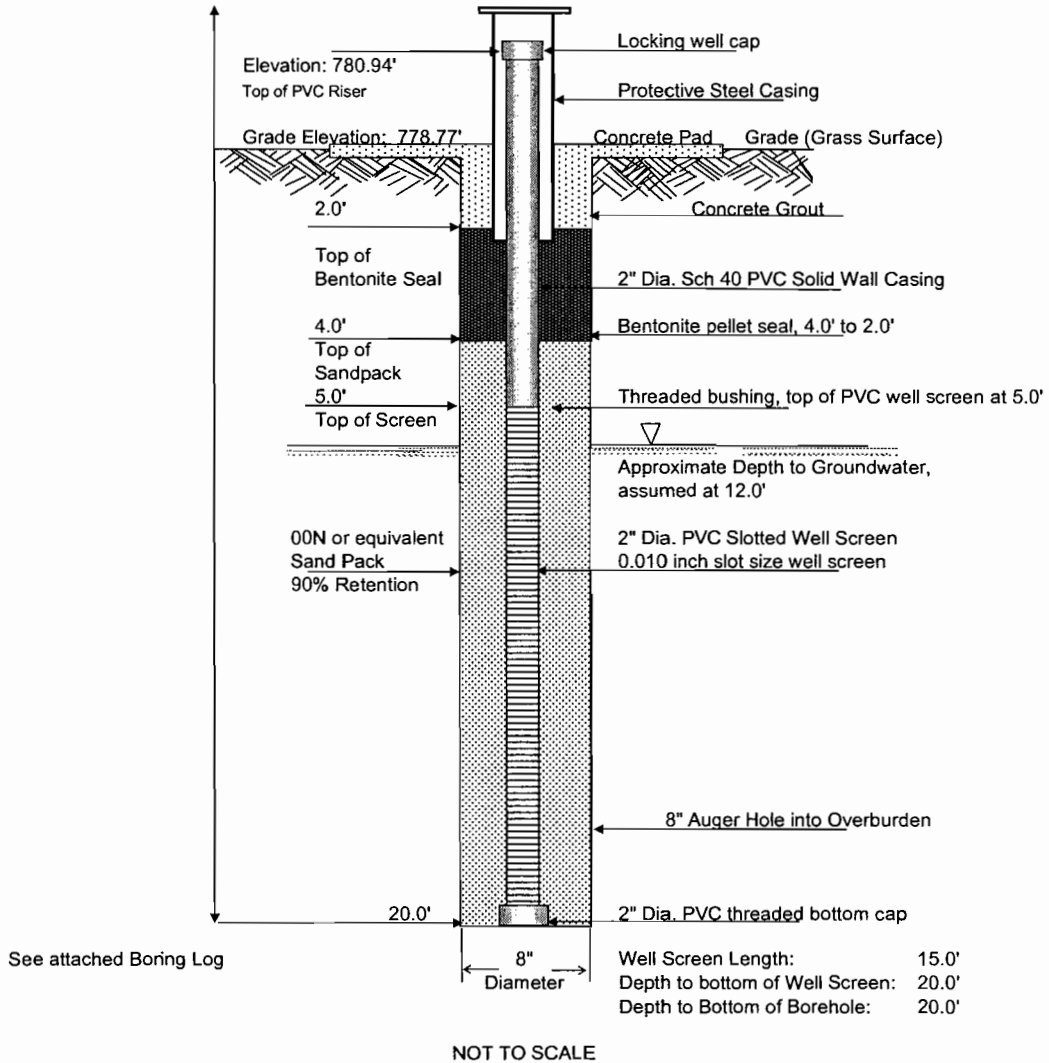
**BORING/WELL NUMBER:** Test Boring B-6/MW-6

PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/30/02 Finish Date: 07/30/02 Top of Well: N/A Boring No: B-6/MW-6  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In grass strip north of building , near property line  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 12 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 15 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 21.0 ft. to 6.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 22.0 ft to 5.0 ft  
 Seal: 5.0 to 2.0 feet Weather Conditions: Overcast, humid, 75 degrees in morning  
 Protective Steel Casing installed over the monitoring well.


DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION			Field Screening for VOCs, ppm, using PID
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth				
0	3	2			9	1	0-2'	soil	54%	Grass surface	1.1 ppm
			7	4						GRAVEL and F-C Sand Fill to 2'	
	2	2			4	2	2'-4'	soil	71%	Damp Br Mottled Soft SILT, some F. Sand. Partings evident	
5			2	4						Same, Stiff, becomes Moist at 7'6"	1.7 ppm
	3	4			10	3	4'-6'	soil	63%		
10			6	6							0.5 ppm
	3	3			6	4	6'-8'	soil	100%	Same, M. Stiff to 8.0', then Gravel	0.8 ppm
			3	4							
	8	15			25	5	8'-10'	soil	75%	Moist Br. M. Dense F-M GRAVEL, some f-C Sand, Trace Silt	
15			10	8							2.6 ppm
	6	5			10	6	10'-12'	soil	50%	Same, becomes, Loose, moist	1.6 ppm
			5	7							
	7	9			19	7	12'-14'	soil	58%	Same, M. Dense, Saturated. WT ~ 12'	
8	12			27	8	14'-16'	soil	100%	Same, saturated, becomes Gray	2.1 ppm	
20			15	23							14.7 ppm
	10	26			56	9	16'-18'	soil	100%	Same, becomes V. Dense	22.0 ppm
			30	50							
	5	20			51	10	18'-20'	soil	100%	Same, V. Dense	
25			31	23							27.0 ppm
	10	10			31	11	20'-22'	soil	100%	Same to 20.5', then Damp Clay	10.0 ppm
			21	40						Damp Gray Hard SILT and Clay Trace pebbles. Glacial Till	
30											
										Boring terminated at 22.0 feet	
										2" diameter monitoring well installed in test boring	
										All cuttings placed in drums. Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-7/MW-7**



Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level

	<b>GOWANDA DAY HABILITATION CENTER</b> <b>4 INDUSTRIAL PLACE, GOWANDA, NEW YORK</b>	Date Installed: 30-Jul-02
	<b>MONITORING WELL CONSTRUCTION DETAIL</b> <b>MW-7</b>	

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-7/MW-7

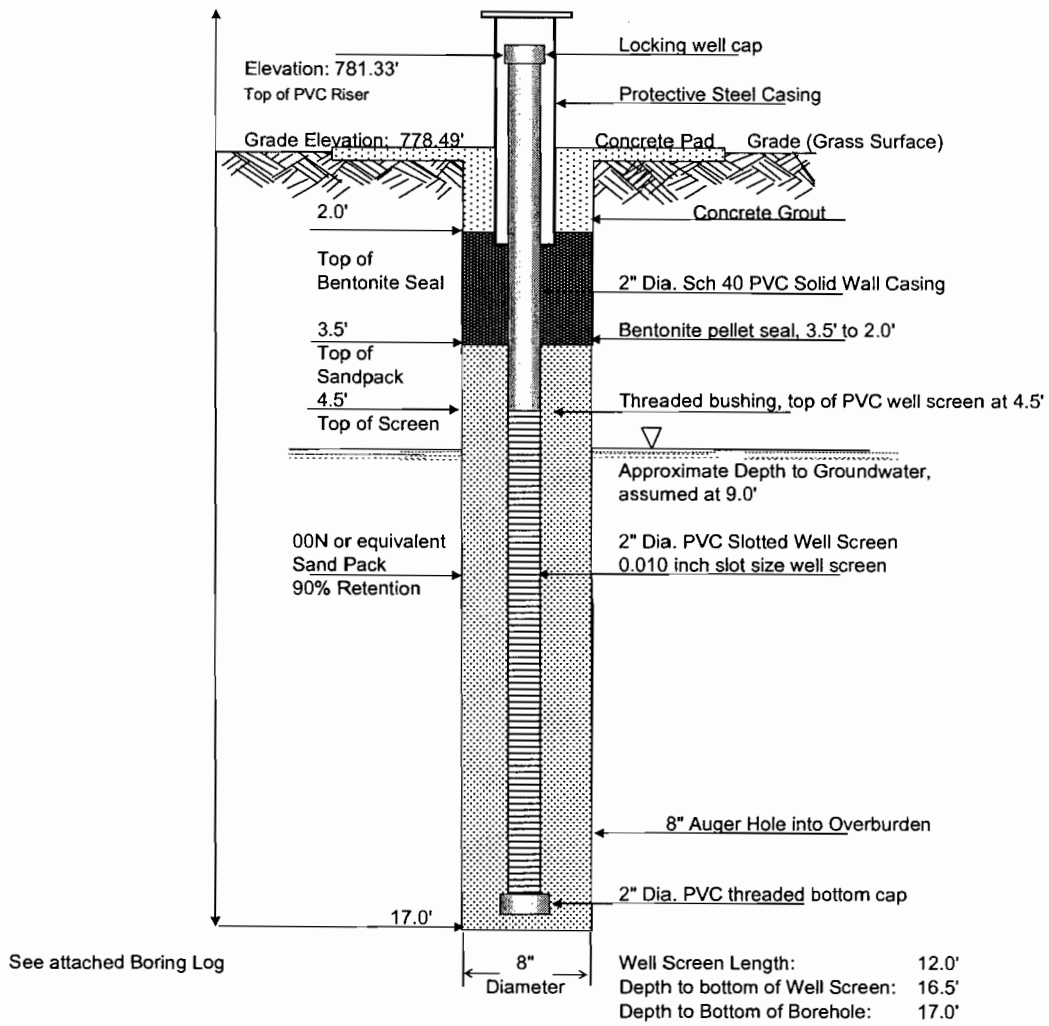
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/30/02 Finish Date: 07/30/02 Top of Well: N/A Boring No: B-7/MW-7  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In grass strip north of building at northwest corner  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 12 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 15;9" feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 20 ft. to 5.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 20.0 ft to 4.0 ft  
 Seal: 4.0 to 2.0 feet Weather Conditions: Overcast, humid, 75 degrees in morning  
 Protective Steel Casing installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0	1	4			11	1	0-2'	soil	58%	Grass surface	1.1 ppm
			7	11						F. GRAVEL and F-C Sand. Fill 2'2"	
	3	5			7	2	2'-4'	soil	71%	Damp Mottled BR & GR M. Stiff SILT, Some F. Sand	
5			2	4						Same M. Stiff, mottled brown & gray	0.9 ppm
	4	3			6	3	4'-6'	soil	71%		
10			3	5						Same, Soft, mottled brown & gray, moist	0.9 ppm
		3	2			4	4	6'-8'	soil	100%	
				2	3						0.7 ppm
		2	2			8	5	8'-10'	soil	75%	Same SILT to 9.0', then Gravel 9.0'
15			6	8						V. Moist Br F-M M. Dense GRAVEL, Some F-C Sand, Tr. Silt	0.8 ppm
		3	3			4	6	10'-12'	soil	33%	
				1	WR					Same, becomes V. Loose, Wet at 12'	2.9 ppm
		1	2			7	7	12'-14'	soil	38%	Same, becomes Loose, saturated
20			5	6						Same, saturated, becomes Gray	2.0 ppm
		3	2			6	8	14'-16'	soil	63%	
			4	29						Same Gray GRAVEL, Some F-C Sand, becomes V. Dense	2.1 ppm
25		17	43			93	9	16'-18'	soil	94%	
				50/4"						Same to 19'6"	3.7 ppm
		3	9			33	10	18'-20'	soil	100%	
30			24	24						Damp Gray V. Stiff SILT and Clay Glacial Till	2.1 ppm
										Boring terminated at 20.0 feet	
										2" diameter monitoring well installed in test boring	
										All cuttings placed in drums.	
										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow




**MONITORING WELL B-8/MW-8**



NOT TO SCALE

Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level

	<b>GOWANDA DAY HABILITATION CENTER</b> <b>4 INDUSTRIAL PLACE, GOWANDA, NEW YORK</b>	Date Installed: 24-Jul-02
	<b>MONITORING WELL CONSTRUCTION DETAIL</b> <b>MW-8</b>	

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-8/MW-8

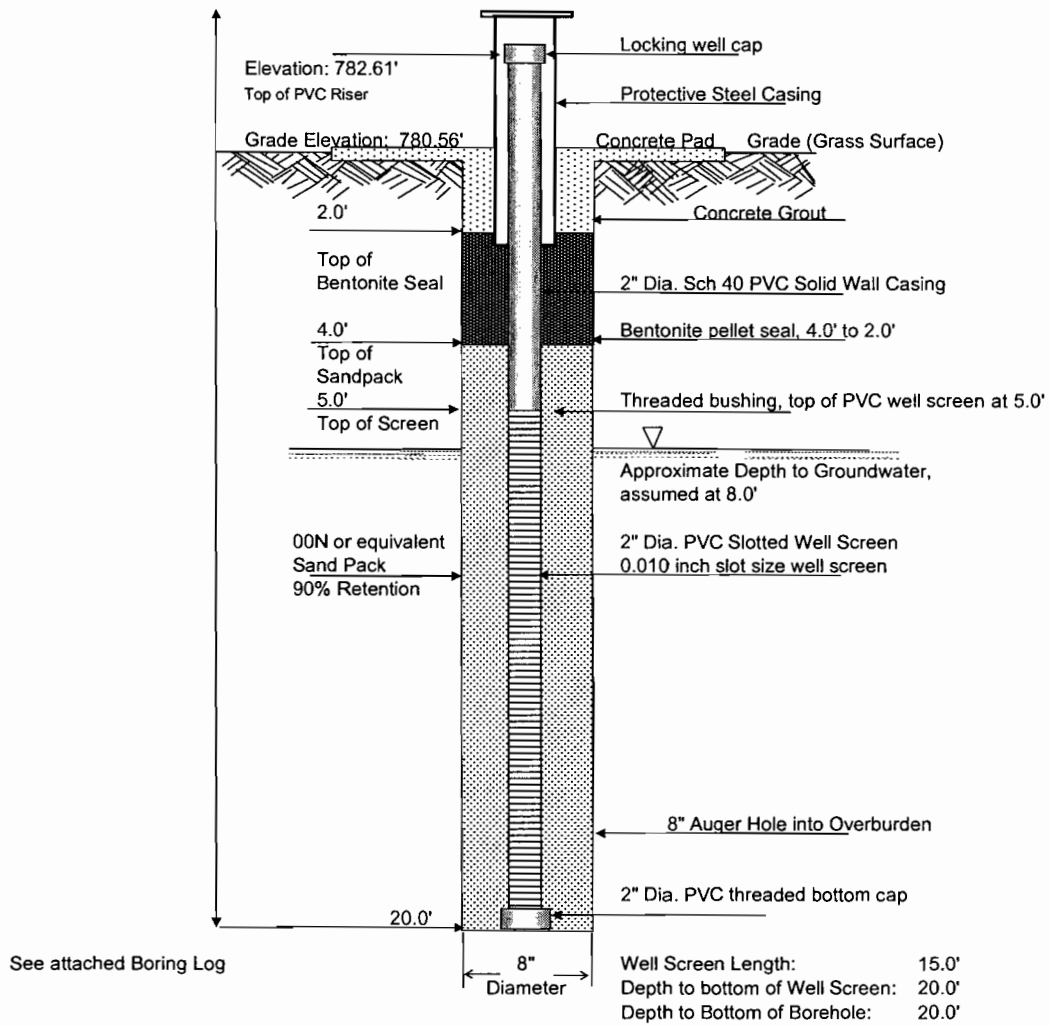
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/24/02 Finish Date: 07/24/02 Top of Well: N/A Boring No: B-8/MW-8  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In grass at the southwest corner of the building.  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 9 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 7.9 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 4.5 ft. to 16.5 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 17.0 ft to 3.5 ft  
 Seal: 3.5 to 2.0 feet Weather Conditions: Sunny, 80 degrees in afternoon.

Protective Steel Casing installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0	1	5			10	1	0-2'	soil	75%	Grass surface, Sand & Gr. Fill to 1.0'	ND
			5	4			2'-4'	soil	63%	Damp mottled Loose SILT, Some F. Sand	
	3	4			10	2				Same damp mottled SILT and F. Sand	
5			6	7			4'-6'	soil	75%	Loose	ND
	2	4			9	3				Same, damp, Loose	
10			5	5			6'-8'	soil	13%	Same, Very Loose	ND
	1	1			2	4					
			1	WH			8'-10'	soil	67%	Same to 8'6" 8'6"	
WH	4			11	5	Wet F-M GRAVEL, some F-C Sand					
15			7	20			10'-12'	soil	33%	Same, M. Dense, saturated, trace silt	ND
	5	11			22	6					
			11	10			12'-14'	soil	58%	Same, saturated, M. Dense	
10	11			25	7						
20			14	23			14'-16'	soil	58%	Same to 15'10" 15'10"	ND
	5	12			24	8					
25			12	12			16'-17'	soil	83%	Damp Hard Gray CLAY	
	41	50/4			50+	9				Trace gravel-pebbles. TILL 17'	
										Boring terminated at 17.0 feet 2" diameter monitoring well installed in test boring.  All cuttings placed in drums.	
30										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	


N=No. of Blows to Drive 2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-9/MW-9**



NOT TO SCALE

Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level

	<b>GOWANDA DAY HABILITATION CENTER</b> <b>4 INDUSTRIAL PLACE, GOWANDA, NEW YORK</b>	Date Installed: 11-Jul-02
	<b>MONITORING WELL CONSTRUCTION DETAIL</b> <b>MW-9</b>	

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-9/MW-9

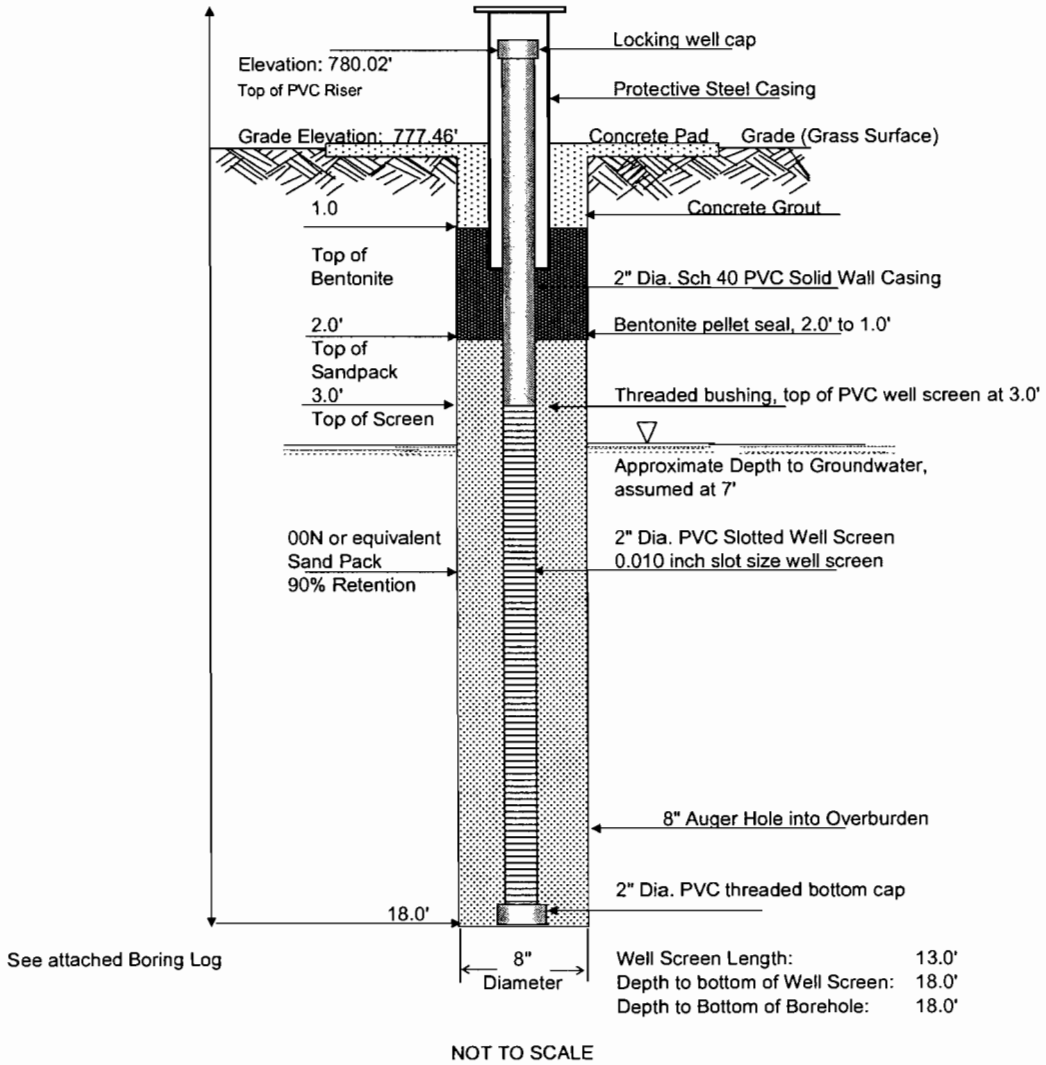
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/11/02 Finish Date: 07/11/02 Top of Well: N/A Boring No: B-9/MW-9  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: By access road, west of the building.  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 8 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 13'4" feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 5.0 ft. to 20.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 20.0 ft to 4.0 ft  
 Seal: 4.0 to 2.0 feet Weather Conditions: Sunny, 65 degrees F in Morning

Protective Steel Casing installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0	11	12			19	1	0-2'	soil	67%	Grass surface; Gravel Fill to 1.0'	1.0'
			7	7						Damp Br. Stiff SILT, mottled, partings	ND
	5	6			15	2	2'-4'	soil	63%	Same SILT, Stiff, little F. Sand	ND
5			9	10							ND
	4	7			13	3	4'-6'	soil	83%	Same Damp Br. Silt, layers of F. Sand	ND
10			6	6							ND
	2	2			3	4	6'-8'	soil	83%	Same SILT, V. Soft, some F. Sand	ND
			1	1						Wet, Saturated at 8.0'	ND
	WH	WH			3	5	8'-10'	soil	83%	Brown F. SAND, some Silt, Saturated	10.0' ND
15		1			6	6	10'-12'	soil	25%	Saturated Br to Gr Loose F-M GRAVEL	ND
			5	5						Some F-C Sand, Trace Silt	ND
	5	7			16	7	12'-14'	soil	83%	Same, Saturated, M. Dense	ND
			9	8							ND
20	8	3			12	8	14'-16'	soil	58%	Same, Wet, M. Dense	ND
			9	12							ND
	22	16			31	9	16'-18'	soil	33%	Same, Wet, Dense F-M GRAVEL,	19.5" ND
			15	10						Some F-C Sand, Trace Silt	ND
25	4	5			20	10	18'-20'	soil	83%	Damp Grey V. Stiff SILT, Little Clay,	20' ND
			15	25						Trace Gravel. Laminated. TILL	ND
30										Boring terminated at 20.0 feet	
										2" diameter monitoring well	
										installed in test boring.	
30										All cuttings placed in drums.	
										Minirac 2000 PID with 10.6 ev lamp	
										used to screen soil samples for VOCs	

N=No. of Blows to Drive 2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-10/MW-10**



Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**MONITORING WELL CONSTRUCTION DETAIL  
MW-10**

Date Installed:  
10-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-10/MW-10

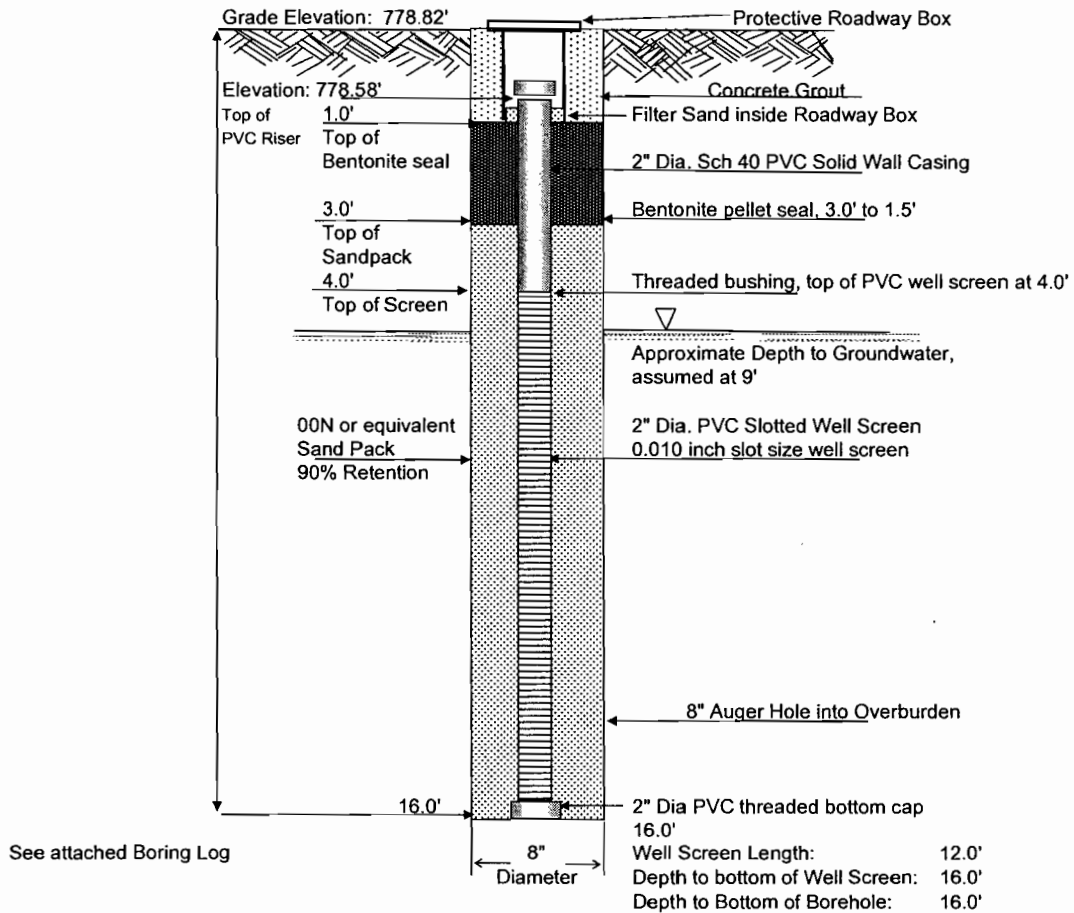
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/10/02 Finish Date: 07/10/02 Top of Well: N/A Boring No: B-10/MW-10  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: In grass south of the building, near property line  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 7 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, CME-55 rig Water Level (Post Drilling): Approx. 6' 6" feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 3.0 ft. to 18.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 18.0 ft to 2.0 ft  
 Seal: 2.0 to 1.0 feet Weather Conditions: Sunny, 80 degrees in afternoon.

Protective Steel Casing installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0	1	3			9	1	0-2'	soil	58%	Grass, then Fill: Damp F-C SAND and Gravel, Brick fragments' 2.5'	ND
	3	3	6	5	9	2	2'-4'	soil	42%		
	5	5	6	6	9	3	4'-6'	soil	83%		
5			4	2						V.Moist Loose F. SAND, Some Silt	ND
	1	3			8	4	6'-8'	soil	33%		
	8	3	5	7	9	5	8'-10'	soil	42%		
10			6	10						Wet Brown M. Dense M-F GRAVEL, Same Gravel, Saturated, Loose	ND
	4	11			22	6	10'-12'	soil	50%		
	6	3	11	12	7	7	12'-14'	soil	83%		
15			4	4						Same, becomes Gray, Loose	ND
	6	14			34	8	14'-16'	soil	83%		
			20	30							
20	22	36			85	9	16'-18'	soil	75%	Same Gray Gravel, some Sand, Dense Same to 17.5' 17.5'	ND
			49	40							
25										Damp Grey Hard SILT, Little Clay, Trace Gravel. Laminated. TILL 18'	ND
30										Boring terminated at 18.0 feet 2" diameter monitoring well installed in test boring.  All cuttings placed in drums.	

N = The number of blows to advance a 2" Split Spoon 12" with a 140 lb. Hammer dropped 30" each blow.

**MONITORING WELL B-11/MW-11**



NOT TO SCALE

Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**MONITORING WELL CONSTRUCTION DETAIL  
MW-11**

Date Installed:  
17-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-11/MW-11

PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/17/02 Finish Date: 07/17/02 Top of Well: N/A Boring No: B-11/MW-11  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: Inside the Building, by Nurse Clinic, Room 39  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 9 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, skid rig Water Level (Post Drilling): Approx. 10 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 16 ft. to 4 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 16.0 ft to 3.0 ft  
 Seal: 3.0 to 1.0 feet Weather Conditions: Not applicable: work was indoors.

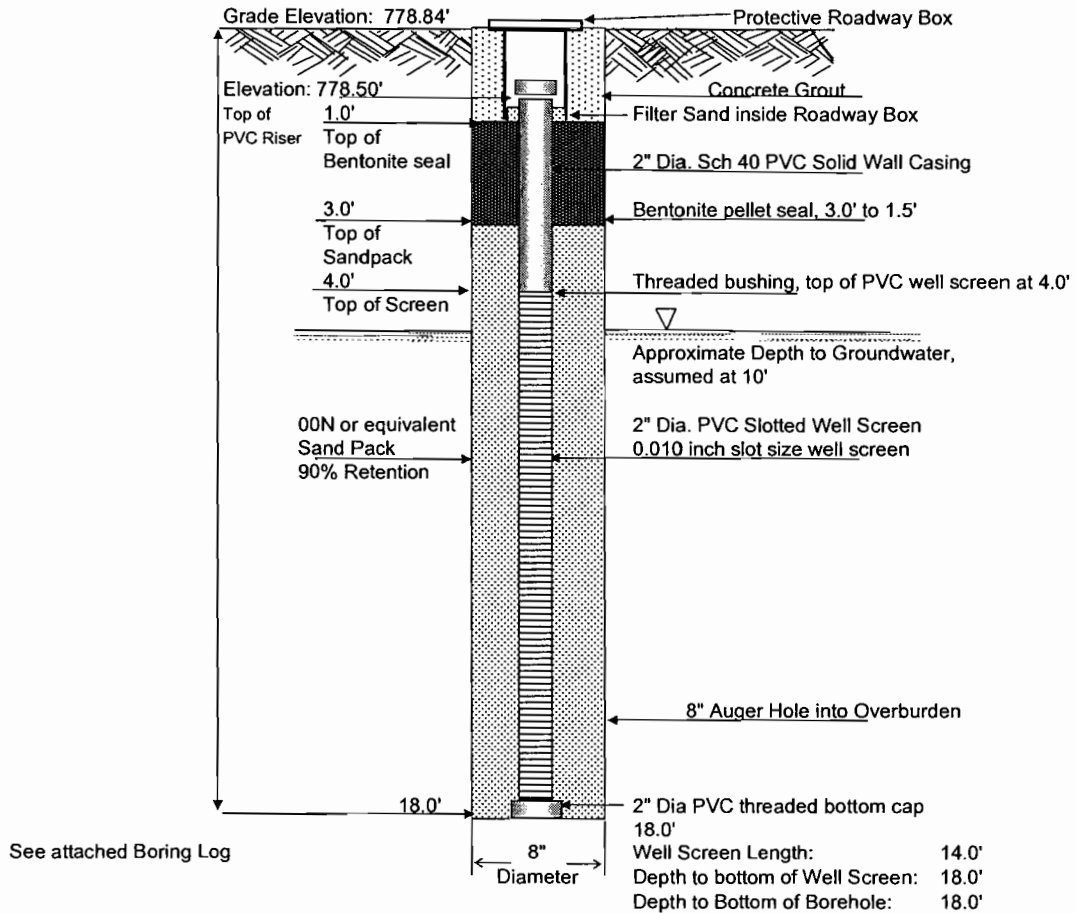
Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0		14			48	1	0-2'	soil	67%	Concrete floor to 0.5 feet	ND
			34	30			2'-4'	soil	58%	Damp Dark Br. F-C SAND and F-M Gravel, Some Silt. FILL 3.0'	
5	not recorded				0	2				Damp Brown mottled SILT, some F. Sand	74 ppm
	2	5			9	3	4'-6'	soil	38%	Moist mottled Stiff SILT, some F. Sand	130 ppm
10			4	4			6'-8'	soil	13%	V. Moist at 6'	75 ppm
	5	5			10	4				Moist Br. Stiff SILT, some F-C Sand	
			5	6			8'-10'	soil	17%	Same to 8' 8.0'	
15	4	1			5	5				Saturated Br. Loose F-M GRAVEL, some F-C Sand, trace silt	60 ppm
	15	18			38	6	10'-12'	soil	50%	Same, becomes Dense G-M Gravel, some F-C Sand, Trace Silt	41 ppm
	7	26			60	7	12'-14'	soil	79%	Same, becomes V. Dense	41 ppm
20			34	27			14'-16'	soil	63%	Same Saturated Gravel and Sand to 15'3" 15'3"	32.8 ppm
			36	48			16'-18'	soil	75%	Damp Gray Hard Silty CLAY, laminated, trace pebbles. TILL 16'	33.5 ppm
25					0	9				Boring terminated at 16.0 feet 2" diameter monitoring well installed in test boring.	
										All cuttings placed in drums.	
30										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	

N=No. of Blows to Drive      2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow



**MONITORING WELL B-12/MW-12**



NOT TO SCALE

Elevation for Top of Well Casing (TOC) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER**  
**4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**MONITORING WELL CONSTRUCTION DETAIL**  
**MW-12**

Date installed:  
 16-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-12/MW-12

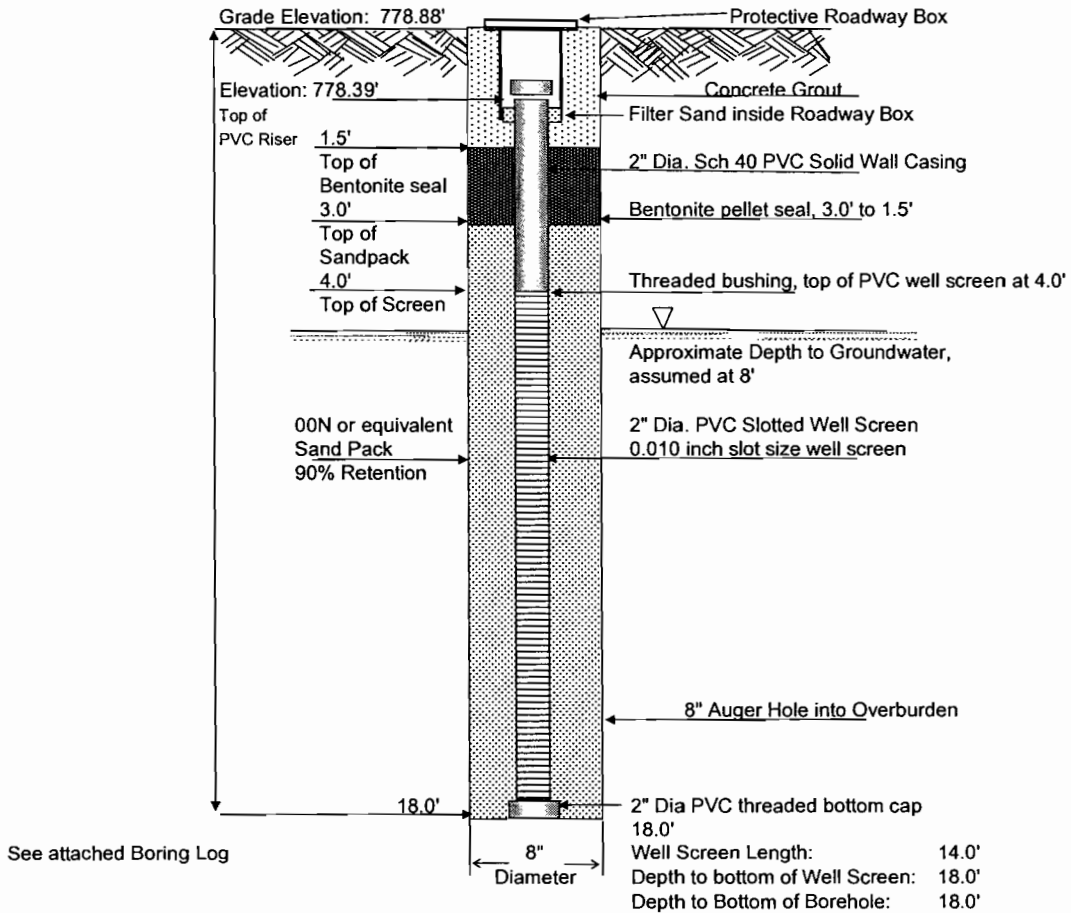
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/16/02 Finish Date: 07/16/02 Top of Well: N/A Boring No: B-12/MW-12  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: Inside the Building, by Cafeteria, Room 50  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 10.0 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, skid rig Water Level (Post Drilling): Approx. 10 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 18 ft. to 4 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 18.0 ft to 3.0 ft  
 Seal: 3.0 to 1.0 feet Weather Conditions: Not applicable: work was indoors.

Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION		Field Screening for VOCs, ppm, using PID	
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth	Type	Recovery		
0		18			46	1	0-2'	soil	83%	Concrete floor to 0.5 feet	
			28	45						Damp Br. F-C SAND and F-M Gravel	7.0 ppm
	23	6			14	2	2'-4'	soil	58%	Trace silt. Reworked. Fill	3.0' 8.0 ppm
5			8	6						Damp mottled Stiff SILT, Some F-C Sand	
	8	12			20	3	4'-6'	soil	63%	Same, V. Stiff SILT, some F. Sand	6.5 ppm
			8	6							
10		6	5		10	4	6'-8'	soil	25%	Same, Damp, Stiff SILT, some F. Sand	10.0 ppm
			5	4							
	not recorded				0	5	8'-10'	soil	83%	same Silt & F. Sand to 9.0'	9.0' 8.9 ppm
15	9	17			32	6	10'-12'	soil	42%	Wet brown Dense F-M GRAVEL, some F-C Sand, Trace Silt.	16.0 ppm
			15	12							
	8	12			24	7	12'-14'	soil	75%	Same, M. Dense, saturated	30.0 ppm
20			12	8							
	22	39			75	8	14'-16'	soil	63%	Same, M. Dense, saturated F-M GRAVEL	14.0 ppm
			36	34						some F-C Sand, Tr. Silt	
25	21	14			64	9	16'-18'	soil	75%	Same to 17' 2"	17.17 9.0 ppm
			50	50/4"						Damp Gray Hard SILT and Clay,	
										Laminated TILL	18' 15 ppm
30										Boring terminated at 18.0 feet	
										2" diameter monitoring well installed in test boring.	
										All cuttings placed in drums.	
										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	

N=No. of Blows to Drive 2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-13/MW-13**



NOT TO SCALE

Elevation for Top of Well Casing (TOC) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

**MONITORING WELL CONSTRUCTION DETAIL  
MW-13**

Date installed:  
16-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-13/MW-13

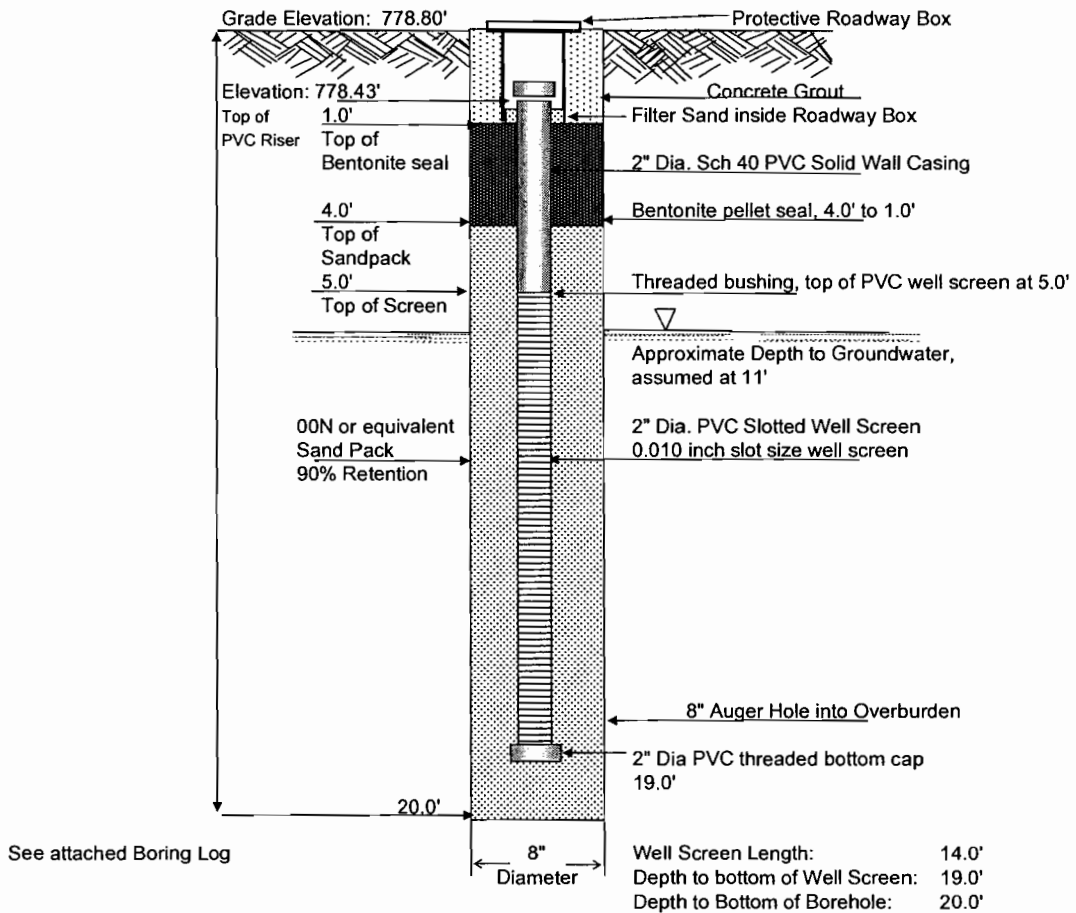
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/15/02 Finish Date: 07/16/02 Top of Well: N/A Boring No: B-13/MW-13  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: Inside the Building, in hallway by Room 58B  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 8 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, skid rig Water Level (Post Drilling): Approx. 14.5 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 18 ft. to 4 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 18.0 ft to 3.0 ft  
 Seal: 3.0 to 1.5 feet Weather Conditions: Not applicable: work was indoors.

Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0		7			18	1	0-2'	soil	44%	Concrete floor to 0.5 feet	ND
			11	12						Damp brown F-C SAND and F-G Gravel, Tr. Silt	
5	23	11			18	2	2'-4'	soil	25%	Re-Worked soil, Fill	ND
			7	8						Fill to 4.5'	4.5'
10	10	8			17	3	4'-6'	soil	63%		
			9	8						Damp Brown V. Still SILT and F-Sand, Faint partings/laminae to 6'	6.0'
15	12	18			29	4	6'-8'	soil	54%		
			11	7						Damp dark Br. M Dense F-C SAND and F-M Gravel, Tr. Silt. Wet at 8'	
20	14	6			20	5	8'-10'	soil	83%	Wet Gr. Br. M. Dense F-M GRAVEL	
			14	9						some F-C Sand, Tr. Silt	9.0 ppm
25	3	5			33	6	10'-12'	soil	25%	Same, Wet, becomes Dense	
			28	12						Same, saturated, Dense	5.0 ppm
30	20	17			49	7	12'-14'	soil	63%		
			32	20						Same, becomes V. Dense	
35	48	33			53	8	14'-16'	soil	25%		
			20	12						Same, M. Dense to 17'5"	17'5
40	10	6			16	9	16'-18'	soil	50%		
			10	30						Damp Gray Hard CLAY and Silt	
45										Trace gravel-pebbles. Till	18'
										Boring terminated at 18.0 feet	
50										2" diameter monitoring well installed in test boring.	
										All cuttings placed in drums.	
55										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	

N=No. of Blows to Drive      2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-14/MW-14**



NOT TO SCALE

Elevation for Top of Well Casing (TOC) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER**  
**4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**  
**MONITORING WELL CONSTRUCTION DETAIL**  
**MW-14**

Date Installed:  
18-Jul-02

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-14/MW-14

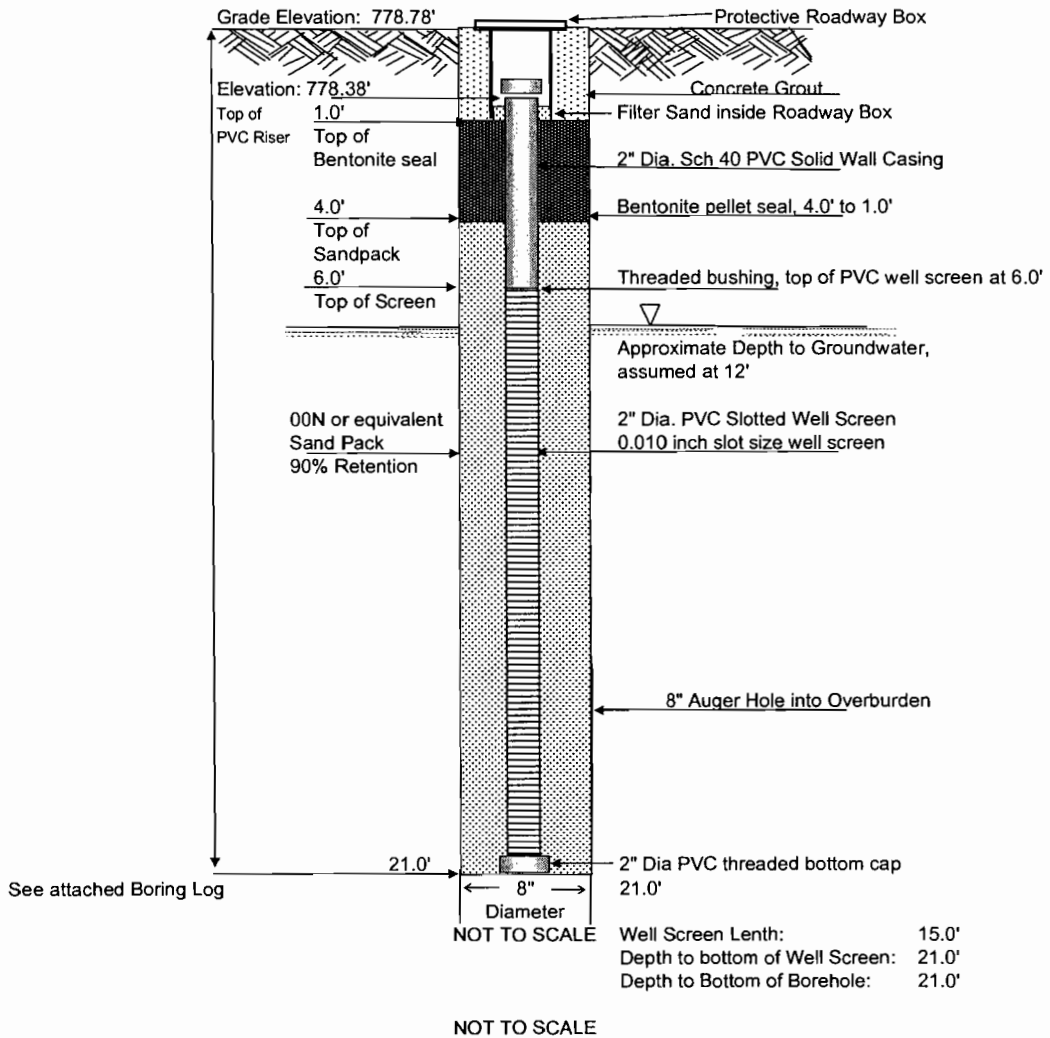
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/18/02 Finish Date: 07/18/02 Top of Well: N/A Boring No: B-14/MW-14  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: Inside loading dock area, by east wall.  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 11 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, skid rig Water Level (Post Drilling): Approx. feet 13 below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 19 ft. to 5 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 19.0 ft to 4.0 ft  
 Seal: 4.0 feet to 1.0 feet Weather Conditions: Not applicable: work was indoors.

Flush to grade roadway box installed over the monitoring well.


DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0		6			17	1	0-2'	soil	78%	Concrete floor to 0.5 feet	
			11	20						Damp Brown F-C Sand and F-C Gravel Fill to 3'6"	16 ppm 120 ppm
5	14	9			15	2	2'-4'	soil	42%		
			6	20						Damp DarkBrown SILT, some F. Sand	
10	5	3			8	3	4'-6'	soil	75%	Damp mottled M. Stiff SILT, some F-Sand	51 ppm
			5	5						Same Silt, inter-layered wth F-M Sand	78.5 ppm
15	6	5			11	4	6'-8'	soil	58%		
	WH	WH			1	5	8'-10'	soil	50%	Damp Br. V. Soft SILT, some F. Sand	42 ppm
20			1	1						Wet Brown F SAND, Some Silt	
	1	2			8	6	10'-12'	soil	58%	same to 11'	11' 143 ppm
25			6	7						Wet F-M GRAVEL some F-C Sand	
	14	15			33	7	12'-14'	soil	54%	Same, saturated, with a trace of Silt	60 ppm
30			18	12						Same saturated Gravel, M. Dense	53 ppm
	3	8			14	8	14'-16'	soil	50%		
35			6	5						Same to 17'	43 ppm
	10	18			66	9	16'-18'	soil	91%	Wet Grey M. Dense F-M GRAVEL	
40			48	50/4"						Some F-C Sand	18'6"
	8	29			69	10	18'-20'	soil	100%	Damp Gray Hard SILT and Clay, Trace Pebbles TILL	20' 53 ppm
45			40	50/2"						Boring terminated at 20.0 feet	
										2" diameter monitoring well installed in test boring.	
50										All cuttings placed in drums.	
										Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	

N=No. of Blows to Drive 2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL B-15/MW-15**



Elevation for Top of Well Casing (TOC) and Grade Elevation are in feet, relative to Mean Sea Level

	<b>GOWANDA DAY HABILITATION CENTER</b> <b>4 INDUSTRIAL PLACE, GOWANDA, NEW YORK</b>	Date Installed: 19-Jul-02
	<b>MONITORING WELL CONSTRUCTION DETAIL</b> <b>MW-15</b>	

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring B-15/MW-15

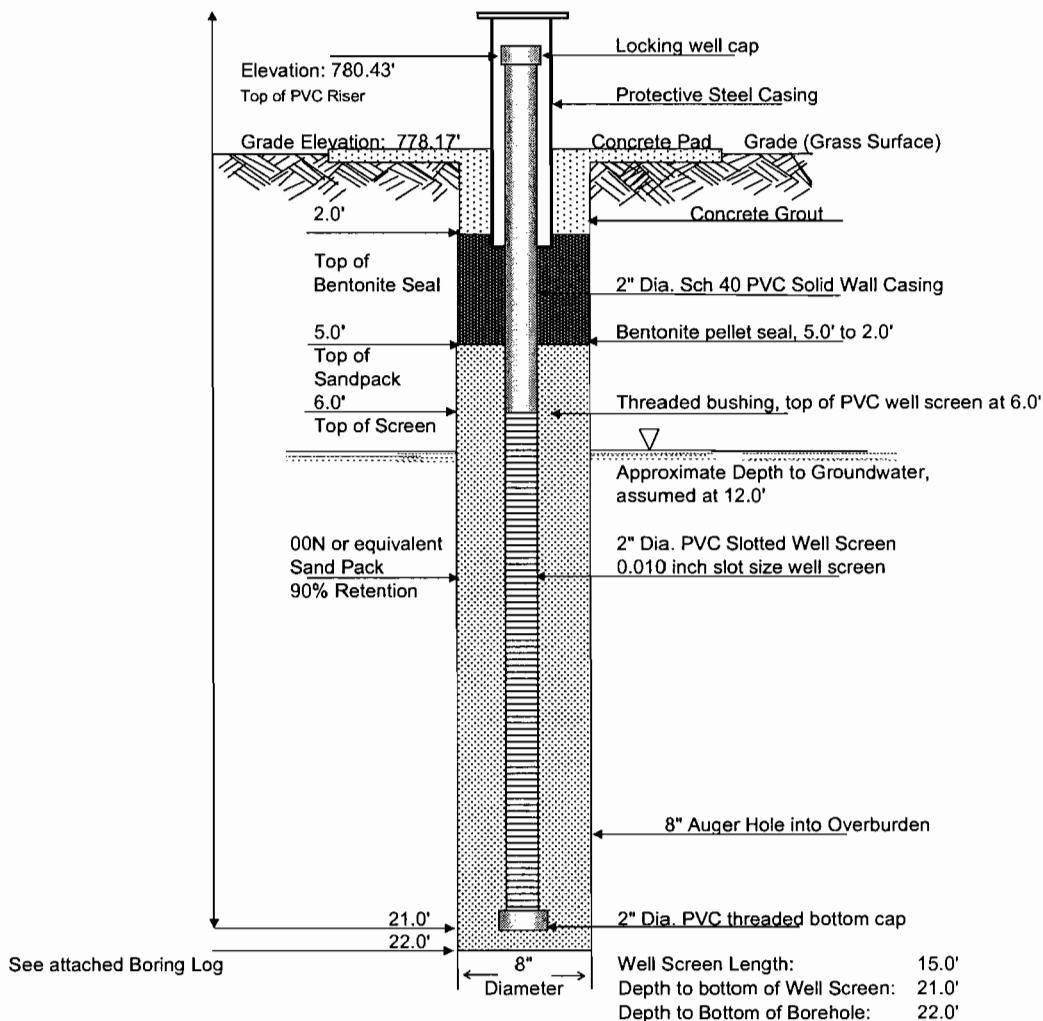
PROJECT: Gowanda Day Habilitation Center Project No: 5596.03 Page No. 1 of 1  
 Start Date: 07/19/02 Finish Date: 07/19/02 Top of Well: N/A Boring No: B-15/MW-15  
 Driller: Steven Laramie, Geologic NY/NorthStar Boring Location: Inside building, in north cafeteria, room 124  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 12 feet  
 Drilling Method: 4-1/4 inch Hollow Stem Augers, skid rig Water Level (Post Drilling): Approx. 15 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed via auger pull back method.  
 Screened Interval: 21 ft. to 6 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 21.0 ft to 4.0 ft  
 Seal: 4.0 feet to 1.0 feet Weather Conditions: Not applicable: work was indoors.  
Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0		7			21	1	0-2'	soil	72%	Concrete floor to 0.5 feet	102 ppm 161 ppm
			14	30			2'-4'	soil	58%	Damp F-C SAND and F-C Gravel Fill to 3.5' 3'6"	
	41	12			17	2				Mottled Soft SILT, Some F. Sand	
5			5	4			4'-6'	soil	75%	Damp mottled Soft SILT, some F-Sand	99 ppm
	1	1			4	3					
10			3	5			6'-8'	soil	67%	Moist mottled stiff SILT, Some F. Sand partings/faint laminations evident	96.6 ppm
			6	7			8'-10'	soil	67%	Same to 9'6" 9'6"	77 ppm
	3	2			9	5				Damp Br. F-M GRAVEL, some	
15					17	6	10'-12'	soil	50%	F-C Sand, Tr. Silt	83 ppm
			7	10			12'-14'	soil	33%	same, becomes M. Dense, wet at 11'10"	84 pm
			2	1			14'-16'	soil	58%	Same, saturated, becomes Loose	84 ppm
20					6	8					
			5	9			16'-18'	soil	91%	Same, saturated, becomes V. Dense	70.2 ppm
	25	34			68	9	18'-20'	soil	50%	Same, becomes Dense	75.4 ppm
25			34	42							
			5	15			20-22'	soil		Same to 20.5' 20.5'	not recorded
			25	35						Gray hard CLAY and Silt, TILL 21'	
30					50+	11					
										Boring terminated at 21.0 feet 2" diameter monitoring well installed in test boring.	
										All cuttings placed in drums. Minirae 2000 PID with 10.6 ev lamp used to screen soil samples for VOCs	

N=No. of Blows to Drive      2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow



**MONITORING WELL MW-16**



NOT TO SCALE

Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER**  
**4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**  
**MONITORING WELL CONSTRUCTION DETAIL**  
**MW-16**

Date Installed:  
10-Jul-03

# DRILLING LOG



**B E R G M A N N**  
associates

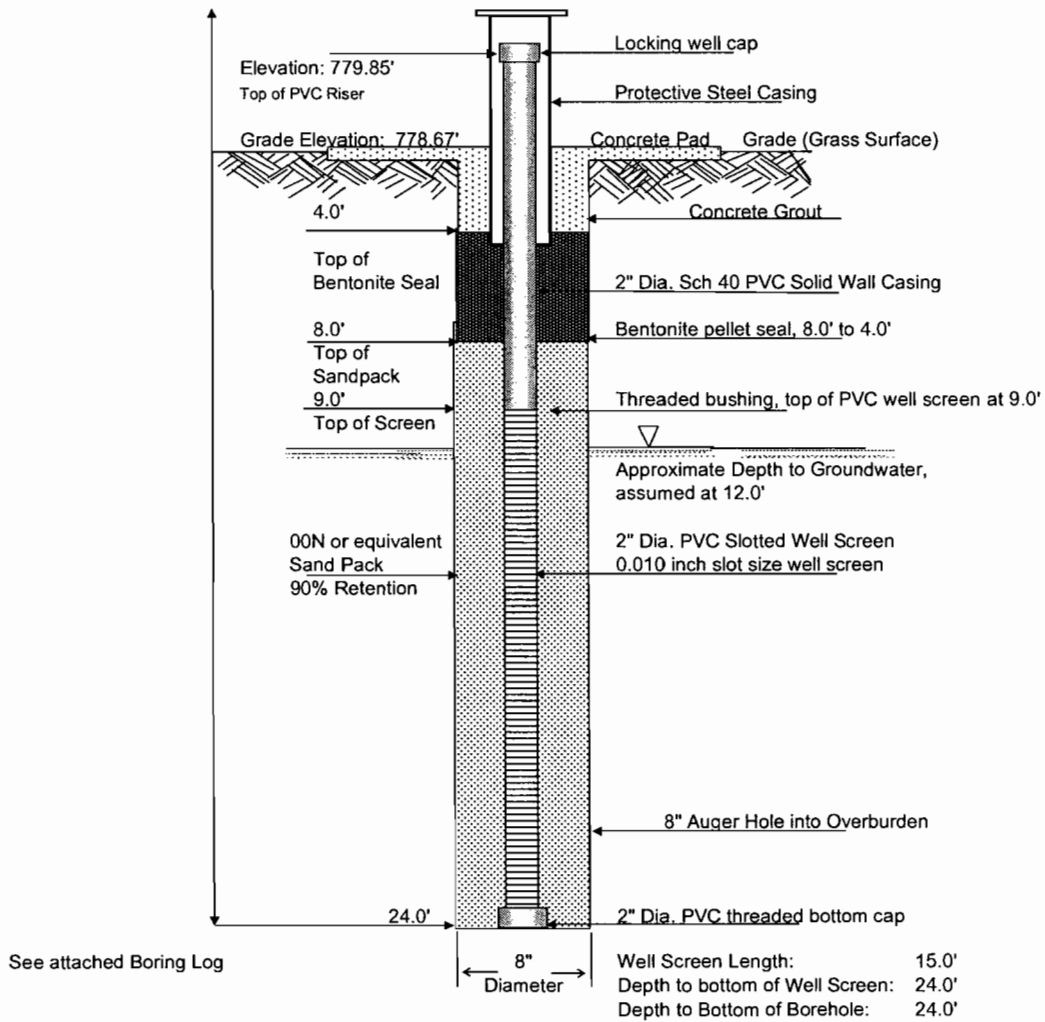
**BORING/WELL NUMBER:** Test Boring MW-16

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 07/10/2003 Finish Date: 07/10/2003 Top of Well: N/A Boring No: MW-16  
 Driller: Dennis Honor, Geologic NY Boring Location: Northwest corner of property, by access road  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 11' 10"  
 Drilling Method: 4-1/4 inch HAS Augers, CME-45 C towed rig Water Level (Post Drilling): Approx. 12 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed through augers via pull back method.  
 Screened Interval: 21.0 ft. to 6.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 21.0 ft to 5.0 ft  
 Seal: 5.0 feet to 2.0 feet Weather Conditions: Overcast, humid, 75 degrees in morning  
 Protective Steel Casing installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0	2	25			51	1	0-2'	soil	75%	Grass surface, topsoil to 6" F. GRAVEL and F-C Sand, Tr. Silt. Fill Fill to 3.0' <span style="float: right;">3.0 ft</span> Damp Br. Soft SILT and F. Sand Same, Soft, mottled brown & gray, damp Same to 7'4", then change to F. GRAVEL and F-C Sand, Tr. Silt 7'4" Damp Br.M Dense GRAVEL & F. Sand Br. Damp M. Dense F GRAVEL And F-C Sand Same, Damp, Loose Becomes wet, Saturated at 11' 10" Same Saturated Loose GRAVEL and F-C Sand, Trace Silt. Grey at 14' Same Saturated M. Dense GRAVEL and F-C Sand Same to 17' Grey Dense M-C SAND, Some F. Gravel Wet F. GRAVEL and F-C Sand, Tr. Silt Same to 20'6", then Till <span style="float: right;">20.5'</span> Damp Gray Hard CLAY and Silt, Little Gravel. Glacial Till <span style="float: right;">22'</span>  Boring terminated at 22.0 feet 2" diameter monitoring well installed in test boring All cuttings placed in drums.  H NU HW101 PID with 10.6 ev lamp used to screen soil samples for VOCs	ND
			26	13			2'-4'	soil	67%		ND
		4	4			6	2				
5			2	1			4'-6'	soil	83%	0.3 ppm	
	1	1			2	3					
10			1	1			6'-8'	soil	100%	0.4 ppm	
	1	2			9	4					
			7	6			8'-10'	soil	33%	1.3 ppm	
15	4	9			16	5					
			7	4							
	2	3			7	6	10'-12'	soil	50%	5.5 ppm	
20			4	3			12'-14'	soil	46%	2.2 ppm	
	2	4			8	7					
			4	5			14'-16'	soil	54%	3.3 ppm	
25	8	7			10	8					
			3	3			16'-18'	soil	100%	4.0 ppm	
	12	43			81	9					
30			38	50/3"			18'-20'	soil	92%	5.6 ppm	
	15	45			95	10					
30			50	32			20'-22'	soil	100%	1.1 ppm	
	20	31			81	11					
			50	50/2"							

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL MW-17**



NOT TO SCALE

Elevation for Top of Well Riser (TOR) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER**  
**4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**  
**MONITORING WELL CONSTRUCTION DETAIL**  
**MW-17**

Date Installed:  
9-Jul-03

# DRILLING LOG



**B E R G M A N N**  
associates

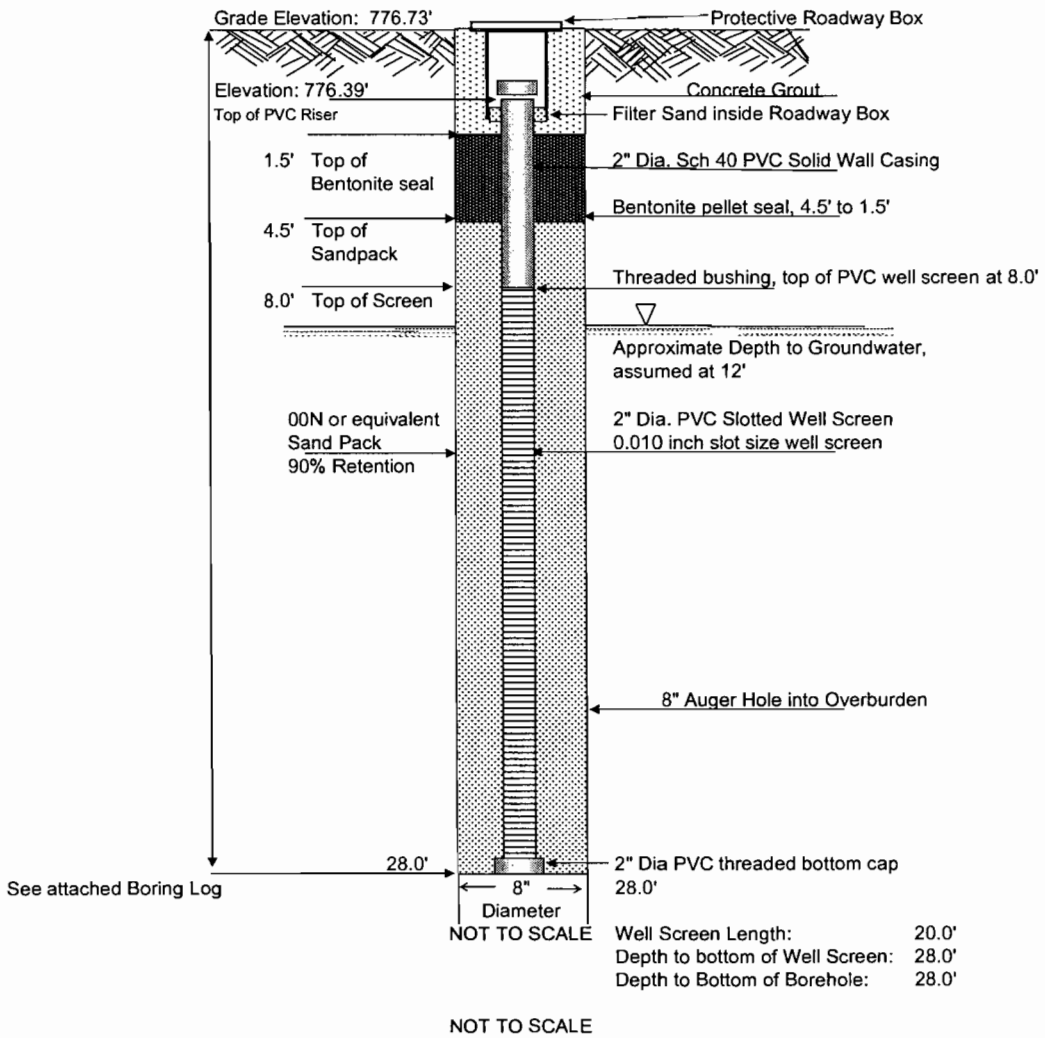
**BORING/WELL NUMBER:** Test Boring MW-17

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 07/09/2003 Finish Date: 07/09/2003 Top of Well: N/A Boring No: MW-17  
 Driller: Dennis Honor, Geologic NY Boring Location: North property line, at Boring B-24 location  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 11'10'  
 Drilling Method: 4-1/4 inch HAS Augers, CME-45 C towed rig Water Level (Post Drilling): Approx. 12 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed through augers via pull back method.  
 Screened Interval: 24.0 ft. to 9.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 24.0 ft to 8.0 ft  
 Seal: 8.0 feet to 4.0 feet Weather Conditions: Overcast, humid, 80 degrees in afternoon  
 Protective Steel Casing installed over the monitoring well.


DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening for VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0	2	6			11	1	0-2'	soil	75%	Grass surface, topsoil to 6"	ND
			5	5						F-C SAND and F. Gravel. Fill 1'10"	
	3	4			7	2	2'-4'	soil	50%	Damp light Brown M. Stiff SILT and F. Sand. Roots	
5			3	3						Same. Lt. Br. M. Stiff SILT & F. Sand	ND
	2	3			6	3	4'-6'	soil	50%	Mottled	
10			3	5						Same Br. M. Stiff SILT & F. Sand	ND
	3	3			6	4	6'-8'	soil	79%		
			3	4						Same to 9'	
15			9	8			8'-10'	soil	67%	9.0'	0.7 ppm
										V. Moist Br. F. GRAVEL & F-C Sand	1.4 ppm
	12	4			10	6	10'-12'	soil	67%	Same, Loose	
		6	6						Becomes Wet at 11'10"		
20	5	6			17	7	12'-14'	soil	67%	Same saturated, M.Dense Br. F GRAVEL	0.7 ppm
			11	5						some F-C Sand, little Silt	0.4 ppm
	50/5"				50	8	14'-16'	soil	21%	Wet V. Dense F. GRAVEL	
									Some F-C Sand Tr. Silt		
25	28	24			59	9	16'-18'	soil	100%	Same, Wet Gr. V. Dense F. GRAVEL	3.4 ppm
			35	32						some F-C Sand, Tr. Silt	1.4 ppm
	6	34			70	10	18'-20'	soil	50%	Same, wet, V.Dense GRAVEL some Sand	
		36	30								
30	7	21			48	11	20'-22'	soil	82%	Same, wet, Dense	2.3 ppm
			27	32							1.5 ppm
	21	50/6"			50	12	22'-24'	soil	100%	Same wet Gravel to 23'5"	
									23'5"		
30					0					Damp Grey Hard CLAY Till	0.5 ppm
										Boring terminated at 24.0 feet	0.5 ppm
										2" diameter monitoring well installed in test boring	
									All cuttings placed in drums.		
										H NU HW101 PID with 10.6 ev lamp used to screen soil samples for VOCs	

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL MW-18**



Elevation for Top of Well Casing (TOC) and Grade Elevation are in feet, relative to Mean Sea Level

	<b>GOWANDA DAY HABILITATION CENTER</b> <b>4 INDUSTRIAL PLACE, GOWANDA, NEW YORK</b>	Date Installed: 10-Jul-03
	<b>MONITORING WELL CONSTRUCTION DETAIL</b> <b>MW-18</b>	

# DRILLING LOG



**B E R G M A N N**  
associates

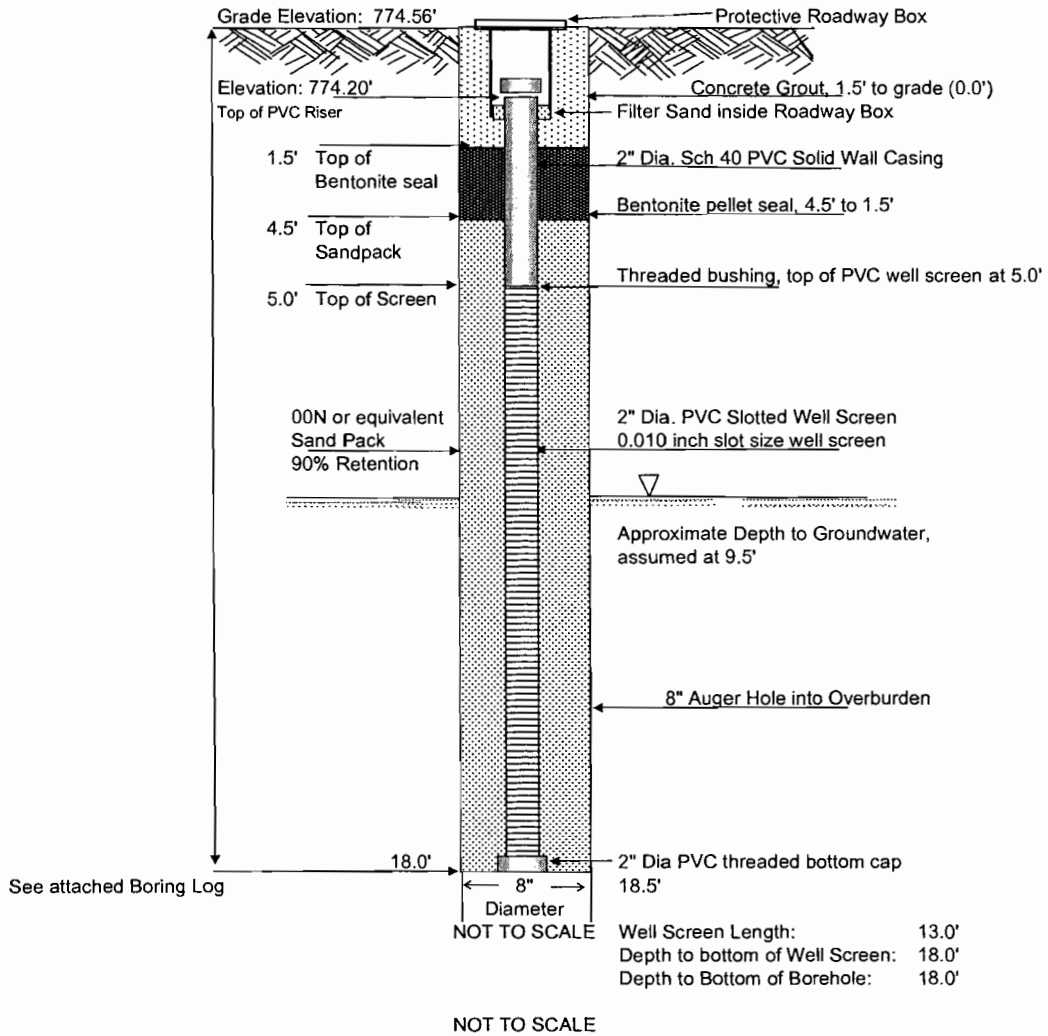
**BORING/WELL NUMBER:** Test Boring MW-18

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 07/10/2003 Finish Date: 07/10/2003 Top of Well: N/A Boring No: MW-18  
 Driller: Dennis Honor, Geologic NY Boring Location: In front of #118 Torrance Pl., south side of road  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 10 feet  
 Drilling Method: 4-1/4 inch HAS Augers, CME-45 C towed rig Water Level (Post Drilling): Approx. 12 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed through augers via pull back method.  
 Screened Interval: 28.0 ft. to 8.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 28.0 ft to 4.5 ft  
 Seal: 4.5 feet to 1.5 feet Weather Conditions: Rain, very heavy in evening. 75 degrees  
 Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION		Field Screening for VOCs, ppm, using PID	
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth	Type	Recovery		
0	3	3			8	1	0-2'	soil	67%	Grass surface, topsoil to 6"	1.3 ppm
			5	4						F-C SAND Some Gravel, FILL 2'	
5	1	2			5	2	2'-4'	soil	83%	Damp Br. M. Stiff Mottled SILT and Fine Sand. Faint laminations visible	0.4 ppm
			3	2						Same to 5'5", then Gravel 5'5"	0.4 ppm
10	5	6			14	3	4'-6'	soil	83%		
			8	15						Damp Br. F. GRAVEL and F-C Sand	0.4 ppm
	8	7			12	4	6'-8'	soil	67%	Damp Dark Br. M. Dense F. GRAVEL some F-C Sand, Trace Silt	0.4 ppm
15			5	5						Same F. GRAVEL and F-C Sand, Tr Silt Becomes Loose	0.4 ppm
	5	3			4	5	8'-10'	soil	42%		
			1	1							
20	3	1			1	6	10'-12'	soil	46%	Same. Becomes Wet, V. Loose at 10'	0.5 ppm
			WH	3							
	8	12			32	7	12'-14'	soil	75%	Same, Saturated Dense Grey at 13'	0.7 ppm
25			20	24						Same, Dense, becomes brown-grey	1.3 ppm
	7	15			33	8	14'-16'	soil	92%		
			18	23							
30	32	34			75	9	16'-18'	soil	67%	Same F. GRAVEL and F-C Sand to 15'6"	5.6 ppm
			41	50/4"						Then 6" of M-C SAND, Grey, wet	
	15	24			53	10	18'-20'	soil	100%	Wet V. Dense F. GRAVEL and F-C Sand, Tr Silt	2.2 ppm
30			29	48							
	16	61			111	11	20'-22'	soil	100%	Same, V. Moist, V. Dense Grey	2.0 ppm
			50	50/4"						F. GRAVEL and F-C Sand, Little Silt	
	40	52			89	12	22'-24'	soil	100%	V. Moist Grey V. Dense F-C SAND and F. Gravel Trace Silt. Sand Lens	1.0 ppm
30			37	32						Wet Grey V. Dense F. GRAVEL and F-C Sand, Some Silt	1.4 ppm
	6	41			111	13	24'-26'	soil	100%		
			70	100						Same to 27'5 feet, then Clay 27.5'	1.1 ppm
30	48	81			184	14	26'-28'	soil	100%	Damp Grey Hard CLAY. Till 28'	
			103	76						Boring terminated at 28 feet.	H NU PID with
										2" well installed in boring.	10.6 ev lamp

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL MW-19 R**



Elevation for Top of Well Casing (TOC) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

Date Installed:  
13-Oct-04

**MONITORING WELL CONSTRUCTION DETAIL  
MW-19 R**

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring MW-19-R

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 10/13/2004 Finish Date: 10/13/2004 Top of Well: N/A Boring No: MW-19-R  
 Driller: Scott Breed, Geologic NY Boring Location: In Road, north side of Torrance Place  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 9.5 feet  
 Drilling Method: 4-1/4 inch HAS Augers, CME-45 C towed rig Water Level (Post Drilling): Approx. 9.5 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed through augers via pull back method.  
 Screened Interval: 5.0 ft. to 18.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 18.0 ft to 4.5 ft  
 Seal: 4.5 feet to 1.5 feet Weather Conditions: Cool, 60 degrees,

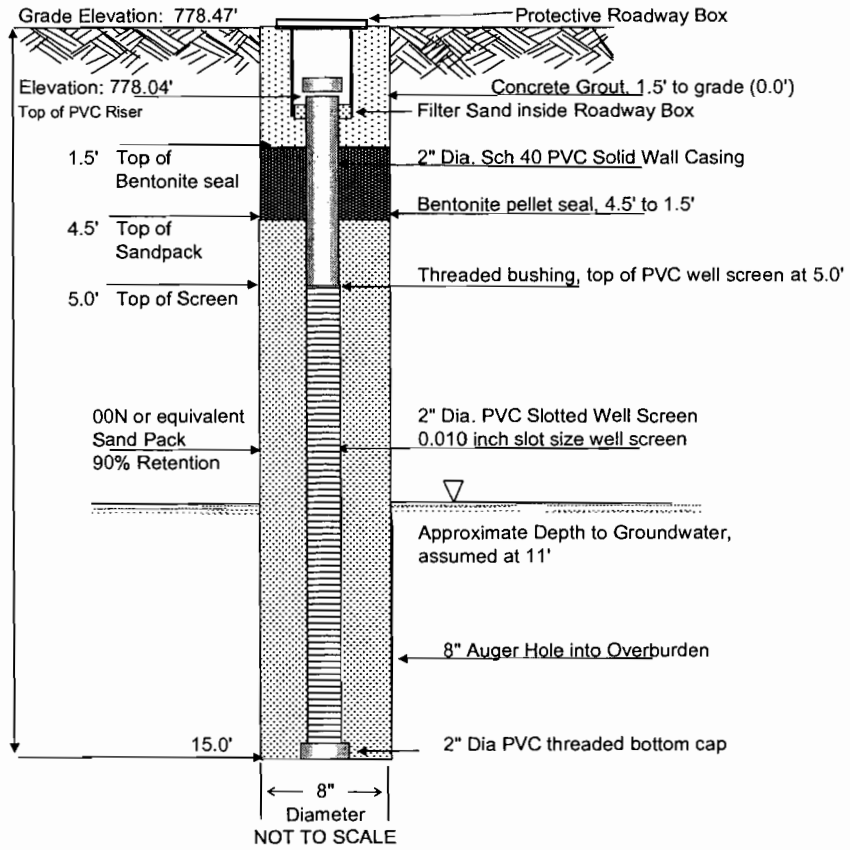
Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0											
	8	4			8	1	1'-3'	soil	83%	Asphalt-Road base Damp Brown Loose motled Fine SAND, little silt	0.5 ppm background
			4	4							
5											
	6	8			28		5'-7'	soil	42%	Lt. Br. M. Dense Fine SAND and Silt Damp F-C SAND, Some Gravel 6.0' cobble at 6' Rods wet, water table ~9.5'	2.4 ppm
			20	55		2					
10											
	10	8			14	3	10'-12'	soil	33%	Saturated Br. M. Dense F GRAVEL and F-C Sand, Little Silt	0.5 ppm
			6	5							
15											
	11	24			50	4	15'-17'	soil	96%	Same Br. GRAVEL and Sand to 16' Grey Wet F. SAND, No Gravel 17'8"	0.6 pm bkgd = 0.5 ppm
			26	38							
45	50/2"				5	17'-18'	soil	100%	Damp Grey Hard SILT and Clay. Till Spoon refusal at 17'8" 18.0' Till at 17'8"		
20											
25											
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow



**MONITORING WELL MW-20**




See attached Boring Log

Well Screen Length: 10.0'  
 Depth to bottom of Well Screen: 15.0'  
 Depth to Bottom of Borehole: 15.0'

NOT TO SCALE

Elevation for Top of Well Casing (TOC) and Grade Elevation are in feet, relative to Mean Sea Level

	<b>GOWANDA DAY HABILITATION CENTER</b> <b>4 INDUSTRIAL PLACE, GOWANDA, NEW YORK</b>	Date Installed: 14-Oct-04
	<b>MONITORING WELL CONSTRUCTION DETAIL</b> <b>MW-20</b>	

# DRILLING LOG



**B E R G M A N N**  
associates

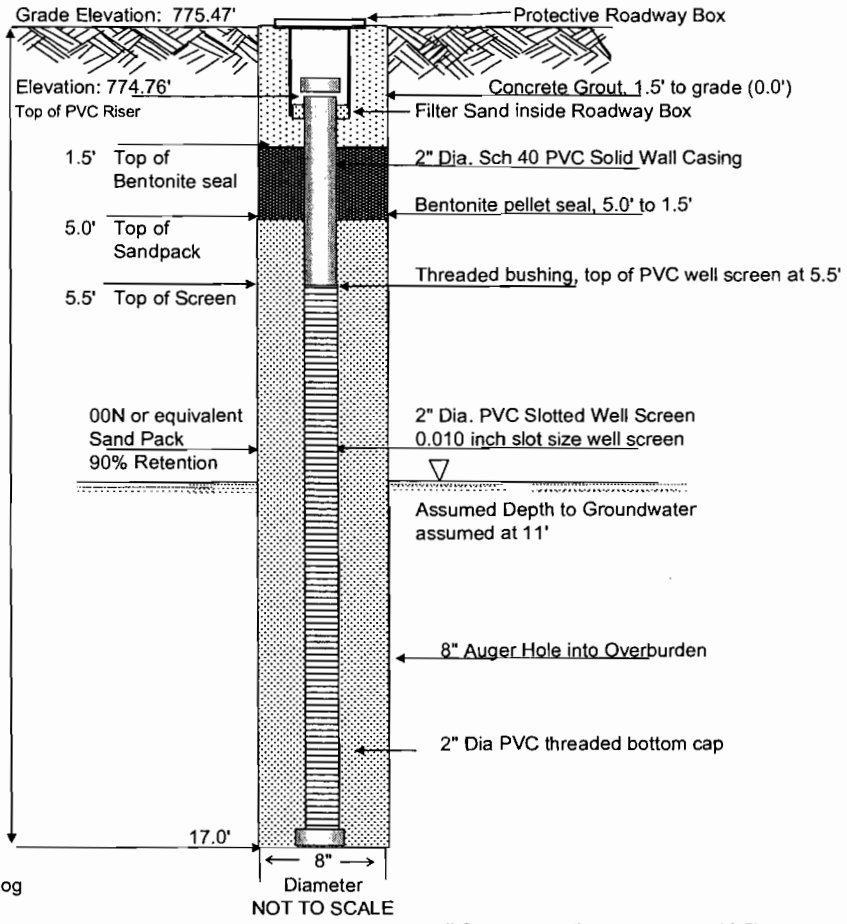
**BORING/WELL NUMBER:** Test Boring MW-20

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 10/14/2004 Finish Date: 10/14/2004 Top of Well: N/A Boring No: MW-20  
 Driller: Scott Breed, Geologic NY Boring Location: Northeast corner of property, asphalt, by fence  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 11 feet  
 Drilling Method: 4-1/4 inch HAS Augers, CME-45 C towed rig Water Level (Post Drilling): Approx. 11 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed through augers via pull back method.  
 Screened Interval: 5.0 ft. to 15.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 15.0 ft to 5.0 ft  
 Seal: 4.5 feet to 1.5 feet Weather Conditions: Cool, 50 degrees in AM, overcast  
 Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
0										Asphalt-Road base Damp Dark Br.Loose Sand and Gr. FILL	0.4 ppm = background
	8	5			8	1	1'-3'	soil	33%		
			3	5							
5										Damp. Br. Loose F. SAND to 6.5' Damp F. GRAVEL and F-C Sand 6.5'	0.8 ppm Bkgd =0.4 ppm
	2	3			8		5'-7'	soil	67%		
			5	12		2					
10										V. Moist Br. M. Dense F-C SAND and Fine Gravel, Tr Silt. Grey at 12'	2.2 ppm Bkgd =0.4 ppm
	5	7			16	3	10'-12'	soil	58%		
			9	10							
15										Wet Br. Dense F-C SAND and F. Gravel Damp Grey Laminated SILT & Clay 14"4"	0.8 pm bkgd =0.5 ppm
	16	18			44	4	14'-16'	soil	75%		
			24	40		4	17'-18'	soil	100%		
20										Till at 14"4" Dropstones 15'	Boring terminated at 15.0 feet 2" diameter monitoring well installed in test boring All cuttings placed in drums.
25											
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

**MONITORING WELL MW-21**



See attached Boring Log

Diameter  
8"  
NOT TO SCALE

Well Screen Length: 11.5'  
 Depth to bottom of Well Screen: 17.0'  
 Depth to Bottom of Borehole: 17.0'

NOT TO SCALE

Elevation for Top of Well Casing (TOC) and Grade Elevation are in feet, relative to Mean Sea Level



**GOWANDA DAY HABILITATION CENTER  
 4 INDUSTRIAL PLACE, GOWANDA, NEW YORK**

Date Installed:  
 14-Oct-04

**MONITORING WELL CONSTRUCTION DETAIL  
 MW-21**

# DRILLING LOG



**B E R G M A N N**  
associates

**BORING/WELL NUMBER:** Test Boring MW-21

PROJECT: Gowanda Day Habilitation Center Project No: 5596.12 Page No. 1 of 1  
 Start Date: 10/14/2004 Finish Date: 10/14/2004 Top of Well: N/A Boring No: MW-21  
 Driller: Scott Breed, Geologic NY Boring Location: South side of Torrance Place, west of driveway  
 Inspector: Edward Jones, Bergmann Associates Water Level (During Drilling): Approximately 11 feet  
 Drilling Method: 4-1/4 inch HAS Augers, CME-45 C towed rig Water Level (Post Drilling): Approx. 11 feet below grade  
 Remarks: Advanced test borings via Hollow Stem Augers. Monitoring well installed through augers via pull back method.  
 Screened Interval: 5.5 ft. to 17.0 ft. Slot Size: 0.010 inch Well Type: 2" dia. PVC Sandpack: 17.0 ft to 5.0 ft  
 Seal: 5.0 feet to 1.5 feet Weather Conditions: Cool, 50 degrees in AM, overcast  
 Flush to grade roadway box installed over the monitoring well.

DEPTH	BLOWS ON SAMPLER				SAMPLE			SOIL AND ROCK INFORMATION	Field Screening VOCs, ppm, using PID		
	0"/6"	6"/12"	12"/18"	18"/24"	N	NO.	Depth			Type	Recovery
5	7	6			11	1	1'-3'	soil	33%	Asphalt-Road base Damp F-C SAND and Gravel FILL Large cobble at 4.5' to 5.0'	1.3 ppm bkgd =0.3 ppm
			5	5							
10	4	5					5'-7'	soil	38%	Damp Br. M. Dense F-C SAND and Fine Gravel. Similar to fill	1.2 ppm Bkgd = 0.3ppm
			7	12	12	2					
15	3	2					10'-12'	soil	42%	Moist Br. Loose F. GRAVEL and F-C Sand. Wet at 11' Water table ~ 11'	0.7 ppm Bkgd =0.4 ppm
			4	5	6	3					
20	8	25					15'-17'	soil	100%	Wet Grey Dense F GRAVEL and F-C Sand at 16.5': Dry Grey Hard SILT 16'5" Till begins at 16.5 17.0'	1.0 pm bkgd = 0.5 ppm 1.1ppm at 17'
			22	50	47	4					
25										Boring terminated at 17.0 feet 2" diameter monitoring well installed in test boring All cuttings placed in drums.	
30											

2" Spoon 12" with 140 lb wt. Hammer 30" Each Blow

## **Attachment 4**

### **GTP – Maintenance Procedures**

- **Filter Bag Change-Out Procedure**
- **Flooded Air Stripper Fan Draining Procedure**
- **Air Stripper Tower Cleaning Procedure**

# **GTP - Bag Filter Change-Out Procedures**

## **1.0 Introduction**

This protocol describes the procedures to be used to change out the bag filters located on the GTP System Skid. The filters will need to be changed based on an increase in filter pressure from normal operational pressures. Initial pre-bag filter pressure range from 2 to 3 PSI after a fresh set of filters has been installed. This assumes the EQ transfer pump is operating at a 32 to 34 PSI range.

## **2.0 Materials**

The following materials, as required, shall be available during bag filter changes:

- 2 - 5 gallon buckets.
- Metal bar (kept at onsite) or plumber's adjustable pipe wrench.
- Appropriate health and safety equipment, as specified in the Health and Safety Plan
- O & M forms to record the filter change and before and after pressures

## **3.0 Procedures**

1. Begin by recording filter pressure on the appropriate O & M form.
2. Shut down the well field by closing the solenoid valve on the control board.
3. Shut off the EQ transfer pump.
4. Lock Out / Tag Out the electrical Supply.
5. Close the Influent and Effluent ball valves to and from the bag filter units.
6. Don safety equipment, as required in the Health and Safety Plan. Don a new pair of disposable gloves. Place an outer glove over the disposable.

7. Working on only one bag filter unit at a time, drain 1 to 2 gallons from the bag filter unit into a 5 gallon bucket using the drain port on the bottom of the filter housing. Open the top air bleed valve for flow.
8. Remove the used filter bag and screen. Allow water in the bag filter to drain back into the filter housing or remove and pour the water into the 5 gallon bucket.
9. Remove the waste bag filter from metal screen.
10. Place the waste bag filter into the waste collection drum available onsite.
11. Install a new bag filter after removing the filter tag into the metal screen.
12. Replace the new filter and screen unit into the bag filter housing.
13. Reassemble the top of the filter housing making sure the o-ring is in place. Install the three eye bolts and hand tighten.
14. Using the metal bar or pipe wrench tighten the three eye bolts until snug. Do not over tighten.
15. Repeat with the second bag filter housing.
16. Open the ball valves feeding water to the bag filter units and to the stripper tower.
17. Place used PPE in the appropriate waste receptacle.
18. Remove the Lock Out / Tag Out from the electrical supply. Restart the EQ transfer pump.
19. Bleed air out of the filter housings with the ball valve located in the center of each filter housing cap. Do this several times over the course of an hour.
20. Record filter pressures after the change.

## **GTP – Flooded Air Stripper Fan Draining Procedure**

### **1.0 Introduction**

This protocol describes the procedures to be used to drain water from the air stripper blower, in the event of system shut-down and flooding of the blower

### **2.0 Materials**

The following materials, as required, shall be available during groundwater sampling:

- Appropriate health and safety equipment, as specified in the Health and Safety Plan
- Buckets
- Adjustable Wrench

### **3.0 Procedures**

1. Once the fan has been identified as flooded with water, don the appropriate PPE.
2. Place a bucket under the fan housing.
3. Using an adjustable wrench remove the plug from the bottom of the fan housing.
4. Allow the water to drain into the bucket until it is  $\frac{3}{4}$  full. Exchange the bucket with an empty one.
5. Pour the collected drain water into the EQ tank for processing.
6. Continue to repeat this exercise until the fan housing is empty.
7. Replace the plug in the bottom of the fan housing.
8. Discard PPE in the appropriate receptacles.



## **GTP – Low Profile Air Stripper Tower Cleaning Procedure**

### **1.0 Introduction**

This protocol describes the procedures to be used for the general cleaning of the Groundwater Treatment System Low Profile Air Stripper Tower.

### **2.0 Materials**

The following materials, as required, shall be available during groundwater sampling:

- Appropriate health and safety equipment, as specified in the Health and Safety Plan
- Appropriate Lock Out/Tag Out equipment.
- Miscellaneous tools and scrapers.
- 5 Gallon Buckets
- Shop Vacuum

### **3.0 Procedures**

1. Turn off all possible incoming flow to the system.
2. Shut down power to the system and apply the appropriate Lock Out/Tag Out device to the Groundwater Treatment System.
3. Don safety equipment, as required in the Health and Safety Plan. Don a new pair of disposable gloves as an inner layer and a protective heavier glove as the working outer layer.
4. Remove the influent water pipe located at the top of the treatment tower.
5. Remove the Fernco effluent vapor fitting connecting the treatment tower to the carbon vessels.
6. Remove the vapor extraction pipe work from the top of the treatment tower.

7. Open the over-center latching clips on each tray of the treatment tower.
8. Remove each tray individually, noting the position and number of the tray. The trays must be reassembled in the same manner in which they were removed.
9. Observe the air dispersion holes for build-up or plugging. Should the internal section of the tray visually contain scale, debris or build-up, use an appropriate scrapping tool to clean each tray as needed.
10. Remove all water in the sump section of the treatment tower using the shop vacuum. The water may be placed back into the EQ tank.
11. Observe the treatment sump for collection of sediments in the bottom of the unit. Clean as appropriate to eliminate any debris present within the unit.
12. Remove the effluent pipe between the treatment sump and the effluent pump and clean the pipe if necessary. Reassemble when complete.
13. Remove the site glass floats and clean as necessary. Reassemble when complete.
14. Fill the treatment sump with clean water until the site glass is close to the on position.
15. Reassemble the unit following the above information in reverse order.
16. All wastes generated from equipment maintenance activities (with the exception of groundwater) will be containerized for off-site disposal.

Scheduled maintenance information for treatment equipment, tanks, pumps and blowers, is also provided in the Equipment and Instrumentation Manuals

## **Attachment 5**

### **Inspection Checklists and Monitoring Forms**

- **Site Inspection Checklist**
- **Groundwater Monitoring Form**
- **Well Development Form**
- **Groundwater Sampling Worksheet 7**
- **Verbatim Alarm and Troubleshooting Matrix**
- **Preventive Maintenance Schedule**
- **Spare Parts List**
- **Contacts List**

**ATTACHMENT A  
 DASNY - NYS WESTERN DDSO DAY HABILITATION CENTER  
 GOWANDA, CATTARAUGUS COUNTY, NEW YORK**

**SITE INSPECTION CHECKLIST**

Name of Inspector: \_\_\_\_\_  
 Date of Inspection: \_\_\_\_\_  
 Weather Conditions: \_\_\_\_\_  
 Other Personnel On Site: \_\_\_\_\_

General Inspection Items:	OK	Comments:
Site entrance and access:		
Overall appearance:		
Building exterior:		
Entry door- GW		
Overhead door- GW		
Entry door- SVE		
Groundwater Treatment System/SVE: Inspection Items	OK	Comments:
Building Interior:		
Indication of Spills or Leaks		
Heating Operational		
Phone System		
Verbatim Unit		
Exhaust Fan		
Fire Extinguishers		
Groundwater Treatment System Components	OK	Comments:
Air Blower		
Air Stripper		
Air Stripper Discharge Pump		
EQ Tank		
EQ Transfer Pump		
Bag Filter Unit #1		
Bag Filter Unit #2		
Carbon Unit #1		
Carbon Unit #2		
Sanitary Sewer connection		
Air Compressor/Groundwater Recovery Components:	OK	Comments:
Well Pumps		
Compressor		
Evaporator Drain		
Compressor Oil Level		
Soil Vapor Extraction System Components:		
SVE Vacuum Pump		
Knock-out tank		
Cooler fan		
Air Filter		
Water transfer pump		

**ATTACHMENT A  
 DASNY - NYS WESTERN DDSO DAY HABILITATION CENTER  
 GOWANDA, CATTARAUGUS COUNTY, NEW YORK**

**SITE INSPECTION CHECKLIST**

Name of Inspector: \_\_\_\_\_  
 Date of Inspection: \_\_\_\_\_

<b>Groundwater Treatment System Instrumentation Readings:</b>	<b>Readings:</b>	<b>Normal Operating Ranges</b>
Sanitary Effluent Meter		Chem on order 9/1/05
Sequestering Agent Pump settings	total	
Sequestering Agent Drum Level	speed	
EQ Tank Transfer Pump	inches	
QED Sump Discharge Pump	PSI	
QED Air Stripper Blower Pressure	PSI	
Bag Filter Pressure Pre Filters	" H2O	
Bag Filter Pressure Post Filters	psi	
Air Effluent Discharge to SVE	psi	
Carbon Unit #1 Pressure <i>Pre</i>	" H2O	
Carbon Unit #2 Pressure <i>Mid</i>	" H2O	
Carbon Unit Effluent <i>Post</i>	" H2O	
EQ Tank	low, normal, high	
Air Stripper Air Effluent to SVE:	" H2O	
Estimated Flow Rate into EQ Tank:		
Estimated Flow Rate through Stripper:		
Calculated Flow Rate to Sewer		
<b>Compressor</b>		
Hours		read
Temp	F	read
Load PSIG	psig	read
PSI to Well Field	psi	read

<b>SVE System Instrumentation Readings:</b>	<b>Readings:</b>	<b>Normal Operating Ranges</b>
Instantaneous combined Air Flow CFM		
Air Totalizer		
Knock-out	" H2O	
Vacuum Pump	" H2O	
Air Flow to the Carbon Vessels:	" H2O	
Air Temp to Cooler	°F	
Air Temp after Cooler	°F	

<b>Water Level Readings:</b>	<b>Readings:</b>	<b>Readings: Final Set, recorded at 3:50 PM</b>		
Time: _____	<b>DTW</b>	<b>Counter</b>	<b>Vacuum</b>	
SVE-1			<b>Sub-Slab Vacuum Readings</b> SP-1	
SVE-2				SP-2
DR-1				SP-3
DR-2				SP-4
DR-3				SP-5
DR-4				SP-6
G-1				SP-7
G-2				SP-8



### GROUNDWATER MONITORING FORM

Gowanda Day Habilitation Center  
 4 Industrial Place, Gowanda, New York  
 VCA # V-00463-9

	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10
Casing Elevation*	778.23	778.08	778.38	778.43	778.61	781.10	780.94	781.33	782.61	780.02
Depth to Groundwater (btoc)										
Groundwater Elevation										
Well Diameter	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
Product Thickness	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Well Depth (btoc)	16.02	17.15	16.30	15.78	13.95	22.88	21.80	17.65	20.96	19.42
Bottom of Well Elevation	762.21	760.93	762.08	762.65	764.66	758.22	759.14	763.68	761.65	760.60
Thickness of Water Column										
Minimum Purge Volume (gal)										
3 Volumes										
Actual volume purged										
Comments	Flush = -0.29'	Flush = -0.30'	Flush = -0.23'	Flush = -0.34'	Flush = -0.24'	Stickup=2.17'	stickup=2.17'	stickup=2.84'	stickup=2.05'	stickup=2.56'

	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18	MW-19R	MW-20	MW-21
Casing Elevation	778.58	778.50	778.39	778.43	778.38	780.43	779.85	776.39	774.2	778.04	774.76
Depth to Groundwater (btoc)											
Groundwater Elevation											
Well Diameter	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
Product Thickness	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Well Depth (btoc)	15.48	17.38	17.40	18.15	19.80	23.26	25.18	25.0	17.67	14.75	15.82
Bottom of Well Elevation	763.10	761.12	760.99	760.28	758.58	757.17	754.67	751.39	756.53	763.29	758.94
Thickness of Water Column											
Minimum Purge Volume (gal)											
3 Volumes											
Actual volume purged											
Comments	Flush = -0.23	Flush = -0.35	Flush = -0.48	Flush = -0.39	Flush = -0.38	Stickup=2.26'	stickup=1.18'	Flush = -0.26'	Flush = -0.36'	Flush = -0.43'	Flush = -.71'

**NOTES**

btoc = Below top of casing (inner riser)

nd = No floating product encountered

Minimum purge volume = 3 X well volume. 0.163 gallon per foot in a 2" diameter well. 0.653 gallon per foot in a 4" diameter well.

Monitoring well MW-19 was removed and the area restored on July 23, 2003 immediately after the well was developed, purged of 3 volumes and sampled. The borehole for MW-19 was backfilled with a cement-bentonite grout after the PVC screening and casing was successfully removed.

Wells MW-19R, MW-20 and MW-21 were installed in October 2004.

All measurements are in feet, referenced to Mean Sea Level

TOTAL VOLUME to PURGE, 3X ALL WELLS:

0.0 Gallons

**WELL DEVELOPMENT FORM**

Gowanda Day Habilitation Center  
 4 Industrial Place, Gowanda, New York  
 VCA # V-00463-9

IRM RECOVERY WELLS

Average depth to groundwater:  
 Average water elevation:

	DR-1	DR-2	DR-3	DR-4	G-1	G-2	SVE-1	SVE-2
Casing Elevation	779.66	779.93	779.78	779.64	779.83	779.72	779.66	779.91
Depth to Groundwater (btoc)							DRY	4.90
Groundwater Elevation							DRY	775.01
Well Diameter	4"	4"	4"	4"	4"	4"	4"	4"
Product Thickness	nd	nd	nd	nd	nd	nd		
Well Depth (btoc)	18.06	18.06	20.45	19.69	22.98	20.72		
Bottom of Well Elevation	761.6	761.87	759.33	759.95	756.85	759	8.39	8.63
Thickness of Water Column								
Minimum Purge Volume (gal)								
3 Volumes								
Actual volume purged								
Comments	stickup=0.85'	stickup=1.06'	stickup=0.95'	stickup=0.84'	stickup=1.03'	stickup=0.86'	stickup=0.89'	stickup=1.05'



## GROUNDWATER SAMPLING WORKSHEET

**PROJECT NAME:** Gowanda Day Habilitation Center  
**Project Number:** Gowanda, NY  
**Site Location:** \_\_\_\_\_  
**Sample Date:** \_\_\_\_\_  
**Weather:** \_\_\_\_\_  
**Personnel:** \_\_\_\_\_



### GROUNDWATER SAMPLE POINT

**Well Number:** \_\_\_\_\_  
**Location:** \_\_\_\_\_  
**Casing Diameter:** \_\_\_\_\_

**Depth to water, below top of casing:** \_\_\_\_\_  
**Depth to bottom of the well:** \_\_\_\_\_  
**Length of water column in well:** \_\_\_\_\_

Well Dia.	Volume/Foot
1"	= 0.041 gal/foot
2"	= 0.163 gal/foot
4"	= 0.653 gal/foot
6"	= 1.469 gal/foot
8"	= 2.611 gal/foot

**Volume of water in well casing, gallons:** \_\_\_\_\_  
**3 Well volumes (= length water column X gal/foot X 3):** \_\_\_\_\_  
**Actual volume purged prior to sampling:** \_\_\_\_\_  
**Sampling Methodology:** \_\_\_\_\_  
**Sampling Equipment:** \_\_\_\_\_  
**Well Recharged?** \_\_\_\_\_  
**Required Analysis:** \_\_\_\_\_

### FIELD PARAMETER MEASUREMENTS

Parameter	Accumulated Volume Purged in Gallons									
Turbidity										
Temperature										
pH										
Conductivity										
Oxygen										
Salinity										

**Time sample was collected:** \_\_\_\_\_

**COMMENTS** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**GTP AND SVE SYSTEM**  
**VERBATIUM ALARM AND TROUBLESHOOTING MATRIX**  
**GOWANDA DAY HABILITATION CENTER**

Alarm Message	Possible Cause	Possible Remedy
SVE Skid High Level (Autodialer Channel 1)	<ul style="list-style-type: none"> <li>• Excessive vacuum.</li> <li>• Liquid pump malfunction.</li> <li>• Starter malfunction.</li> </ul>	<ul style="list-style-type: none"> <li>• Lower vacuum setting by opening the bleed air inlet</li> <li>• Check liquid pump for proper operation</li> <li>• Reset pump motor starter</li> </ul>
SVE Skid High Temperature (Autodialer Channel 2)	<ul style="list-style-type: none"> <li>• Excessive vacuum.</li> <li>• SVE blower is operating "Hot."</li> </ul>	<ul style="list-style-type: none"> <li>• Check blower and blower motor for proper operation.</li> <li>• Check high temperature set point. Check temperature sensor, replace as needed.</li> <li>• Check Air Filter.</li> <li>• Check for SVE blockage due to excessive sediment.</li> <li>• In the case of excessive ambient temperature, allow blower to cool prior to restarting.</li> </ul>
SVE Skid High Discharge Pressure (Autodialer Channel 3)	<ul style="list-style-type: none"> <li>• Failure of heat exchange unit</li> <li>• Water in the Dwyer gauge</li> <li>• Blockage in air discharge piping.</li> </ul>	<ul style="list-style-type: none"> <li>• Remove condensate from condensate knockout.</li> <li>• Check motor starter for the heat exchange unit</li> <li>• Confirm fan operation on the heat exchanger</li> <li>• Check Dwyer gauge and tubing for water</li> <li>• Check pressures on the carbon units</li> <li>• Check for carbon blockage</li> </ul>
SVE Skid Low Discharge Pressure (Autodialer Channel 4)	<ul style="list-style-type: none"> <li>• Pipe damage or leakage</li> <li>• Blockage in air discharge piping.</li> <li>• Plugging of recovery piping. or filter</li> <li>• Water in the Dwyer gauge</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect air discharge piping for breaks or plugging, repair as needed.</li> <li>• Check high pressure setting. Check high pressure sensor, replace as needed.</li> <li>• Check Dwyer gauge and tubing for water</li> </ul>
WTS EQ Tank High Level (Autodialer Channel 5)	<ul style="list-style-type: none"> <li>• Bag filter high pressure</li> <li>• Starter malfunction.</li> <li>• Liquid pump malfunction</li> <li>• Increase in the rate of incoming flow</li> </ul>	<ul style="list-style-type: none"> <li>• Check and replace both bag filters</li> <li>• Reset EQ liquid pump starter motor and confirm pump operation</li> <li>• Check the rate of incoming flow should be 10 gpm or less.</li> <li>• Check for silt in the EQ tank above the effluent pipe.</li> <li>• Check for air/vapor locking in the system.</li> </ul>
WTS Air Stripper High Level (Autodialer Channel 6)	<ul style="list-style-type: none"> <li>• Starter malfunction.</li> <li>• Liquid pump malfunction</li> <li>• Blockage in effluent water pipe</li> </ul>	<ul style="list-style-type: none"> <li>• Confirm the liquid effluent pump is operational</li> <li>• Check and reset motor starter for the liquid pump</li> <li>• Clean effluent piping</li> </ul>
WTS General Shutdown Alarm (Autodialer Channel 7)		<ul style="list-style-type: none"> <li>• Attributed to any of the above alarms</li> </ul>
High VOC Alarm	<ul style="list-style-type: none"> <li>• Pipe leakage</li> </ul>	<ul style="list-style-type: none"> <li>• Open room to outside atmosphere and exit room</li> </ul>

(Autodialer Channel 8)	<ul style="list-style-type: none"> <li>• EQ tank vapors exhausting into the treatment room</li> <li>• Carbon vessel breakthrough or leakage</li> </ul>	<ul style="list-style-type: none"> <li>• Do not enter until VOC level can be confirmed in room</li> <li>• Confirm that pipework is not leaking</li> <li>• Confirm flow through the Carbon vessels</li> </ul>
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### TROUBLE SHOOTING MATRIX

Alarm Message	Possible Cause	Possible Remedy
SVE Blower Motor Starter Overload	<ul style="list-style-type: none"> <li>• Motor malfunction.</li> <li>• Blockage in influent and effluent piping.</li> </ul>	<ul style="list-style-type: none"> <li>• Repair or motor.</li> <li>• Check for pipe blockage.</li> <li>• Check and replace air filter.</li> </ul>
Air discharge flow rate measured outside of normal range (90-200 scfm)	<ul style="list-style-type: none"> <li>• Lose or broken pulley or belt.</li> <li>• Excessive condensate in vapor recovery piping.</li> <li>• Blower or blower motor malfunction.</li> </ul>	<ul style="list-style-type: none"> <li>• Blower or blower motor malfunction.</li> <li>• Check, repair or replace pulley or belt.</li> <li>• Check for pipe blockage.</li> <li>• Remove condensate from vapor recovery piping.</li> <li>• Repair or replace blower motor as needed.</li> </ul>

The following additional problems could occur with the treatment systems but would not cause an autodialer alarm.

Recovery Well Pump Overload	<ul style="list-style-type: none"> <li>• Excessive start/stop cycling.</li> <li>• Recovery well motor or pump malfunction.</li> <li>• Recovery well pump is clogged with silt.</li> </ul>	<ul style="list-style-type: none"> <li>• Check condition and positioning of water level sensors, repair or replace as needed.</li> <li>• Check, repair or replace recovery well pump or motor if necessary.</li> <li>• Remove pump from well and remove silt from pump.</li> <li>• Check and clean check valve, flow restricter on recovery piping.</li> </ul>
Sequestering Agent Pump not Operating	<ul style="list-style-type: none"> <li>• Malfunction of pump valve.</li> <li>• Loss in pump prime.</li> <li>• Low sequestering agent level.</li> <li>• Clogged foot valve.</li> <li>• Metering pump malfunction.</li> <li>• Peristaltic tubing needs replacement</li> </ul>	<ul style="list-style-type: none"> <li>• Check for adequate level in sequestering agent tank, refill tank if needed.</li> <li>• Disconnect chemical feed pump line from system, confirm proper operation of pump.</li> <li>• Clean or replace foot valve.</li> <li>• Check metering pump prime. Prime pump if needed.</li> <li>• Rebuild or replace metering pump.</li> </ul>

**Preventive Maintenance Schedule  
Gowanda Day Rehabilitation Center IRM**

Preventive Maintenance Item	Month											
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
GTP System Routine Maintenance & Inspection			x			x			x			x
Inspect and Change Bag Filters	x	x	x	x	x	x	x	x	x	x	x	x
Complete Air Stripper Cleaning		x					x					
GTP Turbo Pressure Blower			x						x			
G&L Liquid Pump Pressures	x	x	x	x	x	x	x	x	x	x	x	x
Lubrication as needed												
Calibration Check of Air & Water Pressure Instrumentation			x									
Sequestering Agent	x	x	x	x	x	x	x	x	x	x	x	x
Sequestering Agent Pump	x	x	x	x	x	x	x	x	x	x	x	x
SVE Roots Blower			x						x			
Lubrication as needed												
Electric Motor												
G&L Liquid Pump Pressures	x	x	x	x	x	x	x	x	x	x	x	x
Evaluate Anticipated Parts Needs	x											
Assessment EQ Tank and Sediment Buildup	x	x	x	x	x	x	x	x	x	x	x	x
Fire Extinguisher Inspection							x					
Carbon Change Out	x						x					

Notes:

1. Routine air stripper cleaning is scheduled bi-annually. This frequency may increase based on operational conditions encountered.
2. Sequestering agent (Ultra-Treat) online to reduce the frequency of air stripper cleanings.
3. Carbon change outs are conducted as needed, based on the operating pressure, flow conditions and analytical results of the carbon beds.

**DASN, GOWANDA  
SPARE PARTS EQUIPMENT LIST**

Item	Part Number	Estimated Net Price (per unit)	Supplier	Phone Number	Estimated Life Expectancy	Estimated Lead Time for Delivery	Recommended Spare Part Inventory	Current Spare Part Inventory
Well Pumps Top Loading Groundwater Pump	MVP		Durham Geo Enterprises	(770) 465-7557	Program		0	0
Well Pumps Counters	MVP Pumps HECON GO490001 J4		Durham Geo Enterprises	(770) 465-7557	Program	1 Week	0	0
EQ Tank Float Switches Innovative Float Switch	L5000908080300		Bisco Innovative Solutions	(781) 963-0090 (203) 729-6434	Program	2 weeks Made to order	0	0
EQ Tank Effluent Pump Goulds Pumps NPE G&L Series	1ST1E5C4		Bisco	(781) 963-0090			0	0
QED Air Stripper Blower Twin City Fan and Blower	TBNS 22N4		Bisco	(781) 963-0090			0	0
QED Air Stripper Effluent Pump Goulds Pumps NPE G&L Series	1ST1E5C4		Bisco	(781) 963-0090			0	0
QED Air Stripper Effluent Pump Solberg Inlet Filter	FS-31P-250		Bisco	(781) 963-0090			2	2
QED Air Stripper Dwyer Explosion Proof Pressure Switch High Pressure	1950-20		Dwyer Instruments	(219) 879-8000			0	0
QED Air Stripper Dwyer Explosion Proof Pressure Switch Low Pressure	1950P-8		Dwyer Instruments	(219) 879-8000			0	0
QED Air Stripper Sump Float Switches Innovative Solutions	L5000908080300		Bisco Innovative Solutions	(781) 963-0090 (203) 729-6434		2 weeks Made to order	0	0
Carbon Units Carbrotol Calgon Replacement Carbon	Filtrisorb 300		Mike Oliver WTS	-716	6 Months Per Analysis	1 Week	0	0

**DASN, GOWANDA  
SPARE PARTS EQUIPMENT LIST**

Item	Part Number	Estimated Net Price (per unit)	Supplier	Phone Number	Estimated Life Expectancy	Estimated Lead Time for Delivery	Recommended Spare Part Inventory	Current Spare Part Inventory
SVE System Roots Blower	47 URAI-J		Bisco	(781) 963-0090			0	0
SVE System Marathon Electric Motor	U652		Bisco	(781) 963-0090			0	0
SVE System Heat Exchanger	ACA-6302-3		Bisco	(781) 963-0090			0	0
SVE System Solberg Inlet Filter	CT-235P-300C		Bisco	(781) 963-0090	1 year		2	2
Bag Filter Assembly Replacement Filter Bags	AP25P2S		Aftek		1 week to 1 month	1 week	50	50
Brass Sanitary Flow Meter Hays	MT-1							
GTP and SVE Electrical / Control Panel Fuse 2 in each panel	FS1-2		Supply House		replace as needed	1 Day	4	0
GTP and SVE Electrical / Control Panel Fuse 1 in each panel	FS3		Supply House		replace as needed	1 Day	2	4

Reference : Bisco Build Number 11757

DASNY GOWANDA  
SPARE PARTS EQUIPMENT LIST

Item	Part Number	Estimated Net Price (per unit)	Supplier	Phone Number	Estimated Life Expectancy	Estimated Lead Time for Delivery	Recommended Spare Part Inventory	Current Spare Part Inventory
Pressure Switch High Omega Indicator Gauge Omega Pressure Transmitter	PGC-25L-100 PX410-100SI							
Sprinkler Pump Crain Demming Pump Head General Electric Electric Motor	3031 5KE184BC105B		Gehring Pump	(585) 425-4288				
Sprinkler Pump Float Switch Levelarm	unknown		Vector Manufact.	2550 Walash Ave. St. Paul MN.				
Flow Transmitters +GF+ Signet Flow Transmitter +GF+ Signet Flow Element	8550-1 51530-PO							
Flow Control Valves Worcester Control 1.5" Valve Worcester Control 1.5" Actuator Worcester Control 1.5" Positioner	4416PFSP 20754W120A 20AF4174120A							
Flow Valve Selenoid Asco	8210G101							
Brass Sanitary Flow Meter Hays	MT-1							
Line Voltage Thermostat White-Rodgers	2E997							
Building Sump Pump Goulds Floor Sump Pump	LSP03							
Motor Starters Square D Size 2, 208 Volt Square D Size 0, 208 Volt Square D Size 0, 110 Volt	NPF2010V02 NPG2005V02 SBG5V02							

**REMEDIAL PROGRAM CONTACT LIST  
GOWANDA DAY HABILITATION CENTER**

<u>Company</u>	<u>Function</u>	<u>Name</u>	<u>Work Phone #</u>	<u>Pager #</u>	<u>Cellular #</u>
Bergmann Associates	Project Manager	Gary Flisnik	(585) 232-5137 x346	--	(585) 303-9067
	O&M Specialist	Jim Marschner	(585) 232-5137 x286	--	(585) 455-7043
	Site Geologist	Edward Jones	(585) 232-5137 x409	--	--
DASNY	Project Manager	Richard Buckley	(518) 257-3239	--	--
	Field Representative	Larry Nephew	(716) 886-2583	--	--
WNYDDSO	Site Representative	Rodney Davey	--	--	(716) 912-7209
Waste Technology	Project Manager	Mike Oliver	(716) 282-4100	--	--
	Technician	Marty Greg	(716) 282-4100	--	--
NYSDEC	Project Manager	Maurice Moore	(716) 851-7220	--	--
NYSDOH	Project Manager	Cameron O'Connor	(716) 847-4385	--	--

Date: March 8, 2006

This Remedial Program Contact List will be updated on a periodic basis as the remedial program team changes.

**Verbatim Number:**

**Site Phone: (716) 532-9242**



## **Attachment 6**

### **Air/Summa Canister Sampling Procedures**

#### **1.0 Introduction**

This protocol describes the procedures to be used to collect indoor ambient air and remediation system air sample. A Summa type canister is to be used along with a regulator set to a specific duration. Samples are to be sent to a approved laboratory for parameter specific TO-15 Analysis.

#### **2.0 Materials**

The following materials, as required, shall be available during groundwater sampling:

- Summa Canisters
- Time Released Regulator
- Appropriate health and safety equipment, as specified in the Health and Safety Plan
- Vacuum Gauge
- Teflon Tubing for sample port connection
- Appropriate transport containers and appropriate labeling, packing, and shipping materials
- Sampling logs
- Chain-of-custody forms
- Indelible ink pens
- Site map with sample point locations

### 3.0 Procedures

1. Identify site and sample location on sampling log sheets or in a field notebook along with date, arrival time, and weather conditions. Identify the personnel and equipment utilized and other pertinent data requested on the logs provided at the end of this procedure.
2. Record the location number, Summa canister ID number and the regulator number for each sample collected.
3. Label all sample containers with indelible ink on the labels only. Do not write on the sampling canister.
4. Record the start time and end time of each sample location and the representative Summa canister.
5. Remove the protective cap from the can.
6. Hold the regulator in one hand and slide back the collar.
7. Hold the Summa canister in the other hand and face the sampler tip into the regulator.
8. Insert the sampler tip into the regulator and release the collar. There should be no gap between the collar and the can.
9. The sampler will automatically start with our power upon completing number 8.
10. Record the starting vacuum reading from the regulator.
11. Check the vacuum gauge periodically for loss in vacuum. Vacuum should start at -30 " Hg at the beginning of the sample collection and end at -1 to -5 "g.
12. When sampling is complete record the time and sample canister vacuum reading. Pull back the collar of the regulator and slide out the Summa canister
13. Replace the protective cap on the sampler tip.
14. Complete the procedures for packing, shipping, and handling with associated chain-of-custody.
15. Return the all sampling equipment to the analytical laboratory.

## Attachment 7

### Groundwater Sampling Procedures for Monitoring Wells

#### 1.0 Introduction

This protocol describes the procedures to be used to collect groundwater samples. A low-flow pump or dedicated bailers will be used to purge the wells prior to sampling. After purging is completed, samples will be drawn from the pumping system. During precipitation events, groundwater sampling will be discontinued until precipitation ceases.

#### 2.0 Materials

The following materials, as required, shall be available during groundwater sampling:

- Photoionization detector (PID)
- Appropriate health and safety equipment, as specified in the Health and Safety Plan
- Peristaltic Pump, tubing, etc., as necessary for low flow purging and sampling (e.g., Geotech Series II or Masterflex Environmental Sampling Pump)
- Appropriate AC/DC power supply
- Tygon Tubing for groundwater purging and sample collection
- Bailers (disposable or dedicated) if required
- Polypropylene rope, if required
- Buckets to measure purge water
- Water level well probe
- Water Quality Monitoring System with Flow Through Cell (e.g., Horiba U-22)
- Appropriate water sample containers

- Appropriate blanks (trip blank supplied by the laboratory)
- Appropriate transport containers (coolers with ice) and appropriate labeling, packing, and shipping materials
- Groundwater sampling logs
- Chain-of-custody forms
- Indelible ink pens
- Site map with well locations and groundwater contour maps
- Keys to wells

### **3.0 Procedures**

1. Identify site and well sampled on sampling log sheets (a sample log sheet is supplied in this appendix) along with date, arrival time, and weather conditions. Identify the personnel and equipment utilized and other pertinent data requested on the logs provided at the end of this procedure. Calibrate field instruments in accordance with the manufacturer's instruction manual and record this calibration in the field notebook.
2. Label all sample containers with indelible ink.
3. Don safety equipment, as required in the Health and Safety Plan. Don a new pair of disposable gloves for each well sampled. Disposable gloves will be used for the entire sampling event and are well-specific.
4. Remove lock from well and if rusted or broken, replaced with a new brass keyed-alike lock.
5. Obtain a water level depth and bottom of well depth using a well probe and record on sampling log sheet using indelible ink. Clean the well probe after each use with a soapy (Alconox) water wash and a distilled/deionized water rinse. (Note: water levels may be measured at all wells prior to initiating any sampling activities.)
6. Calculate the number of gallons of water in the well. Record the well volume on the groundwater sampling field log using indelible ink.

7. Calculate the length of the tubing needed to extend the intake to the required depth leaving enough length at the top of the tubing to reach the peristaltic pump. Connect a length of tubing from the pump head to the purge water container.
8. Plug the pump controller into a source of power. Move the pump switch and adjust the flow of the pump to match the incoming groundwater flow rate of the well. Monitor with the water level meter.
9. Measure and record the initial temperature, specific conductance, and pH of the purge water and periodically make additional measurements during well evacuation. Evacuation should continue until these parameters have stabilized to within  $\pm 10\%$  over at least 2 successive well volumes removed or until at least 3 well volumes have been purged.
10. After purging the groundwater sample will be collected from the peristaltic pump. Do not adjust the flow rate in order to keep the low flow recharge consistent.
11. Secure with packing material and maintain at approximately 4°C on wet ice in an insulated transport container provided by the laboratory.
12. Remove all sampling equipment.
13. Replace the well cap and lock well.
14. Record the time sampling procedures were completed on the field logs.
15. Place all disposable materials (PPE, tubing, etc.) in appropriate containers. Go to next well and repeat the above steps until all wells are sampled.
16. Complete the procedures for packing, shipping, and handling with associated chain-of-custody.

## Attachment 8

### GTP – Groundwater Influent and Effluent Sampling Procedure

#### 1.0 Introduction

This protocol describes the procedures to be used to collect the influent and effluent groundwater samples from the GTP Treatment System.

#### 2.0 Materials

The following materials, as required, shall be available during groundwater sampling:

- Appropriate health and safety equipment, as specified in the Health and Safety Plan.
- Appropriate water sample containers. Use of new, 40 millimeter zero-head space glass vials pre-pared with HCL is to be used.
- Appropriate blanks (trip blank supplied by the laboratory), if needed.
- Appropriate transport containers (coolers with ice) and appropriate labeling, packing, and shipping materials.
- Chain-of-custody forms.
- Indelible ink pens.

#### 3.0 Procedures

1. Identify site and location (influent or effluent) sampled on sampling on the O&M log sheets (a sample log sheet is supplied in this appendix) along with date, time and weather conditions.
2. Label all sample containers with indelible ink.
3. Don safety equipment, as required in the Health and Safety Plan. Don a new pair of disposable gloves for each point sampled. A new pair of disposable gloves will be used for the sampling event and are location-specific.

4. Sample the effluent sample point first. Effluent sample is to consist of two 40 ml glass vials, prepared with HCL. Wait for the system to process water from the GTP sump and open the effluent port. Fill the VOA sample bottles and cap with zero headspace.
5. Using a new pair of gloves, sample the influent sample point after collection of the effluent samples. Fill two 50 ml glass vials and cap with zero headspace from the incoming flow into the EQ tank.
6. Secure with packing material and maintain at approximately 4°C on wet ice in an insulated transport container provided by the laboratory.
7. Complete the procedures for packing, shipping, and handling with associated chain-of-custody.

## **Attachment 9**

### **Sub Slab Vacuum Monitoring Procedure**

#### **1.0 Introduction**

This protocol describes the procedures to be used to collect sub slab monitoring vacuum readings. There are eight monitoring points in the sub slab of the facility floor. The following discusses the procedures to use to collect sub slab communication data.

#### **2.0 Materials**

The following materials, as required, shall be available during the collection of readings:

- Appropriate health and safety equipment, as specified in the Health and Safety Plan
- A digital manometer capable of a resolution of 0.001 inches of H<sub>2</sub>O (e.g. Omnigaurd III Differential Pressure Recorder)
- Battery or extension cord to power the manometer.
- Tygon tubing.
- Field notebook.

#### **3.0 Procedures**

1. Identify site and location on the site map. Record all data on the appropriate O&M log sheets (a sample log sheet is supplied in this appendix) along with date, time and weather conditions.
2. Turn on the manometer, connect all appropriate tubing to the unit and allow for the manometer to equilibrate. Zero the unit according to the manufacture's instructions.
3. Connect the unit to the sub slab measurement point.
4. Allow the manometer to stabilize and record the reading.



5. Disconnect the manometer from the sub slab monitoring point. Watch the manometer and confirm that the unit returns to zero.
6. If the unit does not re-zero, zero the unit according to the manufacture's instructions and retake the reading. Follow steps 3 to 5.
7. Follow this procedure for each sub slab monitoring point.

## **Attachment 10**

### **Soil Vapor Extraction System & Groundwater Treatment System**

#### **General System Operation and Maintenance**

##### **Normal Inspection and Maintenance**

Normal inspection and maintenance of the SVE system will focus on the blower, SVE wells, DR wells, influent and effluent pipelines and associated system instrumentation. Normal maintenance of the system will be accomplished by on-site inspections and scheduled maintenance. The SVE system will be inspected on a monthly basis. The following tasks will be completed during each on-site inspection, unless otherwise noted:

- Check the condition of the SVE wells and DR-wells
- Check the condition of the dilution air inlet, blower and associated controls
- Check the flow monitoring devices (pitot tubes), clean as needed
- Record the blower vacuum, SVE well vacuum and DR- well vacuum
- Record the SVE discharge temperatures and pressures

The accumulation of silt in the SVE and DR wells could potentially clog recovery well screens and impede soil treatment. Therefore a plan has been developed to measure the silt levels and to remove the silt if the levels are found to be a problem. The plan consists of measuring the amount of silt accumulation in the SVE and DR wells on a yearly basis during February or March. If significant silt is measured in the SVE or DR wells, and it is determined that the silt is impeding site remediation, the silt will be removed.

A preventive maintenance schedule for the SVE system is provided. An example inspection and maintenance form for the SVE system is provided in the Equipment and Instrumentation Manual.

##### **Routine Monitoring and Laboratory Testing**

Monitoring of the SVE system will be conducted to demonstrate that air emissions from the SVE system do not exceed NYSDEC SGCs or AGCs. Monitoring will be conducted on a quarterly basis. It will be concluded that the system is in compliance with air discharge criteria in the substantive air requirement. If the PID reading exceeds 0.834 pounds/hour of TCE or DCE or 0.010 pounds/hour of vinyl chloride, the system operating conditions and VOC emission rates will be reevaluated to determine whether air discharge criteria have been exceeded.

## **Groundwater Collection and Treatment and Site-Wide Groundwater Pumping and Treatment Systems**

### **System Operation**

Between May 2005 and September 2005, the GTP system was operated such that groundwater was recovered from 4 of the 6 groundwater pumping wells on a continuous basis. Each recovery well pump was activated and deactivated as groundwater fluctuated between the pump initiation settings. The pumped groundwater from both the SVE and GTP site-wide groundwater pumping wells is treated by air stripping.

### **Normal Inspection and Maintenance**

Normal inspection and maintenance of the GTP and site-wide groundwater pumping and treatment systems will focus on the groundwater recovery pumps, influent pipelines and associated instrumentation, groundwater treatment equipment and the groundwater and air discharge pipelines. Normal maintenance of the system will be accomplished by on-site inspections and scheduled maintenance.

The GTP and site-wide groundwater extraction and treatment systems will be inspected on a monthly basis. The following tasks will be completed during each on-site inspection, unless otherwise noted:

- Check the condition of the equipment and controls (e.g. lights, control panel, autodialer, piping and insulation),
- Check the condition of the sewer discharge point for damage,
- Observe the condition of each SVE, recovery well and associated equipment and check for damage,
- Check the condition of the check valves, flow restrictors, counters and flow meters, and clean or replace as needed,
- Check the condition of the treated water discharge pipe,
- Check the condition of the heating and ventilation systems and internal lights,
- Check the condition of the air stripper trays, sump and sight glasses,
- Check the piping and equipment for any signs of loose fittings, leakage or tampering,
- Record bag filter pressure, check the bag filter and replace as needed,
- Visually inspect system components for excessive wear due to mechanical problems, vibration, etc., and replace as necessary,
- Check the condition of the sequestering agent pump. Check the level of sequestering agent in the sequestering agent drum, replenish as needed,
- Check the condition of the air intake filter and replace as necessary,

- Record the air stripper operating pressure,
- Clean the air stripper trays to remove buildup (semi-annually or when air stripper air pressure is greater than a 15 inches of water change).

A preventive maintenance schedule for the GTP and site-wide groundwater pumping and treatment systems are provided. An example inspection and maintenance form for the GTP and site-wide groundwater extraction and treatment systems is provided in the Equipment and Instrumentation Manual.

The accumulation of silt in the site-wide groundwater pumping wells could potentially clog recovery well screens and impede groundwater recovery. Therefore, a plan has been developed to measure the silt levels and to remove the silt if the levels are found to be a problem. The plan consists of measuring the amount of silt accumulation in the extraction wells on a yearly basis in February or March. If significant silt is measured in the wells, and it is determined that the silt is impeding groundwater recovery, the silt will be removed.

### **Routine Monitoring**

Monitoring of the GTP and site-wide groundwater pumping and treatment systems will serve the following purposes:

1. Demonstrate that treated groundwater meets the effluent limitations established by the NYSDEC,
2. Demonstrate that air emissions from the SVE system and air stripper do not exceed NYSDEC SGCs or AGCs,
3. Demonstrate containment of groundwater is being achieved,
4. Assess the condition of site-wide groundwater on a periodic basis.

### **Waste Handling**

Waste storage is located within the treatment room area. This area is used for accumulation of waste materials generated during the O&M of the SVE, GTP and site-wide groundwater pumping systems.

The OMRDD contractor is responsible for properly labeling each container, and coordinating with a waste disposal contractor for waste pickup and additional containers and supplies. Normal routine waste disposal will be coordinated with the facility waste disposal program.

### **Equipment Failure**

An equipment failure (e.g. pipe break or a motor failure) may result in extended periods of treatment system shutdown to complete the necessary repairs. However, downtime will be minimized by maintaining an inventory of spare parts, as discussed below.

## **Spare Parts**

In order to minimize extended shut down periods due to equipment malfunctioning and lead time on replacement equipment, an inventory of spare parts will be maintained. A list of potential spare parts that may be maintained is provided in the Equipment and Instrumentation Manual. The spare parts inventory will be restocked as needed and inventory will be reevaluated on a yearly basis.

## **Troubleshooting**

### **SVE System**

The SVE system is equipped with an autodialer that is programmed to notify the operator in the event of a system shutdown. Each alarm will initiate a general system shutdown and will require action by the operator to restore system operation. The Equipment and Instrumentation Manual provides a trouble-shooting guide which includes a summary of the programmed alarms for the SVE system, possible causes of the alarm and common remedies to restore system operation. It also includes a list of problems that could occur that would not cause an alarm, and common remedies to address such problems.

### **Groundwater collection and treatment and Site groundwater Pumping and treatment system**

The GTP and site-wide groundwater Pumping system is equipped with a common autodialer (also used with the SVE system) which is programmed to notify the operator in the event of a system shutdown. Each alarm will initiate a general system shutdown and will require action by the operator to restore system operation. The Equipment Instrumentation Manual provides a trouble shooting guide which includes a summary of the programmed alarms for the treatment systems, possible causes of the alarm and common remedies to restore system operation. It also includes a list of problems that could occur that would not cause an alarm, and common remedies to address such problems.

**Attachment 11**  
**Contaminated Soil Management Plan**

# **CONTAMINATED SOIL MANAGEMENT PLAN**

**Gowanda Day Habilitation Center  
4 Industrial Place  
Gowanda, NY**

**October 2006**

## **1.0 INTRODUCTION**

This contaminated Soil Management Plan (SMP) is intended to assist the user in making appropriate decisions regarding the screening, segregation, stockpiling, transportation and disposal of impacted soils with the knowledge and approval of the Facility Owner or Engineer in Charge (EIC). In addition it is meant to address the health and safety of construction workers and the general public when impacted soils are encountered. The SMP is designed as a flexible document to accommodate possible changes in site conditions.

### **1.1 Purpose**

The intent of this plan is to provide guidance for the proper handling of impacted soil encountered during the project and ensure that all personnel follow applicable local, New York State and Federal rules and regulations.

### **1.2 Scope of Work**

This project involves any subsurface excavation, construction or soil handling activities at the Gowanda Day Habilitation Center which will result in the possible excavation, handling, and removal of impacted soils while remedial systems are still active at the facility or while the property is subject to cleanup oversight by the NYSDEC. Specific work activities covered by this SMP include:

- Demolition, excavation, foundation work or work beneath the building.
- Installation of test borings or monitoring wells.
- Installation/repairs to on-site subsurface utilities, including sewer lines, water service or natural gas lines.
- Repairs to storm drains or catch basins.

The following is a summary of Soil Management Actions to be taken at the subject property:

- Field Identification of impacted soil.
- Segregation of impacted soil from clean soil.
- Excavation and stockpiling of impacted soil.
- Sampling, analysis and disposal facility approvals.
- Loading, transporting and disposing of impacted soil.
- Field monitoring, sampling, and disposal plan.

The aforementioned tasks may not be limited to those sites listed in Section 1.3, On-Site Areas of Impacted Soil. Due to the historic presence of various spills in the area it is possible that residual contamination may be encountered outside the building at designated areas beneath asphalt access roads.



### 1.3 On-Site Areas of Impacted Soils

Areas of delineated impacted soil at the subject property consist of three areas described as follows:

- Impacted areas directly beneath the building slab.
- Area of impacted soil at monitoring well MW-1, immediately south of the building, extending beneath the asphalt driveway to the south. This area terminates prior to the south property line/MW-2 area.
- The area immediately north of the building extending beneath the asphalt driveway and grass strip between MW-6 and MW-7. Areas east of MW-6 and west of MW-7 have been determined to meet applicable cleanup Standards, Guidelines and Criteria (SCGs). The area of impacted subsurface soil extends north to the property line.

## 2.0 MATERIAL HANDLING

### 2.1 Notification

For projects that may include subsurface excavation at areas of known impacted soil, or should field screening be indicative of impacted soils encountered at other areas at the subject property, the following personnel will be contacted:

Bergmann Associates	Project Manager	Gary Flisnik	(585) 232-5137 x346 (585) 303-9067
	O&M Specialist	Jim Marschner	(585) 232-5137 x286 (585) 455-7043
	Site Geologist	Edward Jones	(585) 232-5137 x409
DASNY	Project Manager	Richard Buckey	(518) 257-3239
	Field Representative	Larry Nephew	(716) 886-2583
WNYDDSO	Site Representative	Rodney Davey	(716) 912-7209
Waste Technology	Project Manager	Mike Oliver	(716) 282-4100
	Technician	Marty Greg	(716) 282-4100
NYSDEC	Project Manager	Maurice Moore	(716) 851-7220
NYSDOH	Project Manager	Cameron O'Connor	(716) 847-4385

## **2.2 Screening and Segregation of Impacted Soil**

Impacted soils shall be identified by the presence of odor, oily sheen and/or staining. All soil will be field tested with a calibrated photo-ionization detector (MiniRae® 2000 or similar) for the presence of organic vapors to aid in the determination of impacted soil. The PID meter will be calibrated in the field at the beginning of each workday to insure accuracy and proper soil segregation.

The staging area will be the asphalt parking lot at the southwest corner of the property. Prior to stockpiling of soils in the staging area, 6-mil polyethylene sheeting will be placed on the ground surface. Care will be taken to ensure that rocks, roots or other debris is removed from the area to prevent damage to the poly sheeting. The soils will be placed on the poly sheeting, covered with 6-mil poly sheeting to prevent contact with precipitation and subsequent impacting of storm water, surface waters and groundwater. The sheeting will be secured on all edges and the area surrounding the soil pile will be sloped so as to provide positive drainage away from the stockpiled material.

The field head space sampling protocol for impacted soils will consist of placing suspect soils in either a sample jar or a zip lock bag (filling the jar or bag approximately 50% to 60% full). In cold weather the jar will be warmed to approximately 60 degrees F. Before the reading is taken the jar or bag will be lightly shaken to allow volatilization of organic compounds.

Soil excavated from the designated areas will be transported to and stockpiled at the on-site designated staging area. Signs will be placed to indicate staging areas for Non-Contaminated, Contaminated or Highly Contaminated soil.

Excavated soils not exhibiting any measurable VOCs (less than 10 ppm), odor or evidence of contamination shall initially be considered “non-Contaminated”, subject to confirmatory sampling and analysis.

Those soils exhibiting a PID reading of greater than 10 parts per million (ppm) but less than 50 parts per million (ppm) above background shall be considered as “Contaminated” and will be transported to the designated stockpiling staging area and placed on the poly sheeting and covered.

Soils exhibiting a PID reading equal to or greater than 50 parts per million (ppm) above background shall be considered as “Highly Contaminated” and will be transported to the designated staging area or placed adjacent to the source area pending disposal characterization, but segregated from the low contaminated pile.

Confirmation sampling of the excavated areas shall be conducted subsequent to removal of impacted soils/project completion. Sampling will consist of one (1) composite sample from the side walls and one (1) composite sample from the bottom of the excavation at a sampling rate of one (1) sample every 30 meters. A composite sample will consist of a mix of 4 to 5 individual grab/point samples. Samples will be submitted to a NYSDOH Certified ELAP or accredited laboratory for analysis of volatile organic compounds by EPA Method 8260 and shall include the site-specific chlorinated VOCs and any other compounds of concern.

### **2.3 Pre-Disposal Laboratory Analysis**

A sample will be collected from stockpiled soils for analysis required for disposal facility approval. One (1) composite soil sample will be collected from every 100 cubic meters of soil to be disposed of. Each composite sample will consist of a minimum of four (4) sample points collected from a minimum of 30 centimeters below the surface of the stockpiled soil. Each sample will be submitted to an accredited laboratory (see below) under standard chain of custody procedures and analyzed within 10 days for the following:

- Volatile organic compounds via EPA Method 8260, to include site-specific chlorinated VOCs.
- pH.
- Ignitability.
- TCLP Benzene.
- TCLP Lead.
- Other appropriate disposal analysis as determined by site conditions, suspect contaminants and landfill requirements (i.e. moisture content)

All analysis shall be performed by an analytical laboratory with valid NYSDOH ELAP certification.

### **2.4 Soil Disposal Determination**

Non-hazardous impacted soils will be disposed of a NYSDEC permitted landfills.

Subsequent to receipt of landfill approval, the stockpiled soils will be loaded and transported. The transporter will have a valid 6 NYCRR Part 364 waste transporter permit. A waste manifest and a copy of the waste profile will accompany each shipment of material.

Soil determined to be hazardous waste (e.g., characteristic of ignitability or lead/benzene toxicity) will be disposed of at a Subtitle C landfill. Hazardous waste will be transported to Waste Management's CWM Chemical Services facility located at 1550 Balmer Road, Model City, New York or at other NYSDEC landfills permitted to accept the excavated soil.

## **2.5 Handling & Disposal of Impacted Groundwater**

Contaminated groundwater that is encountered may require removal from excavations using pumps and associated hoses. The material can be pumped into a holding tank or vacuum tank truck and must be disposed off-site in accordance with applicable regulations.

As an alternative, the contaminated water could be treated (e.g., carbon), and the water could then be discharged to a sanitary sewer system. The appropriate regulatory approval and permitting must be obtained prior to disposing of groundwater in this manner. Treated water cannot be discharged unless it meets the sewer use discharge limitations that are currently established for the Gowanda municipal sewage treatment plant/POTW.

Potentially contaminated groundwater will require testing for volatile organic compounds using EPA Method 8260. The actual parameters tested must be consistent with testing requirements of an approved disposal facility (ie. POTW).

## **3.0 HEALTH & SAFETY PLAN REQUIRMENTS**

A site-specific Health & Safety Plan (HASP) is to be prepared for any excavation or subsurface work that may occur in the designated areas of impacted soil. The following items are to be included in the HASP:

- Hazard overview/evaluation.
- Project personnel and responsibilities.
- Work plan and personal protective equipment (PPE).
- Excavation safety procedures.
- Site monitoring and action levels.
- Decontamination procedures.
- Medical monitoring.
- Personnel training.
- Emergency response procedures (including directions and map to nearest hospital).
- Special precautions.

Areas of Subsurface Impacted Soil

**DASNY**  
**GOWANDA DAY**  
 HABILITATION CENTER  
 4 INDUSTRIAL PLACE  
 GOWANDA, NY



**BERGMANN**  
 associates

Engineers / Architects / Surveyors

200 First Federal Plaza  
 28 East Main Street, Rochester, New York 14614  
 585.232.5135 / 585.232.4652 fax

REVISIONS				
NO.	DATE	DESCRIPTION	REV.	GKD

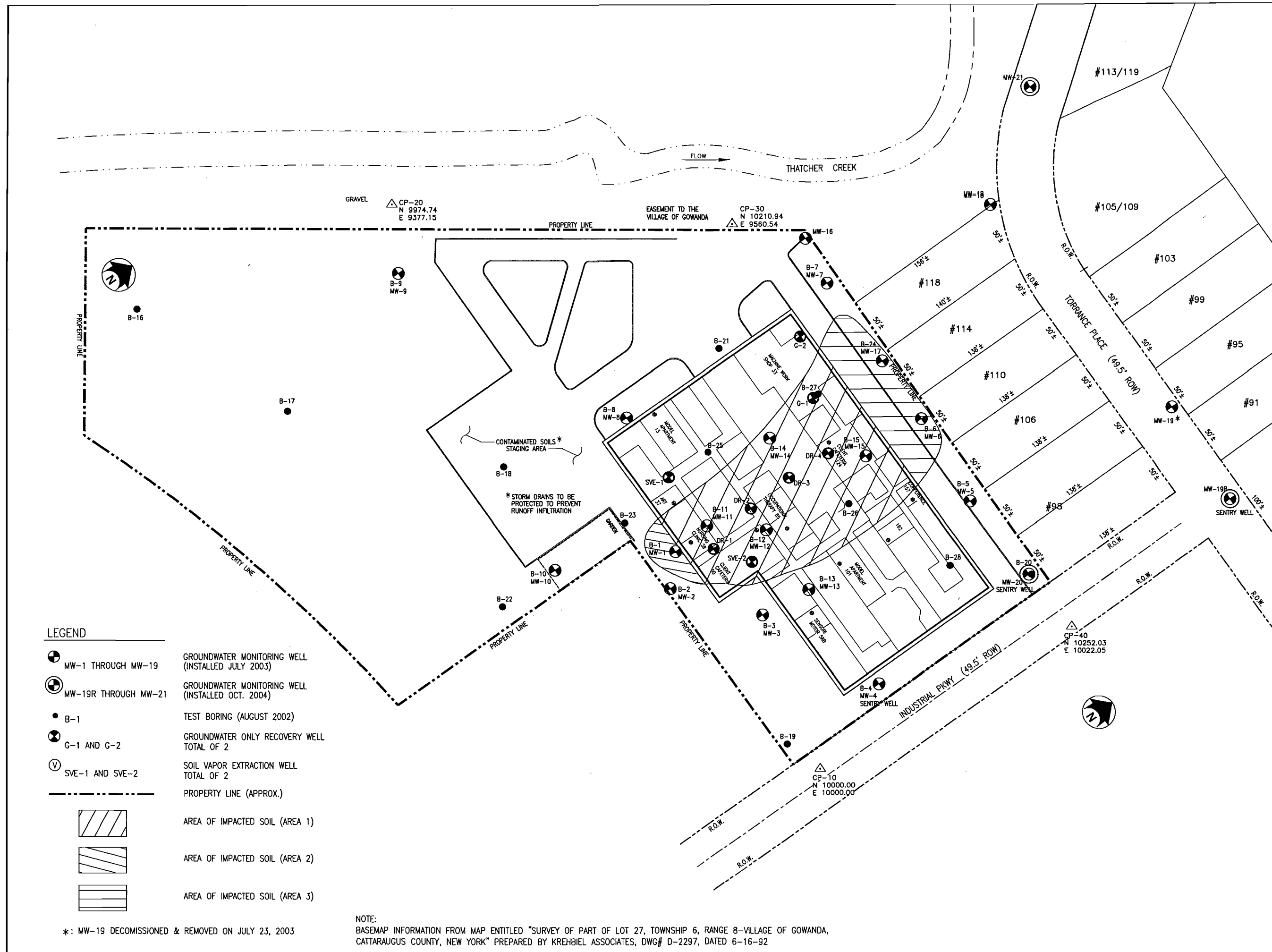
NOTE:  
 Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 145, Section 7209.



**CONTAMINATED SOIL MANAGEMENT PLAN**

Project Manager:  
**G. FLISNIK**  
 Designed by:  
**E. JONES**  
 Drawn by:  
**D. MASE**  
 Checked by:  
**G. FLISNIK**  
 Date Issued:  
**OCTOBER 20, 2006**  
 Scale:  
**1" = 80'**

Date: \_\_\_\_\_  
 Project Number: **5596.28** File Name: **I:\DASNY\5596.56 GOWANDA05-06\CONT.DWG**  
 Drawing Number: \_\_\_\_\_



- LEGEND**
- GROUNDWATER MONITORING WELL (INSTALLED JULY 2003)
  - GROUNDWATER MONITORING WELL (INSTALLED OCT. 2004)
  - TEST BORING (AUGUST 2002)
  - GROUNDWATER ONLY RECOVERY WELL TOTAL OF 2
  - SOIL VAPOR EXTRACTION WELL TOTAL OF 2
  - PROPERTY LINE (APPROX.)
  - AREA OF IMPACTED SOIL (AREA 1)
  - AREA OF IMPACTED SOIL (AREA 2)
  - AREA OF IMPACTED SOIL (AREA 3)

\*: MW-19 DECOMMISSIONED & REMOVED ON JULY 23, 2003

NOTE:  
 BASEMAP INFORMATION FROM MAP ENTITLED "SURVEY OF PART OF LOT 27, TOWNSHIP 6, RANGE 8-VILLAGE OF GOWANDA, CATTARAUGUS COUNTY, NEW YORK" PREPARED BY KREHBIEL ASSOCIATES, DWG# D-2297, DATED 6-16-92

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION  
Annual Site Management Periodic Review Report  
Institutional and Engineering Controls Certification Form  
Voluntary Cleanup Program**



**Site Details**

**Box 1**

**Site No.**    **V00463**

**Site Name**   **Gowanda Day Habilitation Site**

Site Address:    4 Industrial Place                      Zip Code: 14077

City/Town:    Persia (t)                      County:    Cattaraugus

Certification Period: \_\_\_\_\_

Current Use:    Commercial

Intended Use:    Industrial or commercial use, excluding day care, child care and medical uses

**Verification of Site Details**

**Box 2**

	YES	NO
1. Are the Site Details above, correct?	<input type="checkbox"/>	<input type="checkbox"/>
If NO, are changes handwritten above or included on a separate sheet?	<input type="checkbox"/>	
2. Has some or all of the site property been sold, subdivided, merged, or undergone a tax map amendment since the initial/last certification?	<input type="checkbox"/>	<input type="checkbox"/>
If YES, is documentation or evidence that documentation has been previously submitted included with this certification?	<input type="checkbox"/>	
3. Have any federal, state, and/or local permits (e.g., building, discharge) been issued for or at the property since the initial/last certification?	<input type="checkbox"/>	<input type="checkbox"/>
If YES, is documentation or evidence that documentation has been previously submitted included with this certification?	<input type="checkbox"/>	
4. Has a change-of-use occurred since the initial/last certification?	<input type="checkbox"/>	<input type="checkbox"/>
If YES, is documentation or evidence that documentation has been previously submitted included with this certification?	<input type="checkbox"/>	
5. For non-significant-threat Brownfield Cleanup Program Sites subject to ECL 27-1415.7(c), has any new information revealed that assumptions made in the Qualitative Exposure Assessment for offsite contamination are no longer valid ?	<input type="checkbox"/>	<input type="checkbox"/>
If YES, is the new information or evidence that new information has been previously submitted included with this Certification?	<input type="checkbox"/>	
6. For non-significant-threat Brownfield Cleanup Program Sites subject to ECL 27-1415.7(c), are the assumptions in the Qualitative Exposure Assessment still valid (must be certified every five years) ?	<input type="checkbox"/>	<input type="checkbox"/>

SITE NO. V00463

**Description of Institutional Control**

**Box 3**

The Site Management Plan (SMP) for the implemented remedy [which plan was developed by Bergmann Associates, is dated October 2006, and includes an Operations, Monitoring and Maintenance (OM&M) plan and a Soils Management Plan], is be adhered to.

**Control Certification**

**YES NO choose one**

Before occupancy, a sub-slab vapor mitigation system had been installed to maintain a measurable vacuum in the sub-slab of the portion of the existing building being re-occupied and in any new structures. Performance sampling, as outlined in the OM&M plan must be completed to document system effectiveness. This system is independent of the currently installed or future remedial system(s).

**Control Certification**

**YES NO N/A**

Before re-use measures have been implemented to restrict access to portions of the building, specifically the portions of the building occupied by the remedial system(s), and rooms/hallways with extraction wells.

Note: Re-use of occupied areas require engineering controls to manage off-gassing and fugitive emissions from the remedial system(s), such as isolating the treatment area or installing a ventilation system to ensure that the active remediation areas are isolated from occupied areas. Restriction of the active system includes isolation of potential vapor pathways, such as, drop ceilings with shared air spaces, shared cold air return vents, and large openings between the areas, etc.

**Control Certification**

**YES NO N/A**

Groundwater beneath the site is not be used as a potable water source or for any other use without prior written permission of the Department.

**Control Certification**

**YES NO N/A**

**Description of Engineering Control**

**Box 4**

Until the remedial goals for the site are attained or deemed complete or not necessary based on the results of a Department-approved evaluation, the remedial system, consisting of a groundwater control and treatment system and a soil vapor extraction system shall be operated and maintained in accordance with the standards and procedures specified in the SMP and shall continue provide hydraulic control of a groundwater plume. Owner, and Qualified Environmental Professional with a New York Professional Engineer License certify that the remedial system is being operated and maintained in accordance with the standards and procedures specified in the SMP

**Control Certification**

**YES NO**

**Control Certification Statement**

For each Institutional or Engineering control listed above, I certify by checking "Yes" that all of the following statements are true:

- (a) the Institutional Control and/or Engineering Control employed at this site is unchanged since the date that the Control was put in-place, or was last approved by the Department;
- (b) nothing has occurred that would impair the ability of such Control, to protect public health and the environment;
- (c) nothing has occurred that would constitute a violation or failure to comply with the Site Management Plan for this Control; and
- (d) access to the site will continue to be provided to the Department, to evaluate the remedy, including access to evaluate the continued maintenance of this Control.
- (e) if a financial assurance mechanism is required by the oversight document for the site, the mechanism remains valid and sufficient for its intended purpose established in the document.





## Enclosure

### **Certification of Institutional Controls/ Engineering Controls (ICs/ECs) Step-by-Step Instructions, Certification Requirements and Definitions**

The Owner, or Remedial Party, and when necessary, a Professional Engineer (P.E.), or the Qualified Environmental Professional (QEP), must review and complete the IC/EC Certification Form, sign the IC/EC Certifications Signature Page, and return it, along with the Periodic Review Report (PRR), within 45 days of the date of this notice.

Please use the following instructions to complete the IC/EC Certification.

#### **I. Verification of Site Details (Box 1 and Box 2):**

Answer the six questions in the Verification of Site Details Section. Questions 5 and 6 refer to only sites in the Brownfield Cleanup Program. ECL Section 27-1415-7(c) is included in

**IV. IC/EC Certification Requirements.** The Owner and/or your P.E. or QEP may include handwritten changes and/or other supporting documentation, as necessary.

#### **II. Verification of Institutional / Engineering Controls (Box 3)**

Review the listed Institutional / Engineering Controls, confirming that all existing controls are listed, and that all existing controls are still applicable. If there is a control that is no longer applicable the Owner / Remedial Party is to petition the Department requesting approval to remove the control.

2. Select "YES" or "NO" for **Control Certification** for each IC/EC, based on Sections (a)-(e) of the **Control Certification Statement**.

If the Department concurs with the explanation, the corrective measures, and the proposed schedule, a letter authorizing the implementation of those corrective measures will be issued by the Project Manager. If the Department has any questions or concerns regarding the completion of the certification, the Project Manager will contact you.

3. If you cannot certify "Yes" for each Control, please continue to complete the remainder of this **Control Certification** form. Attach supporting documentation that explains why the **Control Certification** cannot be rendered, as well as a statement of proposed corrective measures, and an associated schedule for completing the corrective measures. Note that this **Control Certification** form must be submitted even if an IC or EC cannot be certified; however, the certification process will not be considered complete until corrective action is conducted.

If the Department concurs with the explanation, the corrective measures, and the proposed schedule, a letter authorizing the implementation of those corrective measures will be issued by the Project Manager. Once the corrective measures are complete a new Periodic Review Report (with IC/EC Certification) is to be submitted within 45 days to the Department. If the Department has any questions or concerns regarding the PRR and/or completion of the IC/EC Certification, the Project Manager will contact you.

**III. IC/EC Certification by Signature (Box 5 and Box 6):**

1. If you certified "Yes" for each Control, please complete and sign the IC/EC Certifications page. To determine WHO signs the **IC/EC Certification**, please use Table 1. Signature Requirements for the IC/EC Certification, which follows.

<b>Table 1. Signature Requirements for Control Certification Page</b>		
<b>Type of Control</b>	<b>Example of IC/EC</b>	<b>Required Signatures</b>
IC only	Environmental Easement Deed Restriction.	A site or property owner or remedial party.
IC with an EC which does not include a treatment system or engineered caps.	Fence, Clean Soil Cover, Individual House Water Treatment System, Vapor Mitigation System	A site or property owner or remedial party, and a QEP. (P.E. license not required)
IC with an EC that includes treatment system or an engineered cap.	Pump & Treat System providing hydraulic control of a plume, Part 360 Cap.	A site or property owner or remedial party, and a QEP with a P.E. license.

**IV. IC/EC Certification Requirements:**

Division of Environmental Remediation Program Policy requires periodic certification of IC(s) and EC(s) as follows:

For Environmental Restoration Projects: N.Y. Environmental Conservation Law Section 56-0503 (Environmental restoration projects; state assistance)

For State Superfund Projects: Environmental Conservation Law 27-1318. (Institutional and engineering controls)

For Brownfields Cleanup Program Projects: Environmental Conservation Law Section 27-1415. (Remedial program requirements)

Environmental Conservation Law Section 27-1415-7(c) states:

- (c) At non-significant threat sites where contaminants in groundwater at the site boundary contravene drinking water standards, such certification shall also certify that no new information has come to the owner’s attention, including groundwater monitoring data from wells located at the site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of offsite contamination are no longer valid. Every five years the owner at such sites shall certify that the assumptions made in the qualitative exposure assessment remain valid. The requirement to provide such certifications may be terminated by a written determination by the Commissioner in consultation with the Commissioner of Health, after notice to the parties on the brownfield site contact list and a public comment period of thirty days.

Voluntary Cleanup Program: Applicable program guidance.

Petroleum Remediation Program: Applicable program guidance.

Federal Brownfields: Applicable program guidance.

Manufactured Gas Plant Projects: Applicable program guidance (including non-registry listed MGPs).

WHERE to mail the signed Certification Form:

New York State Department of Environmental Conservation  
Division of Environmental Remediation  
270 Michigan Avenue  
Buffalo New York, 14304

Attn: Project Manager

**Please note that extra postage may be required.**

## V. Definitions

**“Engineering Control”** (EC), means any physical barrier or method employed to actively or passively contain, stabilize, or monitor contamination, restrict the movement of contamination to ensure the long-term effectiveness of a remedial program, or eliminate potential exposure pathways to contamination. Engineering controls include, but are not limited to, pavement, caps, covers, subsurface barriers, vapor barriers, slurry walls, building ventilation systems, fences, access controls, provision of alternative water supplies via connection to an existing public water supply, adding treatment technologies to such water supplies, and installing filtration devices on private water supplies.

**“Institutional Control”** (IC), means any non-physical means of enforcing a restriction on the use of real property that limits human and environmental exposure, restricts the use of groundwater, provides notice to potential owners, operators, or members of the public, or prevents actions that would interfere with the effectiveness of a remedial program or with the effectiveness and/or integrity of operation, maintenance, or monitoring activities at or pertaining to a remedial site.

**“Professional Engineer”** (P.E.) means an individual or firm licensed or otherwise authorized under article 145 of the Education Law of the State of New York to practice engineering.

**“Property Owner”** means, for purposes of an IC/EC certification, the actual owner of a property. If the site has multiple properties with different owners, the Department requires that the owners be represented by a single representative to sign the certification.

**“Oversight Document”** means any document the Department issues pursuant to each Remedial Program (see below) to define the role of a person participating in the investigation and/or remediation of a site or area(s) of concern. Examples for the various programs are as follows:

**BCP** (after approval of the BCP application by DEC) - Brownfield Site Cleanup Agreement.

**ERP** (after approval of the ERP application by DEC) - State Assistance Contract.

**Federal Superfund Sites** - Federal Consent Decrees, Administrative Orders on Consent or Unilateral Orders issued pursuant to CERCLA.

**Oil Spill Program** - Order on Consent, or Stipulation pursuant to Article 12 of the Navigation Law (and the New York Environmental Conservation Law).

**State Superfund Program** - Administrative Consent Order, Record of Decision.

**VCP** (after approval of the VCP application by DEC) - Voluntary Cleanup Agreement.

**RCRA Corrective Action Sites**- Federal Consent Decrees, Administrative Orders on Consent or permit conditions issued pursuant to RCRA.

**“Qualified Environmental Professional”** (QEP), means a person who possesses sufficient specific education, training, and experience necessary to exercise professional judgment to develop opinions and conclusions regarding the presence of releases or threatened releases to the surface or subsurface of a property or off-site areas, sufficient to meet the objectives and performance factors for the areas of practice identified by this Part. Such a person must:

(1) hold a current professional engineer’s or a professional geologist’s license or registration issued by the State or another state, and have the equivalent of three years of full-time relevant experience in site investigation and remediation of the type detailed in this Part; or

(2) be a site remediation professional licensed or certified by the federal government, a state or a recognized accrediting agency, to perform investigation or remediation tasks consistent with Department guidance, and have the equivalent of three years of full-time relevant experience.

**“Qualitative Exposure Assessment”** means a qualitative assessment to determine the route, intensity, frequency, and duration of actual or potential exposures of humans and/or fish and wildlife to contaminants.

**“Remedial Party”** means a person implementing a remedial program at a remedial site pursuant to an order, agreement or State assistance contract with the Department.

**“Site Management”** (SM) means the activities undertaken as the last phase of the remedial program at a site, which continue after a Certificate of Completion is issued. Site management is conducted in accordance with a site management plan, which identifies and implements the institutional and engineering controls required for a site, as well as any necessary monitoring and/or operation and maintenance of the remedy.

**“Site Management Plan”** (SMP) means a document which details the steps necessary to assure that the institutional and engineering controls required for a site are in-place, and any physical components of the remedy are operated, maintained and monitored to assure their continued effectiveness, developed pursuant to Section 6 (DER10 Technical Guide).

**“Site Owner”** means the actual owner of a site. If the site has multiple owners of multiple properties with ICs and/or ECs, the Department requires that the owners designate a single representative for IC/EC Certification activities.

**Attachment 12**  
**Environmental Easement**



**James K. Griffith**  
**CATTARAUGUS COUNTY CLERK**

Cattaraugus County Center 303 Court Street  
Little Valley, NY 14755

(716) 938-9111  
Fax: (716) 938-2773

**Instrument Number**

**\*96693-001\***

No. of Pages: 4  
not including this one

Delivered By: NYS

Receipt No: 96693

Return To:

NYS DORMITORY AUTHORITY  
515 BROADWAY  
ALBANY NY 12207-2964

DATE: 2/22/2008

Time: 10:17 AM

Document Type: RESTRICTIVE COVENANTS

Parties To Transaction: NYS OFFICE MENTAL RETARDATION & DEV

Town/City:

Deed Information

Mortgage Information

Consideration:

Mortgage Amount:

Transfer Tax:

Basic Mtge. Tax:

RETT No: 00000

Special Mtge. Tax:

Additional Mtge. Tax:

State of New York  
Cattaraugus County Clerk

Mortgage Serial No.:

This sheet constitutes the Clerk endorsement required by Section 316-A(5) & Section 319 of the Real Property Law of the State of New York.

Cattaraugus County Clerk

**Please do not remove this page.**





## DECLARATION of COVENANTS and RESTRICTIONS

**THIS COVENANT**, made this 31 day of JANUARY 2008 by The State of New York, acting by and through the **New York State Office of Mental Retardation and Developmental Disabilities**, an agency of the State of New York, with its primary office located at 44 Holland Avenue, Albany, New York 12229, which agency is hereinafter referred to as the "volunteer agency".

WHEREAS, the State of New York acquired a parcel of real property for the New York State Office of Mental Retardation and Developmental Disabilities which parcel is commonly referred to as the Gowanda Day Habilitation Center (the "Site" or "controlled property"), located at 4 Industrial Place in the Village of Gowanda, County of Cattaraugus, and State of New York; and

WHEREAS, the Site is comprised of approximately 5.94 acres, acquired by the State of New York by appropriation pursuant to Article 71 of the Mental Hygiene Law and the Eminent Domain Procedure, *In the Matter of the Appropriation of Property by the People of the State of New York for the J.N. Adam Developmental Center AVM Building, Hostel No. 2430*, as shown on Map 35, Parcel 35 recorded in the Cattaraugus County Clerk's Office in Liber 886 of Deeds at Page 671 on January 13, 1989; and

WHEREAS, the Site has been assigned <sup>Cattaraugus</sup> ~~Chautauque~~ County Tax Map Identifier # 16.027-2-11, and is more particularly described in paragraph "FIRST" hereof, ~~and a diagram of the Site is attached as Schedule "A" to this Declaration and made a part hereof;~~ and

WHEREAS, the volunteer agency is participating in the Voluntary Cleanup Program of the New York State Department of Environmental Conservation (the "Department") and the Site is the subject of a Voluntary Cleanup Agreement ("VCA"), number B9-0596-01-07, Site #V-00463-9, entered into by the volunteer agency and the Department; and

WHEREAS, the Department approved a remedy to eliminate or mitigate all significant threats to the human health and the environment presented by the contamination disposed at the Site and such remedy requires that the Site be subject to restrictive covenants.

NOW, THEREFORE, the property owner, the State of New York, acting by and through the volunteer agency, the New York State Office of Mental Retardation and Developmental Disabilities, for itself and its successors and/or assigns, covenants that:

FIRST: The Site subject to this "Declaration of Covenants and Restrictions", is described as follows:

<sup>Cattaraugus</sup> ~~Chautauque~~ All that certain piece or parcel of land situated in the Village of Gowanda, County of ~~Chautauque~~ <sup>Cattaraugus</sup> and State of New York being part of Lot 27, Township 6, Range 8 of the Holland Land Company's Survey, being bounded and described as follows:

Beginning at a point located on the westerly street boundary of Industrial Street (50.0 feet wide) said point being 136.22 feet southerly from the

southerly street boundary of Torrance Place as measured along the westerly street boundary of Industrial Street; thence continuing southerly along the westerly street boundary of Industrial Street a distance of 276.63 feet to a point; thence westerly at right angles a distance of 243.0 feet to a point; thence southerly at right angles a distance of 250.27 feet to a point; thence westerly along the northerly right-of-way of the Cattaraugus County Industrial Agency Railroad on a curve to the left having a radius of 1465.0 feet a distance of 366.20 feet to a point; thence northwesterly along the southwesterly line of lands conveyed under Liber 840 Page 1184 a distance of 183.25 feet to a point; thence northeasterly at right angles a distance of 632.78 feet to a point; thence easterly at an interior angle of  $124^{\circ} 31' 56''$  a distance of 377.84 feet to the place or point of beginning, said parcel containing 259,471.075± square feet or 5.957± acres more or less.

SECOND: The purpose of this Declaration of Covenants and Restrictions is to establish institutional and engineering controls applicable to the Site that are to run with the land in order to provide an effective and enforceable means of encouraging the reuse and re-development of the Site (the "controlled property") at a level that has been determined to be safe for a specific use while ensuring the performance, maintenance, and/or monitoring requirements applicable to the controlled property; and to ensure the potential restriction of future uses of the land that are inconsistent with the above-stated purpose.

THIRD: The following controls apply to the use of the controlled property, run with the land, are binding on the property owner and its successors and assigns, and are enforceable in law or equity against the property owner, its successors and assigns, any lessees, and any person using the controlled property. The property owner, its successors and assigns, its lessees and licensees, consent to the enforcement by the Department of these controls and the prohibitions and restrictions herein established. The property owner, its successors and assigns, lessees and licensees covenant not to contest the authority of the Department to seek such enforcement.

A. The controlled property may be used for industrial or commercial use, excluding day care, child care and medical uses, as long as the following long-term engineering controls are employed:

(i) until the remedial goals for the site are attained or deemed complete by the Department, the Site Management Plan (SMP) for the implemented remedy [which plan was developed by Bergmann Associates, is dated October, 2006, and includes an Operations, Monitoring and Maintenance (OM&M) plan and a Soils Management Plan], must be adhered to.

(ii) before occupancy, a sub-slab vapor mitigation system must be installed to maintain a measurable vacuum in the sub-slab of the portion of the existing building to be re-occupied and in any new structures. Performance sampling, as outlined in the OM&M plan must be completed to document system

effectiveness. This system must be independent of the currently installed or future remedial system(s).

(iii) before occupancy, if an active remediation system(s) is in place, measures must be implemented to restrict access to portions of the building, specifically the portions of the building occupied by the remedial system(s), and rooms/hallways with extraction wells. Re-use of these area would require engineering controls to manage off-gassing and fugitive emissions from the remedial system(s), such as isolating the treatment area or installing a ventilation system to ensure that the active remediation areas are isolated from occupied areas. Restriction of the active system includes isolation of potential vapor pathways, such as , drop ceilings with shared air spaces, shared cold air return vents, and large openings between the areas, etc.

(iv) the groundwater beneath the site cannot be used as a potable water source or for any other use without prior written permission of the Department.

B. The controlled property may not be used for a higher level of use (such as residential use or restricted residential use) and the above-stated engineering controls may not be discontinued without prior written permission of the Department. Such permission, if granted, must be attached to and made a part of any amendment or extinguishment of this "Declaration of Covenants and Restrictions"

C. The property owner covenants and agrees that until such time as this "Declaration of Covenants and Restrictions" is extinguished with the prior written permission of the Department, the property deed and all subsequent instruments of conveyance relating to the controlled property shall state in at least fifteen-point-bold-faced type:

**This property is subject to a Declaration of Covenants and Restrictions required by reason of a voluntary cleanup agreement entered into by the New York State Office of Mental Retardation and Developmental Disabilities and the New York State Department of Environmental Conservation.**

D. The property owner covenants and agrees that this "Declaration of Covenants and Restrictions" shall be recorded in the Office of the Clerk of the County of Cattaraugus within thirty (30) days of its execution by the property owner, and it shall also be incorporated in full by reference in any leases, licenses, or other instruments granting a right to use the controlled property.

E. The property owner covenants and agrees that it shall annually, or such

time as the Department may allow, submit to the Department a written statement by an expert the Department finds acceptable certifying under penalty of perjury that the controls employed at the controlled property are unchanged from the previous certification or that any changes to the controls employed at the controlled property were approved by the Department, and that nothing has occurred that would impair the ability of such controls to protect the public health and environment or constitute a violation or failure to comply with the SMP for such controls, and giving access to such controlled property to evaluate continued maintenance of such controls,

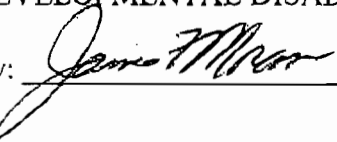
FOURTH: The controlled property is subject to a right herein granted to the Department, its agents, employees or other representatives, to enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-state restrictions.

FIFTH: The term "Department" as herein referenced means the New York State Department of Environmental Conservation, or, if the Department shall no longer exist, any New York State agency or agencies subsequently created to protect the environment of the State and the health of the State's citizens.

IN WITNESS WHEREOF, the undersigned has executed this Declaration of Covenants and Restrictions on the date hereafter written.

Dated: 1/31/08

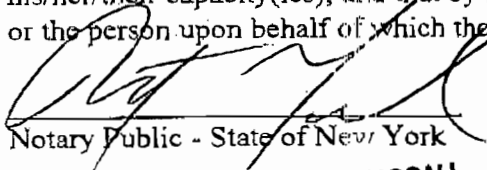
NEW YORK STATE OFFICE OF  
MENTAL RETARDATION AND  
DEVELOPMENTAL DISABILITIES

By: 

Acknowledgment

STATE OF NEW YORK }  
 } ss:  
COUNTY OF ALBANY }

On the 31 day of JANUARY in the year 2008, before me, the undersigned, personally appeared JAMES F MORAN, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

  
Notary Public - State of New York

**ROBERT P. MASCALI**  
Notary Public, State of New York  
No. 4654687  
Qualified in Albany County  
Commission Expires April 30, 20 11

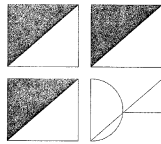
# GOWANDA DAY HABILITATION CENTER INTERIM REMEDIAL SYSTEM INSTALLATION

4 INDUSTRIAL PLACE, GOWANDA, NEW YORK 14070

CLIENT AGENCY: NEW YORK STATE OFFICE OF MENTAL RETARDATION AND DEVELOPMENTAL DISABILITIES

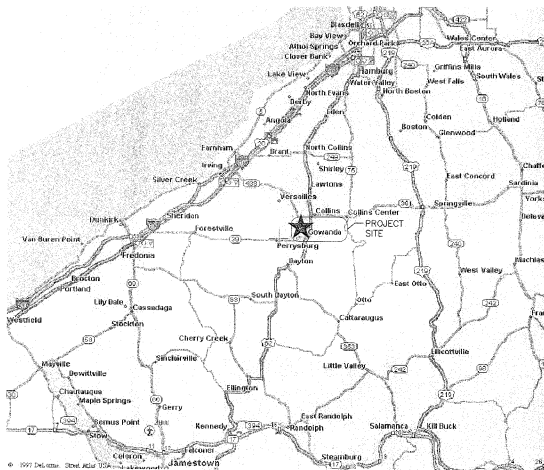
RECORD SET  
SEPTEMBER 2, 2005

DASNY PROJECT NO. 1510509999



Dormitory Authority of the State of New York  
515 Broadway  
Albany, New York 12207-2964  
518-257-3000

## PROJECT LOCATION:



## CONSULTING ENGINEERS:



**B E R G M A N N**  
associates

Engineers / Architects / Surveyors

200 First Federal Plaza  
28 East Main Street, Rochester, New York 14614  
585.232.5135 / 585.232.4652 fax

## DRAWING LIST:

- G-01 COVER SHEET
- M-01 PROCESS AND INSTRUMENTATION DIAGRAM
- M-02 RECOVERY WELL PIPING PLAN
- M-03 ENLARGED MECHANICAL ROOM PLAN AND WELL DETAILS
- M-04 EQUIPMENT SCHEDULE AND DETAILS
- E-01 ELECTRICAL PLAN AND DIAGRAMS
- E-02 ELECTRICAL SCHEDULE AND DETAILS



**GOWANDA DAY  
HAB CENTER  
INTERIM REMEDIAL  
SYSTEM  
INSTALLATION**

**JDE# 1510509999**



**BERGMANN  
associates**

Engineers / Architects / Surveyors

200 First Federal Plaza  
28 East Main Street, Rochester, New York 14614  
585.232.5135 / 585.232.4652 fax

REVISIONS					
NO.	DATE	DESCRIPTION	REV.	CHK'D	
1	4/11/03	30% SUBMITTAL	PCB	SMD	
2	10/06/03	90% SUBMITTAL	PCB	SMD	
3	10/06/04	100% SUBMITTAL	PCB	SMD	
4	3/24/04	RD SET	PCB	LCE	
5	6/11/04	REVISED BID SET	PCB	LCE	
6	8/03/04	REVISED BID SET	PCB	GAF	

NOTE:  
Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 145, Section 720b.

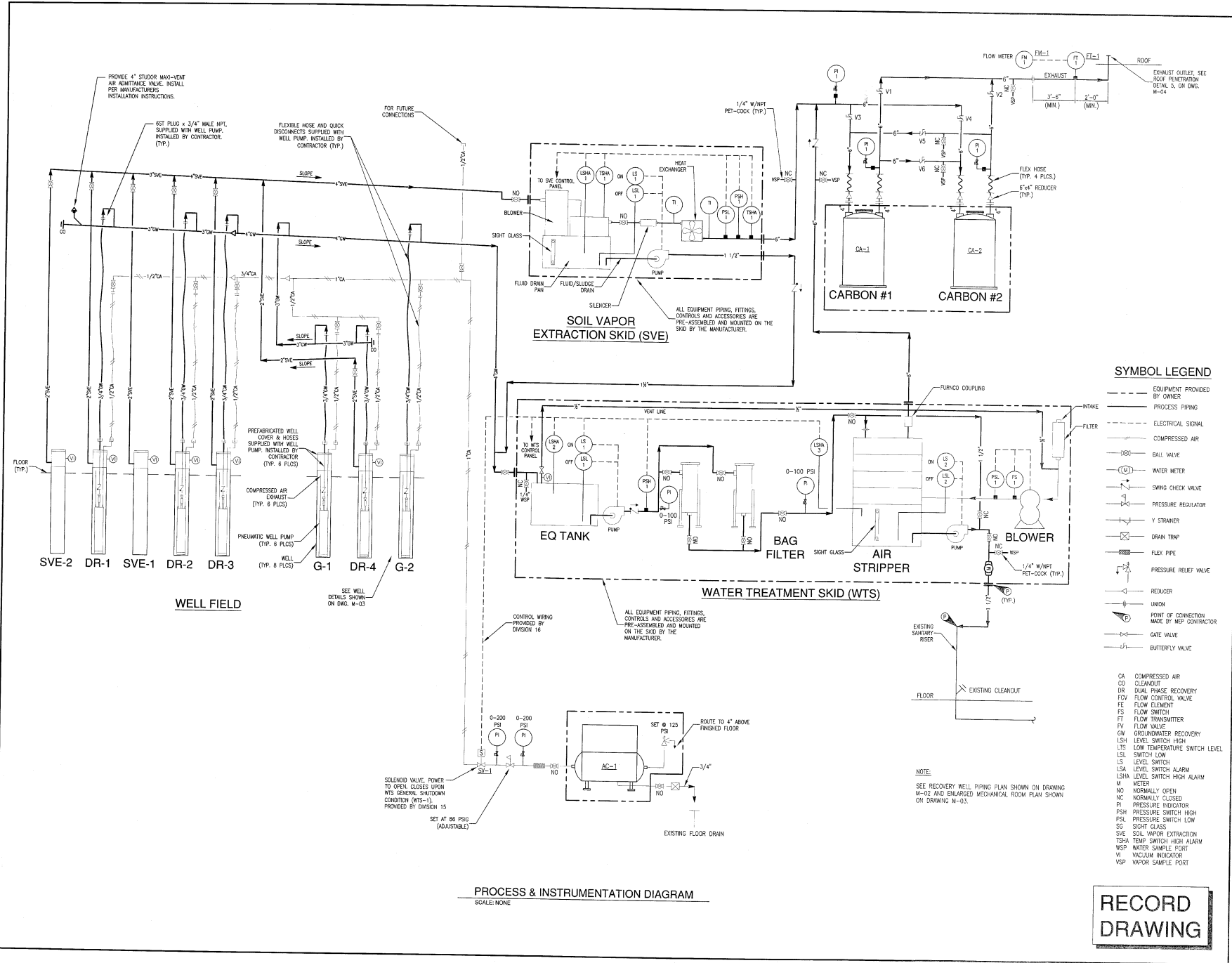
**PROCESS &  
INSTRUMENTATION  
DIAGRAM**



Project Number: GAF  
 Designer: PCB/LCE  
 Drafter: PCB  
 Checked by: L. J. G. GAF/J. G. J. G.  
 Date Issued: 8/28/04  
 Scale: NONE

Project Name: 5506.14  
 I:\RABBY\5506.14\MECH...3000-m01.dwg  
 Drawing Number: **M-01**

**RECORD  
DRAWING**



# GOWANDA DAY HAB CENTER INTERIM REMEDIAL SYSTEM INSTALLATION

JDE# 1510509999



**BERGMANN**  
associates

Engineers / Architects / Surveyors

200 First Federal Plaza  
28 East Main Street, Rochester, New York 14614  
585.232.5135 / 585.232.4652 fax

REVISIONS					
NO.	DATE	DESCRIPTION	REV.	CHKD.	APP'D.
1	4/11/03	30% SUBMITTAL	PCB	SMD	
2	10/06/03	80% SUBMITTAL	PCB	SMD	
3	1/08/04	100% SUBMITTAL	PCB	SMD	
4	3/24/04	BID SET	PCB	LCE	
5	6/11/04	REVISED BID SET	PCB	LCE	
6	9/03/04	REVISED BID SET	PCB	GAF	

NOTE:  
Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 145, Section 7206.

## RECOVERY WELL PIPING PLAN

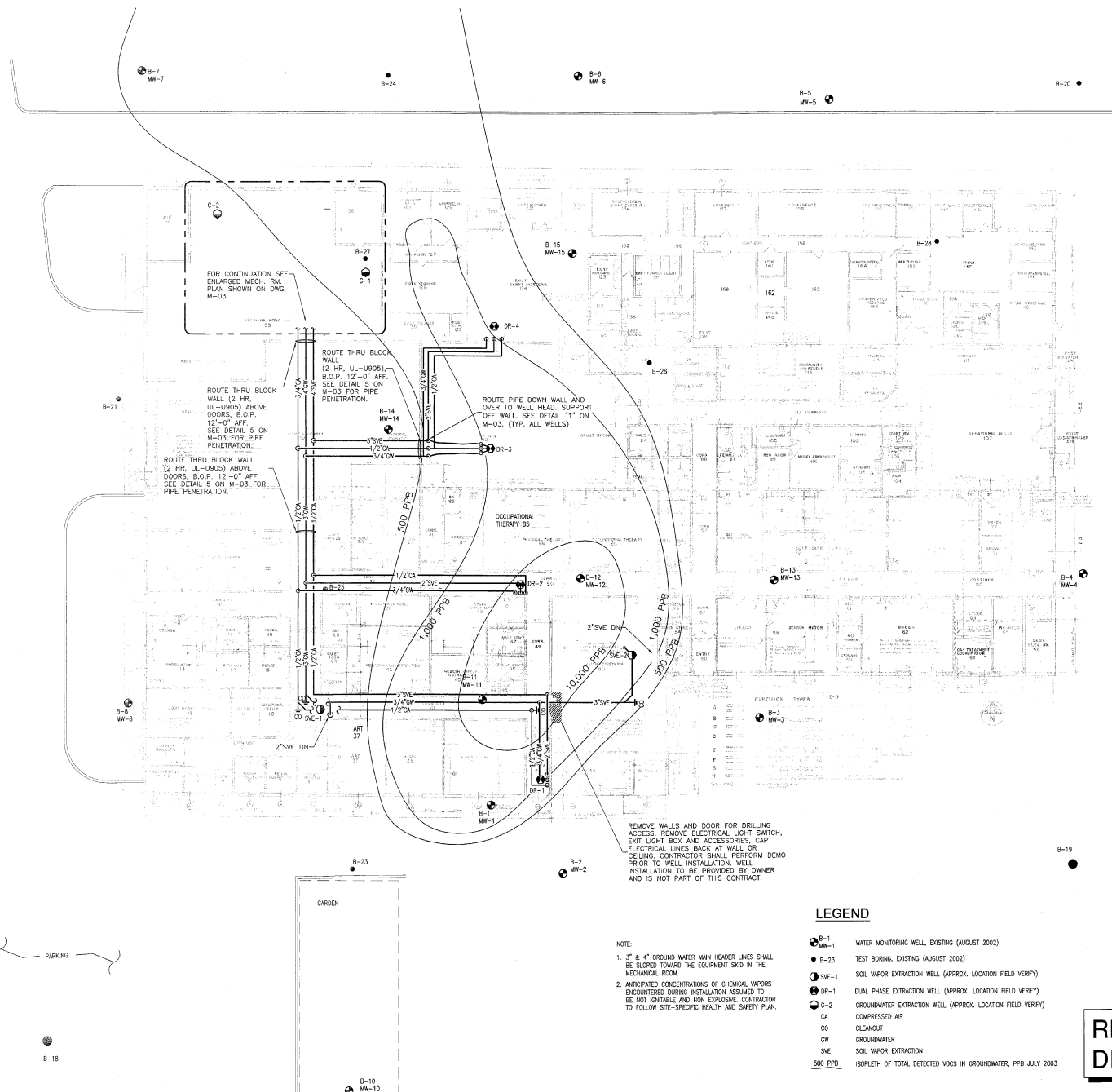


Project Number: 009614  
File Name: I:\DANNY\009614\MECH...15580002.DWG  
Drawing Number: M-02

Date: 1/19/04  
Scale: 1/8" = 1'-0"

**RECORD  
DRAWING**

**M-02**



REMOVE WALLS AND DOOR FOR DRILLING ACCESS. REMOVE ELECTRICAL LIGHT SWITCH, EXIT LIGHT BOX AND ACCESSORIES, CAP ELECTRICAL LINES BACK AT WALL OR CEILING. CONTRACTOR SHALL PERFORM DEMO PRIOR TO WELL INSTALLATION. WELL INSTALLATION TO BE PROVIDED BY OWNER AND IS NOT PART OF THIS CONTRACT.

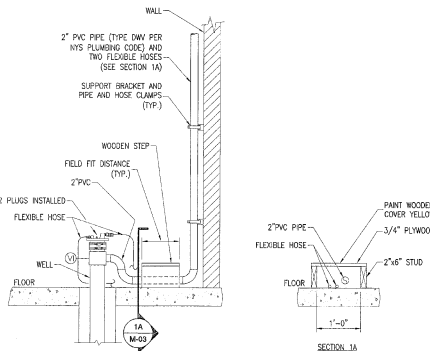
NOTE:  
1. 3" & 4" GROUND WATER MAIN HEADER LINES SHALL BE SLOPED TOWARD THE EQUIPMENT SHED IN THE MECHANICAL ROOM.  
2. ANTICIPATED CONCENTRATIONS OF CHEMICAL VAPORS ENCOUNTED DURING INSTALLATION ASSUMED TO BE NOT IGNITABLE AND NON EXPLOSIVE. CONTRACTOR TO FOLLOW SITE-SPECIFIC HEALTH AND SAFETY PLAN.

- LEGEND**
- B-1 WATER MONITORING WELL (EXISTING (AUGUST 2002))
  - MW-1 TEST BORING (EXISTING (AUGUST 2002))
  - B-23
  - SVE-1 SOIL VAPOR EXTRACTION WELL (APPROX. LOCATION FIELD VERIFY)
  - DR-1 DUAL PHASE EXTRACTION WELL (APPROX. LOCATION FIELD VERIFY)
  - Q-2 GROUNDWATER EXTRACTION WELL (APPROX. LOCATION FIELD VERIFY)
  - CA COMPRESSED AIR
  - CO CLEANOUT
  - GW GROUNDWATER
  - SVE SOIL VAPOR EXTRACTION
  - 500 PPB ISOPLETH OF TOTAL DETECTED VOCs IN GROUNDWATER, PPB JULY 2003

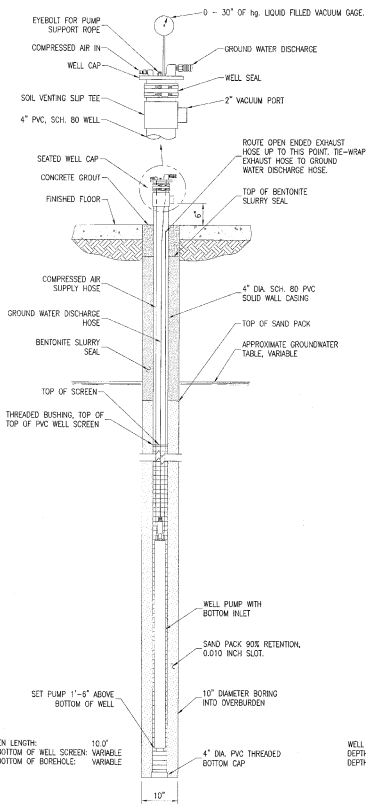


PARKING

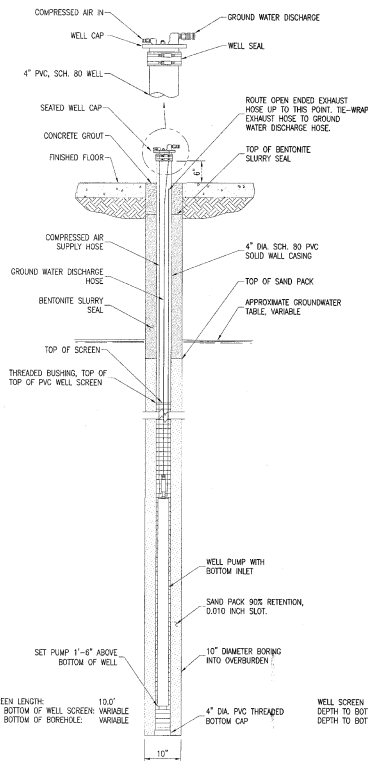
INDUSTRIAL PARK



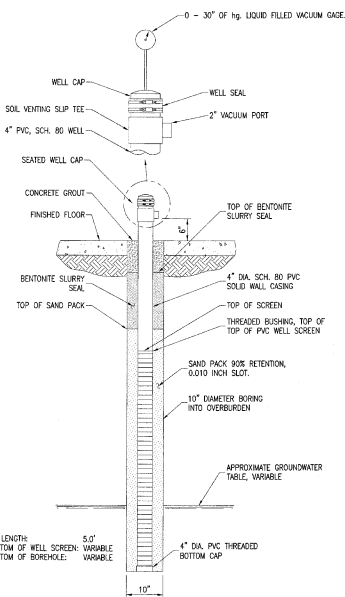
**1 PIPE ROUTING TO WELL DETAIL**  
SCALE: NONE



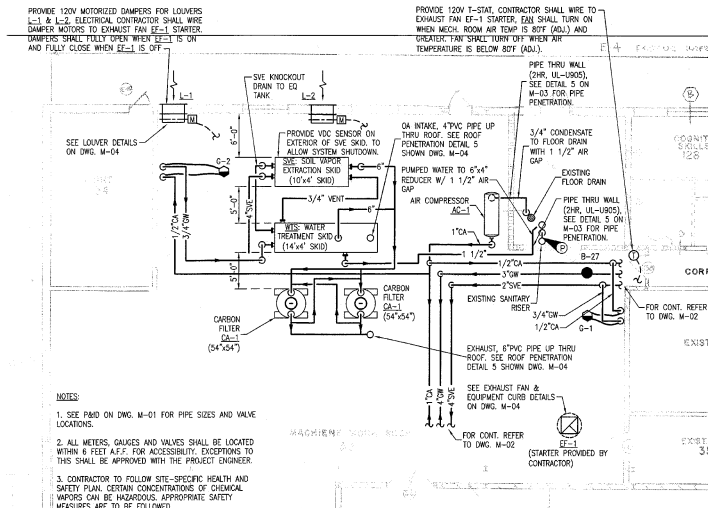
**2 DUAL PHASE RECOVERY WELL DETAIL**  
SCALE: NONE



**3 GROUNDWATER RECOVERY WELL DETAIL**  
SCALE: NONE

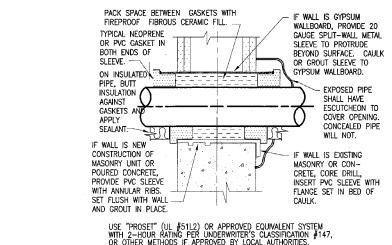


**4 SOIL VAPOR EXTRACTION WELL DETAIL**  
SCALE: NONE



- NOTES:**
1. SEE PAD ON DWG. M-01 FOR PIPE SIZES AND VALVE LOCATIONS.
  2. ALL METERS, GAUGES AND VALVES SHALL BE LOCATED WITHIN 6 FEET A.F.F. FOR ACCESSIBILITY. EXCEPTIONS TO THIS SHALL BE APPROVED WITH THE PROJECT ENGINEER.
  3. CONTRACTOR TO PROVIDE SITE-SPECIFIC HEALTH AND SAFETY PLAN. CERTAIN CONCENTRATIONS OF CHEMICAL VAPORS CAN BE HAZARDOUS. APPROPRIATE SAFETY MEASURES ARE TO BE FOLLOWED.

**ENLARGED MECHANICAL ROOM PLAN**  
SCALE: 1/8"=1'-0"



**5 FIREWALL PENETRATION DETAIL**  
SCALE: NONE

WELL DRILLING SPECIFICATIONS							
RECOVERY WELL	EXISTING FLOOR ELEVATION, RELATIVE TO MEAN SEA LEVEL	ANTICIPATED TOTAL DEPTH	ANTICIPATED BOTTOM, MEAN SEA LEVEL	ANTICIPATED SCREENED INTERVAL	ANTICIPATED DEPTH TO GROUNDWATER	TOTAL WELL DEPTH TO SCREEN LENGTH (SEE NOTE 2)	BENTONITE/GROUT THICKNESS
DR-1	778.8'	16.5'	762.3'	8.5' - 16.5'	5.9'	10.0'	6.0' - 2.0'
DR-2	778.8'	17.5'	761.3'	7.5' - 17.5'	6.9'	10.0'	7.0' - 2.0'
DR-3	778.8'	18.0'	758.8'	9.0' - 18.0'	9.8'	10.0'	8.5' - 2.0'
DR-4	778.8'	21.0'	757.8'	11.0' - 21.0'	10.5'	10.0'	10.5' - 2.0'
G-1	778.8'	23.5'	756.3'	12.5' - 22.5'	11.0'	10.0'	12.0' - 2.0'
G-2	778.8'	20.0'	758.3'	10.0' - 20.0'	11.0'	10.0'	9.5' - 2.0'
SVE-1	778.8'	7.5'	771.3'	2.5' - 7.5'	6.3'	5.0'	2.1' - 1.0'
SVE-2	778.8'	7.5'	771.3'	2.5' - 7.5'	6.9'	5.0'	2.1' - 1.0'

- NOTES:**
1. WELLS SHALL BE INSTALLED BY DRILLING CONTRACTOR. NOT PART OF THIS CONTRACT.
  2. SAND PACK 6" ABOVE TOP OF SCREEN, EXCEPT FOR SVE-1 & SVE-2 (1" ABOVE TOP OF SCREEN).

**RECORD DRAWING**

**GOWANDA DAY  
HAB CENTER  
INTERIM REMEDIAL  
SYSTEM  
INSTALLATION**  
JDE# 151050999



200 First Federal Plaza  
28 East Main Street, Rochester, New York 14614  
585.232.5135 / 585.232.4652 fax

REVISIONS				
NO.	DATE	DESCRIPTION	REV.	CRD.
1	4/11/03	30% SUBMITTAL	PCB	SMD
2	10/06/03	90% SUBMITTAL	PCB	SMD
3	1/06/04	100% SUBMITTAL	PCB	SMD
4	3/24/04	BID SET	PCB	LCE
5	8/11/04	REVISED BID SET	PCB	LCE
6	9/30/04	REVISED BID SET	PCB	GAF

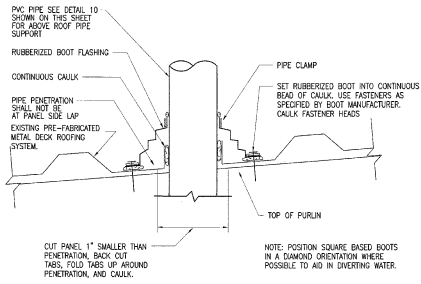
**NOTE:**  
Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 145, Section 7205.

**ENLARGED MECHANICAL  
ROOM PLAN AND  
WELL DETAILS**

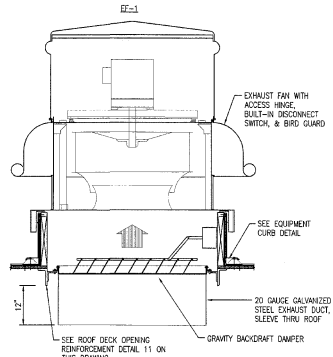
Project Manager: GAF  
Designer: PCB  
Checker: LCE/GAF/SMD  
Date Issued: 2/28/04  
Scale: AS NOTED

Printed From: File Name: 151050999.12.MECH.-ISSUEM03.DWG  
Drawing Number: **M-03**

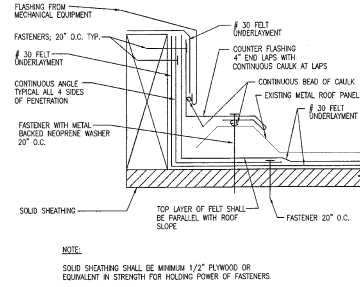




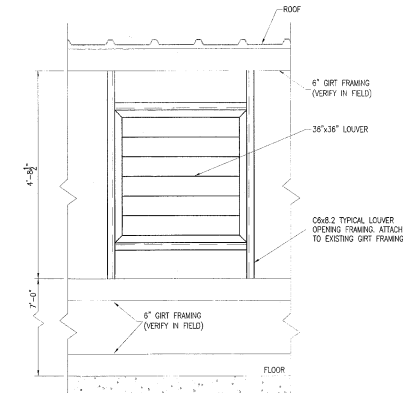
5 ROOF PENETRATION DETAIL  
SCALE: NONE



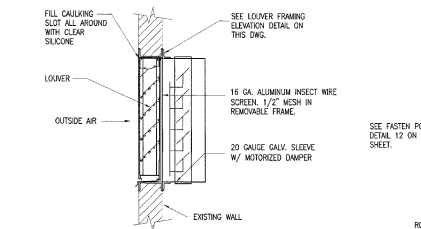
6 ROOF EXHAUST FAN DETAIL  
SCALE: NONE  
NOTES: REFER TO SHOP DRAWINGS AND O & M MANUAL FOR ACTUAL CONFIGURATION



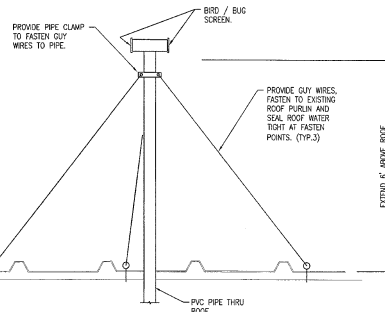
7 EQUIPMENT CURB DETAIL  
SCALE: NONE



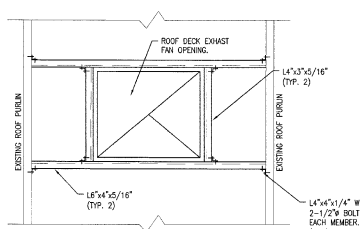
8 LOUVER FRAMING ELEVATION DETAIL  
SCALE: NONE



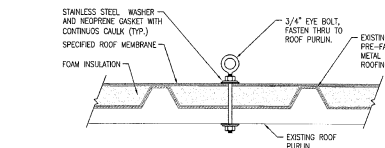
9 LOUVER DAMPER DETAIL  
SCALE: NONE



10 ABOVE ROOF PIPE SUPPORT DETAIL  
SCALE: NONE



11 ROOF DECK OPENING REINFORCEMENT PLAN DETAIL  
SCALE: NONE



12 FASTEN POINT DETAIL  
SCALE: NONE

ITEM	DESCRIPTION	NOTES
WATER TREATMENT SKID (WTS)	PART/MODEL NO. STMT 30, SIX TRY STAINLESS STEEL AIR STRIPPER WITH STAINLESS STEEL SUMP HIGH LEVEL AND PUMP OPERATION SWITCHES, DEMISTER, 3 HP, 480 V, 3 PHASE TFC MOTOR, LOW BLOWER PRESSURE SWITCH, BLOWER PRESSURE GAUGE, 3/4 HP, 480 V, 3 PHASE TFC TRANSFER PUMP, TWO CARBON STEEL BAG FILTERS, 100 PSI MAX DESIGN PRESSURE AND INLET/OUTLET PRESSURE GAUGES, POLYETHYLENE EQUALIZATION TANK AND PUMP SYSTEM INCLUDING 100 GALLON CAPACITY, HIGH LEVEL AND PUMP OPERATION SWITCHES, WIRES CT CENTRIFUGAL TRANSFER PUMP WITH 12 GPM AT 58 FEET TDH, 3/4 HP, 480 V, 3 PHASE TFC MOTOR, DISCHARGE CHECK VALVE, THROTTLING VALVE, METERED MASH PUMP METER AND PRESSURE GAUGES, WIRES CT CENTRIFUGAL DISCHARGE PUMP WITH 12 GPM AT 58 FEET TDH, 3/4 HP, 480 V, 3 PHASE TFC MOTOR, CONTROL PANEL INCLUDING NEMA 4 ENCLOSURE, THREE EACH HSA SWITCHES WITH LIGHTS, THREE EACH IEC MOTOR STARTERS WITH OVERLOADS, ALARM INTERLOCKS WITH RED LIGHTS, ALARM RESET BUTTON, INTRINSIC SAFETY BARRIERS, LOW VOLTAGE CONTROL TRANSFORMERS, ILL LISTING, TERMINAL STRIPS WITH DRY CONTACTS FOR ALARM SWITCHES, SYSTEM INTERLOCKS, AUTOMATIC CONTROL LOGIC, FIELD WIRING CONNECTIONS, SYSTEM INTERFACE CONTACTS, HAND-OFF-AUTO BUTTONS AND MAIN FUSIBLE DISCONNECT SWITCH.	FURNISHED BY DASHI, INSTALLED BY CONTRACTOR
SOL VAPOR EXTRACTION SKID (SVE)	PART/MODEL NO. CARBORAR C4407 20 HP MOTOR/ROOTS 47 LTRM BLOWERS, 480 V, 3 PHASE, TFC MOTOR, ROOTS MODEL 47 LTRM BLOWER WITH AMERICAN INDUSTRIAL HEAT EXCHANGER WITH 150 SCFM CAPACITY, 15 DEG F APPROACH TEMP, 1 HP, 480 V, TFC MOTOR, COPPER TUBES WITH ALUMINUM FINIS AND DISCHARGE TEMPERATURE GAUGE, WIRES CT CENTRIFUGAL TRANSFER PUMP WITH 12 GPM AT 58 FEET TDH, 480 V, 3 PHASE TFC MOTOR.	FURNISHED BY DASHI, INSTALLED BY CONTRACTOR
WELL PUMPS (OTY 6)	PART/MODEL NO. AP-3 BL-H-B 2-3" AUTO PUMP WITH LONG AP30 BRASS CHECK VALVE, 3/4" HOSE NIBB, BOTTOM LOADING GEE AUTO PUMP FOR 3" AND LARGER WELLS. CONTROLLER-LESS PNEUMATIC OPERATION. LIGHT-WEIGHT FIBERGLASS REINFORCED PLASTIC (FRP) PUMP CASING.	FURNISHED BY DASHI, INSTALLED BY CONTRACTOR
AIR COMPRESSOR (AC-1)	PART/MODEL NO. ATLAS COPCO GX 15-175 20 HP ROTARY SCREW AIR COMPRESSOR, 480 V, 3 PHASE, TFC MOTOR, 150 GALLON AIR RECEIVER, INLET AIR FILTER, OIL FLUKE, V-BELT DRIVE WITH TENSIONING LOAD/NO LOAD CAPACITY, SOUND ATTENUATING ENCLOSURE, CONDENSATE TANK DRAIN AND INTEGRAL AIR DRYER.	FURNISHED BY DASHI, INSTALLED BY CONTRACTOR
EXHAUST FAN (EF-1)	COOK MODEL ACE-B, 270088, DOWN BLAST CENTRIFUGAL EXHAUST VENTILATOR, ROOF MOUNTED, BELT DRIVE, 8,000 CFM AT 13" W.C. ESP, 1-1/2 HP (1.43 SHP), 480 V, 3 PHASE, 60 HZ, WITH LOW LEAKAGE BACKDRIFT DAMPER, ROOF CURB, BIRD SCREEN AND PRE-WIRED DISCONNECT STARTER SHALL BE PROVIDED BY ELECTRICAL CONTRACTOR.	FURNISHED AND INSTALLED BY CONTRACTOR
DA INTAKE LOUVERS (L-1 & L-2)	36" X 36" RUSION HIGH PERFORMANCE REMOVABLE LOUVER, MODEL E1F63750, 6" FRAME DEPTH WITH BIRD SCREEN. PROVIDE LOUVER WITH RUSION 120 V, MOTORIZED DAMPER (LOW LEAKAGE, SHALL MEET ENERGY CODE) MODEL COBNDK, AND RUSION ACTUATOR MODEL HF120. ACTUATOR SHALL BE TWO POSITION SPRING RETURN, DIRECT CONTROL TO SWMT.	FURNISHED AND INSTALLED BY CONTRACTOR
VAPOR TREATMENT SYSTEM (VAPOR BY 4 P2)	PART/MODEL NO. ENVROTEK VP-2000 VAPOR ABSORBER	FURNISHED BY DASHI, INSTALLED BY CONTRACTOR
AIR VELOCITY TRANSDUCER (VT-1)	OMEGA MODEL TMA-051-1 VELOCITY AIR TRANSDUCER, 4 - 20 mA OUTPUT WITH 3.75" PROBE. PROBE TEMPERATURE RANGE SHALL BE -40 TO 250 DEGREES F, PROBE MAX. PRESSURE SHALL BE 150 PSIG, AIR FLOW VELOCITY RANGE SHALL BE TO - 5,000 FPM.	FURNISHED AND INSTALLED BY CONTRACTOR
COMPRESSED AIR 2-WAY SOLENOID VALVE (SVP-1)	OMEGA MODEL FSVALS NORMALLY CLOSED 2-WAY PILOT OPERATED SOLENOID VALVE WITH 1" OBTRE, AND 15.0 CFM FLOW RATE.	FURNISHED AND INSTALLED BY CONTRACTOR

**GOWANDA DAY  
HAB CENTER  
INTERIM REMEDIAL  
SYSTEM  
INSTALLATION**

**JDE# 1510509999**



200 First Federal Plaza  
28 East Main Street, Rochester, New York 14614  
585.235.5155 / 585.232.4652 fax

REVISIONS				
NO.	DATE	DESCRIPTION	REV.	CRCD
1	4/11/03	30% SUBMITTAL	PCB	SMD
2	10/09/03	90% SUBMITTAL	PCB	SMD
3	1/06/04	100% SUBMITTAL	PCB	SMD
4	3/24/04	BID SET	PCB	LCE
5	6/11/04	REVISED BID SET	PCB	LCE
6	9/30/04	REVISED BID SET	PCB	GAF

NOTE:  
Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 145, Section 702b.

**EQUIPMENT SCHEDULE  
AND DETAILS**

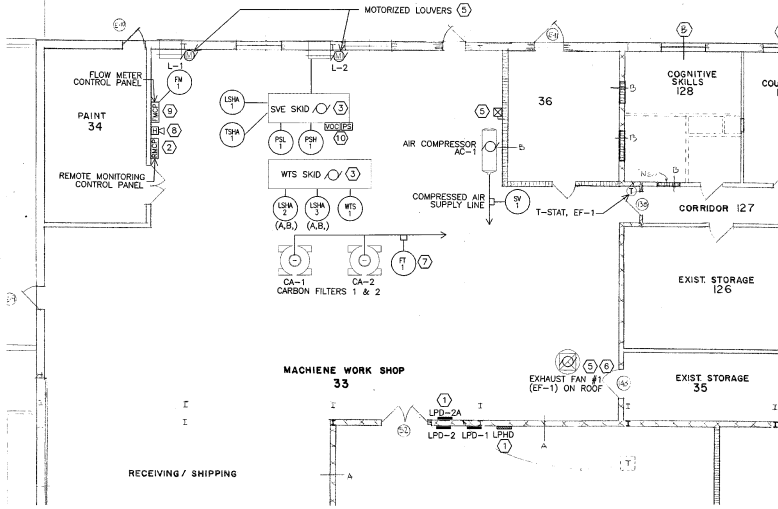
STATE OF NEW YORK  
Professional Engineer  
No. 11705  
Exp. 12/31/04

Project No. 099-14  
Date 6/24/04

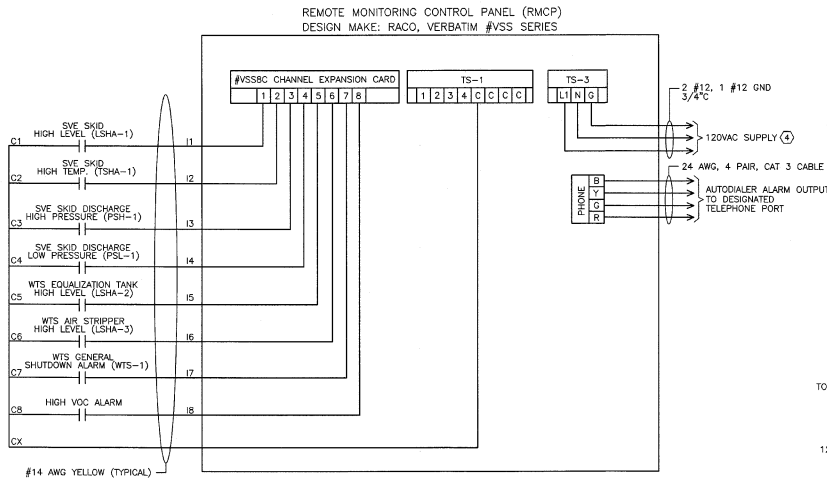
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Project Name INTERIM REMEDIAL SYSTEM INSTALLATION  
Drawing No. M-04

**RECORD  
DRAWING**

**M-04**

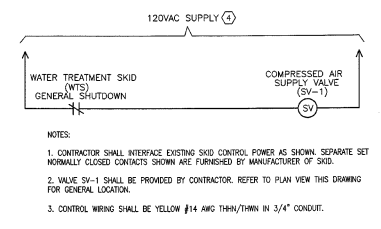


1 ELECTRICAL POWER PLAN  
SCALE: 1/8" = 1'-0"

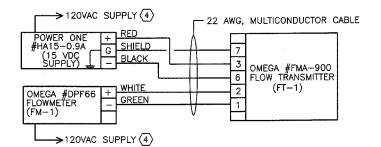


- PROGRAMMING AND INSTALLATION NOTES:
- CONTRACTOR SHALL PROVIDE A REMOTE MONITORING CONTROL PANEL (RACO, VERBATIM #VSSBC) AND WALL MOUNT 66" AFF TO TOP. DRY CONTACT ALARM POINTS INDICATED IN DIAGRAM ARE DEVICES FURNISHED BY OWNER AND LOCATED REMOTE FROM RMCP. CONTRACTOR SHALL PROVIDE NECESSARY CONDUIT, WIRE AND TO CONNECT POINTS TO DEVICES AS INDICATED.
  - CONTRACTOR SHALL PROGRAM "RMCP" WITH A DIFFERENT INDIVIDUAL PRE-RECORDED MESSAGE INDICATING THE TYPE OF ALARM RECEIVED.
  - UPON RECEIPT OF AN ALARM CONDITION THE RMCP SHALL AUTOMATICALLY DIAL OUT A PREDETERMINED NUMBER AND PLAY THE PRE-RECORDED MESSAGE (SEE NOTE 2) INDICATING THE SPECIFIC ALARM CONDITION PRESENT.
  - THE CONTRACTOR SHALL CLOSELY COORDINATE THE PRE-RECORDED MESSAGES AND AUTODIALING FUNCTION AND TELEPHONE NUMBER WITH THE OWNER. ALL PROGRAMMING OF THE RMCP SHALL BE PERFORMED BY THE CONTRACTOR. ADDITIONALLY THE CONTRACTOR SHALL PROVIDE THE OWNER TRAINING TO THE OWNER'S SATISFACTION ENABLING THE OWNER TO PROGRAM AND MODIFY IN THE FUTURE AS NEEDED.
  - CONTRACTOR SHALL COORDINATE BUILDING TELEPHONE SYSTEM IN LOCATION WITH OWNER AND/OR TELEPHONE SERVICE PROVIDER.

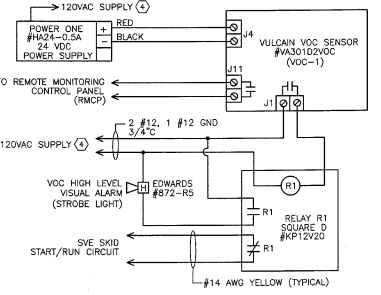
2 REMOTE MONITORING CONTROL PANEL WIRING DIAGRAM  
SCALE: NO SCALE



3 COMPRESSED AIR SUPPLY VALVE DIAGRAM  
SCALE: NO SCALE



4 FLOW TRANSMITTER/METER DIAGRAM  
SCALE: NO SCALE



- NOTES:
- CONTROL WIRING SHALL BE YELLOW #14 AWG THRU/THIN IN 3/4" CONDUIT.
  - SEE PLAN VIEW FOR EQUIPMENT LOCATIONS.

7 VOC SENSOR WIRING DIAGRAM  
SCALE: NO SCALE

LEGEND

- - ELECTRICAL CONNECTION TO EQUIPMENT
- - EXISTING ELECTRICAL 480/277VAC PANELBOARD
- - EXISTING ELECTRICAL 208/120VAC PANELBOARD
- Ⓜ - PROCESS FIELD DEVICE
- RMCP - REMOTE MONITORING CONTROL PANEL
- FMCP - FLOW METER CONTROL PANEL
- VOCS - VOLATILE ORGANIC COMPOUND (VOC) SENSOR
- PS - POWER SUPPLY IN JUNCTION BOX
- 66" - 480VAC COMBINATION STARTER, 66" AFF TO TOP
- SH - SINGLE PROJECTOR HORN, 120VAC
- WTS - WATER TREATMENT SKID
- SVE - SOIL VAPOR EXTRACTION
- TSHA - TEMPERATURE SWITCH HIGH ALARM
- LSHA - LEVEL SWITCH HIGH ALARM
- PSL - PRESSURE SWITCH LOW ALARM
- PSH - PRESSURE SWITCH HIGH
- SV - SOLENOID VALVE
- FT - FLOW TRANSMITTER
- FM - FLOW METER
- T - THERMOSTAT
- X - KEYED NOTE

5 ELECTRICAL GENERAL NOTES

- CONTRACTOR SHALL REFER TO THE ELECTRICAL EQUIPMENT AND CONTROL DATA SCHEDULE, DWG. E-02 FOR MECHANICAL AND ELECTRICAL EQUIPMENT CIRCUIT ASSIGNMENTS, CIRCUIT SIZES, CONDUIT/WIRE SIZING AND INSTALLATION REFERENCE NOTES.
- CONTRACTOR SHALL REFER TO PROCESS AND INSTRUMENTATION DIAGRAM, DWG. I-01 FOR DETAILS.
- CONTRACTOR SHALL PROVIDE ALL PROGRAMMING AND TESTING AND TROUBLESHOOTING OF ALL SYSTEMS AND WIRING ASSOCIATED WITH WORK SHOWN ON THIS DWG.
- CONTRACTOR SHALL COORDINATE ALL WORK IMPACTING OTHER TRADES WITH THOSE TRADES.
- CONTRACTOR SHALL SEAL WITH AN APPROVED METHOD ANY ELECTRICAL PENETRATIONS THRU FIRE PROOF/RATED WALLS OR AREAS.
- CONTRACTOR SHALL VERIFY CIRCUITS AND PROVIDE UPDATED TYPEWRITTEN PANEL SCHEDULES FOR EXISTING PANELBOARDS.
- CONTRACTOR SHALL PROVIDE FUSES SIZED PER MANUFACTURERS RECOMMENDATIONS FOR ALL EQUIPMENT INSTALLED WITH FUSED STARTERS OR DISCONNECTS.
- CONTRACTOR SHALL BE REQUIRED TO VISIT SITE PRIOR TO BIDDING TO ENSURE FULL UNDERSTANDING OF PROJECT SCOPE.
- CONTRACTOR SHALL PROVIDE BACKWIRE, WIRE CABLE AND ASSOCIATED FITTINGS ALONG WITH COMPLETE CONNECTIONS REQUIRED FOR BRANCH CIRCUITS FROM DEVICES TO MAIN OVERCURRENT DEVICE AND LOCAL CONTROL DEVICES) PER PROJECT SPECIFICATIONS.

6 ELECTRICAL KEYED NOTES

- EXISTING 480/277VAC AND 208/120VAC PANELBOARDS. CONTRACTOR SHALL CIRCUIT TO THESE PANELS AS INDICATED ON DWGS. PROVIDE MATCHING CIRCUIT BREAKERS AS REQUIRED. UPDATE PANEL SCHEDULES UPON COMPLETION OF WORK.
- PROVIDE REMOTE MONITORING CONTROL PANEL CONTRACTOR SHALL MOUNT 66" AFF TO TOP. ALL POWER, CONTROL AND TELEPHONE WIRING IN AND OUT OF PANEL SHALL BE PROVIDED IN CONDUIT.
- OWNER-FURNISHED WTS AND SVE SKIDS SHALL BE PROVIDED WITH INTEGRAL CONTROL PANELS. CONTRACTOR SHALL PROVIDE POWER WIRING TO THE SKIDS MAIN DISCONNECT. REFER TO ELECTRICAL EQUIPMENT SCHEDULES FOR DETAILS. CONTRACTOR SHALL ALSO PROVIDE MONITORING CONTROL, CONDUIT, WIRE AND TERMINATIONS FROM SKIDS TO REMOTE MONITORING CONTROL PANEL PER DIAGRAM THIS DWG.
- CONTRACTOR SHALL PROVIDE 20A 120VAC CIRCUIT FROM PANEL LPO-2A CKT. #12 FOR EQUIPMENT INDICATED. UPDATE PANEL SCHEDULE ACCORDINGLY.
- CONTRACTOR SHALL PROVIDE AND FIELD LOCATE INSIDE BLDG. COMBINATION STARTER FOR EXHAUST FAN #1 (EF-1) WITH FEATURES FOR THE FOLLOWING SEQUENCE OF OPERATION:
  - PROVIDE 20A 120VAC CIRCUIT FROM PANEL LPO-2A, CKT. #14 FOR EF-1 CONTROL CIRCUIT.
  - PROVIDE AUXILIARY CONTACTS ON COMBINATION STARTER 480VAC DISCONNECT FOR 120VAC CONTROL CIRCUIT FIELD AND COMBINATION STARTER.
- CONNECT/WIRE CONTROL CIRCUIT TO OPERATE AS FOLLOWS:
  - 120VAC THERMOSTAT CONTROLS ON/OFF FUNCTION OF EXHAUST FAN #1.
  - BOTH 120VAC MOTORIZED LOUVERS SHALL OPEN WHEN EXHAUST FAN RUNS.
- CONTRACTOR SHALL SUBMIT SCHEMATIC TO ENGINEER FOR REVIEW/APPROVAL PRIOR TO CONSTRUCTION.
- REFER TO DWG. E02 FOR "CONDUIT PENETRATION THROUGH ROOF DETAIL" THIS WORK PROVIDED BY CONTRACTOR.
- CONTRACTOR TO PROVIDE FLOW TRANSMITTER AND FLOW METER/TOTALIZER (SEE KEYED NOTE 9). CONTRACTOR RESPONSIBLE FOR CONTROL AND POWER WIRING. SEE DIAGRAM THIS DWG.
- PROVIDE VOC HIGH LEVEL ALARM HORN WALL MOUNTED 8'-0" AFF.
- CONTRACTOR SHALL PROVIDE A CONTROL PANEL (HOFFMAN #A-1412CHTC) WALL MOUNTED 66" AFF TO TOP. CONTROL PANEL SHALL CONTAIN FLOW METER (OMEGA #FPF68-S0PT) MOUNTED TO CONTROL PANEL DOOR. PROVIDE 120VAC POWER SUPPLY (POWER ONE #PA15-0-5A) MOUNTED INSIDE PANEL ON SUSPENDED KEYPING POWER SUPPLY AS FAR AWAY FROM METER AS POSSIBLE. PROVIDE TERMINAL STRIP AS REQUIRED FOR FIELD WIRING COMING INTO PANEL FROM FLOW TRANSMITTER AND 120VAC POWER. PROVIDE 120VAC POWER FROM PANEL LPO-2A, CKT #12. THIS IS THE CIRCUIT THAT FEEDS THE REMOTE MONITORING CONTROL PANEL (RMCP).
- VOLATILE ORGANIC COMPOUND (VOC) SENSOR (VULCAN #VA3102VOC) MOUNT FACING OUT TO BASE OF SVE SKID 60" A.F.F. WITH UNDERBUT AND VIBRATION ISOLATORS. SENSOR HAS 2 ALARM CONTACTS WIRE AS FOLLOWS. (1) IN SERIES IN SVE SKID START CIRCUIT TO SHUT SKID DOWN UPON A VOC ALARM AND (2) WIRE TO THE REMOTE MONITORING CONTROL PANEL. SEE DIAGRAM THIS DWG. PROVIDE AND FIELD LOCATE 24VDC POWER SUPPLY (POWER ONE #PA24-0-5A) AND RELAY R1 (SQUARE D #RP12V20). REFER TO DIAGRAM THIS DWG. PROVIDE 120VAC POWER FROM PANEL LPO-2A CKT. 12.

RECORD DRAWING

GOWANDA DAY HAB CENTER INTERIM REMEDIAL SYSTEM INSTALLATION

JDE# 1510509999



BERGMANN associates  
Engineers / Architects / Surveyors

200 First Federal Plaza  
28 East Main Street, Rochester, New York 14614  
585.232.5137 / 585.232.4652 fax

REVISIONS					
NO.	DATE	DESCRIPTION	REV.	BY	CHKD.
Δ	4/11/03	30% SUBMITTAL	POB	SMD	
Δ	10/06/03	90% SUBMITTAL	DJM	CHS	
Δ	12/18/03	100% SUBMITTAL	DJM	CHS	
Δ	3/24/04	BID SET	DJM	CHS	
Δ	6/11/04	REVISED BID SET	DJM	CHS	
Δ	9/30/04	REVISED BID SET	DJM	GAF	

NOTE:  
Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 14b, Section 7203.

ELECTRICAL PLAN, AND DIAGRAMS



Project No. 5556.14  
Drawing No. 1510509999-13/ELECT.-5556ED-1.DWG

AS NOTED

E-01

# GOWANDA DAY HAB CENTER INTERIM REMEDIAL SYSTEM INSTALLATION

JDE# 15105099



**BERGMANN**  
associates

Engineers / Architects / Surveyors

200 First Federal Plaza  
28 East Main Street, Rochester, New York 14614  
585.232.2135 / 585.232.4603 fax

#### REVISIONS

NO.	DATE	DESCRIPTION	REV.	CHK'D.
△	4/11/03	30% SUBMITTAL	PCB	SMO
△	10/06/03	80% SUBMITTAL	DJM	CHS
△	12/19/03	100% SUBMITTAL	DJM	CHS
△	3/24/04	BID SET	DJM	CHS
△	6/11/04	REVISED BID SET	DJM	CHS
△	9/3/04	REVISED BID SET	DJM	GAF

NOTE:  
Unauthorized alteration or addition to this drawing is a violation of the New York State Education Law Article 146, Section 720b.

## ELECTRICAL SCHEDULE AND DETAILS



Project Manager  
GAF  
Designer/Prep  
DJM  
Checked By  
G. McCullough  
Date Issued  
2.28.04  
Title  
AS NOTED

Project Number: 5596.14 File Name: H:\DANNY\5596.12\ELECT...5596E1.DWG  
Drawing Number: E-02

**RECORD  
DRAWING**

**E-02**

### ELECTRIC EQUIPMENT AND CONTROL DATA SCHEDULE

Name	Equipment				Supply		Control (Unless Noted in Notes on Schedule)									
	From Location (Floor)	Panel Power or Subpanel	Panel	Wiring	Panel or Control Center	Circuit Breaker	Power Rating from Panel to Control Unit	Power Rating from Control Unit to Equipment	Reference Notes	Panel Enclosure Details	New-Factory Enclosure Details	Mounting Method	Magnetic Starter (By Division 16)	Coordination Studies (By Div. 16)	Protective Control Unit, By Manufacturer	Wiring Protection (Enumerated by Div. 16, unless by Div. 16)
SVE SKD	SHOP	240KW	3	480	LPHD	80A	3-#2, 1-#8 GND, 1 1/4"								X	
WTS AIR STRIPPER SKD	SHOP	8KW	3	480	LPHD	35A	3-#10, 1-#10 GND, 3/4"								X	
AIR COMPRESSOR	SHOP	20HP	3	480	LPHD	80A	3-#4, 1-#10 GND, 1 1/4"			X					X	
EXHAUST FAN 1 (EF-1)	ROOF	1 1/2HP	3	480	LPHD	15	3-#12, 1-#12 GND, 3/4"	3-#12, 1-#12 GND, 3/4"	1.2				X			
MOTORIZED LOUVER 1 (L-1)	SHOP		1	120	LPD-2A	20A	2-#12, 1-#12 GND, 3/4"		3							
MOTORIZED LOUVER 2 (L-2)	SHOP		1	120	LPD-2A	20A	2-#12, 1-#12 GND, 3/4"		3							

REFERENCE NOTES:  
1. EXHAUST FAN IS CONTROLLED BY CONTRACTOR PROVIDED 120VAC THERMOSTAT. SEE KEYED NOTE 5 FOR SEQUENCE OF OPERATION. ALL WIRING BY CONTRACTOR.  
2. EF-1 SHALL BE FURNISHED WITH ROOF MOUNTED LOCAL DISCONNECT BY CONTRACTOR.  
3. MOTORIZED LOUVERS L-1 & L-2 SHALL INTERFACE WITH EXHAUST FAN 1. SEE KEYED NOTE 5 DWG. E-01

SYMBOLS:  
AU = AT UNIT

### 1 ELECTRIC EQUIPMENT AND CONTROL DATA SCHEDULE

SCALE: NOT TO SCALE



# Environmental Remediation & Recovery, Inc.

5719 Route 6N  
Edinboro, Pennsylvania 16412

Telephone (814)734-6411  
Fax (814)734-4756

---

## Operations & Maintenance Manual

Gowanda Day Habilitation Center  
4 Industrial Place  
Gowanda, New York 15070

Interim Remedial System Installation  
April 2005

DASNY Project JDE #1510509999  
ER&R Project #2005.01

Environmental Remediation &  
Recovery, Inc.  
5719 Route 6N  
Edinboro, Pennsylvania 16412  
(814) 734-6411

Bergmann Associates  
200 First Federal Plaza  
28 East Main Street  
Rochester, New York 14614  
(585) 232-5137

DASNY  
515 Broadway  
Albany, New York 12207-2964  
(518) 257-3000

Volume 1 of 2



5719 Route 6N  
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# Environmental Remediation & Recovery, Inc.

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## Operations & Maintenance Manual

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Volume 1 of 2

## Table of Contents

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Regulator.....	Volume 1
Air Compressor Drain.....	Volume 1
Controllerless Pump.....	Volume 1
Pulse Counter.....	Volume 1
Motor Starter.....	Volume 1
Thermostat.....	Volume 1
Air Flow Meter & Transmitter.....	Volume 1
Air Flow Transducer.....	Volume 1
DC Power Supply for Flow Meter & VOC Sensor.....	Volume 1
Alarm Volume 1.....	Volume 1
BISCO Equipment Skids.....	Volume 2

BY THIS CERTIFICATE OF COMPLIANCE THE  
**NEW YORK BOARD OF FIRE UNDERWRITERS**  
**BUREAU OF ELECTRICITY**  
 40 FULTON STREET ~ NEW YORK, NY 10038

**CERTIFIES THAT**

Upon the application of **E.R. & R INC.** upon premises owned by **DORMITORY AUTHORITY**  
**5719 ROUTE 6 N.** **STATE OF NEW YORK**  
**EDINBORO, P.A. 16412** **4 INDUSTRIAL DRIVE**  
**GOWANDA, NY 14070**

Located at **4 INDUSTRIAL DRIVE GOWANDA, NY 14070**

**Application Number: 2047249** **Certificate Number: 2047249**

Section: Block: Lot: Building Permit: BDC: **B 539**

Described as a **Commercial** occupancy, wherein the premises electrical system consisting of electrical devices and wiring, described below, located in/on the premises at:

**First Floor,**

visual inspection of the premises electrical system, limited to electrical devices and wiring to the extent detailed herein, was conducted in accordance with the requirements of the applicable code and/or standard promulgated by the State of New York, Department of State Code Enforcement and Administration, or other authority having jurisdiction, and found to be in compliance therewith on the **12<sup>th</sup>** Day of **April**, 2005.

<u>Name</u>	<u>QTY</u>	<u>Rate</u>	<u>Rating</u>	<u>Circuit</u>	<u>Type</u>
<b>Miscellaneous</b>					
1 60AMP. COMBO DISC/STARTER					
<b>Appliances and Accessories</b>					
Exhaust Fan	2	0	0		F.H.P.
<b>Motors</b>					
	1	20			
<b>Wiring and Devices</b>					
Disconnect	1	100	AMP		Commercial
<b>Miscellaneous</b>					
Commercial Inspection Fee					

*seal*

This certificate may not be altered in any way and is validated only by the presence of a raised seal at the location indicated.

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NYSDEC REG 9  
FOIL  
REL UNREL

New York Board  
of Fire Underwriters

Bureau of Electricity

Application #: \_\_\_\_\_

Bld Permit #: \_\_\_\_\_ date: \_\_\_\_\_

Installer: \_\_\_\_\_ Lic #: \_\_\_\_\_

Premises Owner: E. R. K. J. J. J.

Address: #4 Industrial Rd  
Quanda

Electrical wiring, so far as completed, and  
located in the area(s) of:

- basement attic
- 1st floor garage
- 2nd floor outside
- 3rd floor \_\_\_\_\_ floor
- accessory building
- other \_\_\_\_\_

has been inspected, and the items  
detailed below are found to be in  
compliance with the National Electrical  
Code.

- Service CATV
- Alarm system Swimming pool
- Underground raceway/cable assembly
- Power production equipment
- General premises wiring system PUPS
- Deep well water pump
- Telecommunication equipment
- \_\_\_\_\_

Inspector: Rob

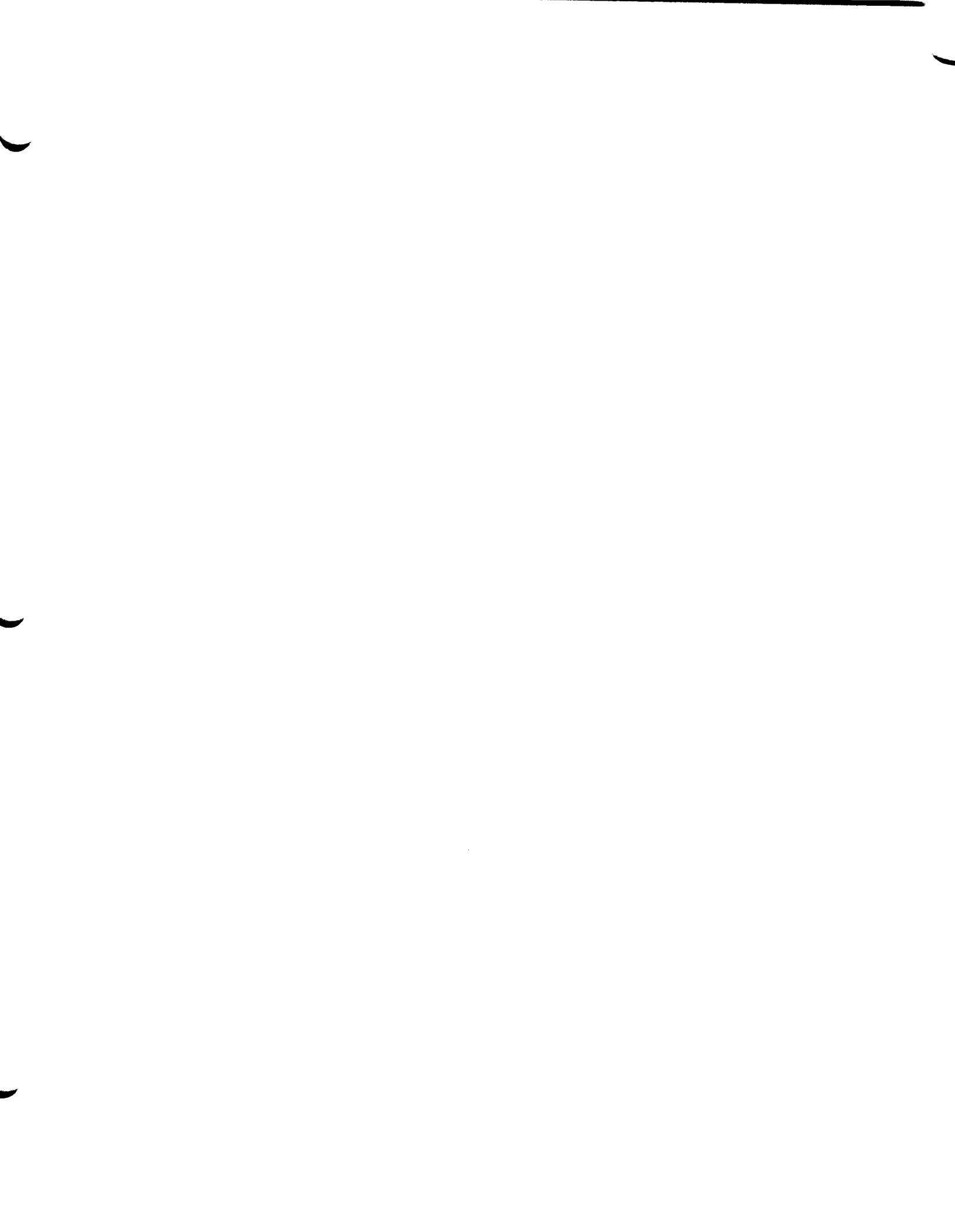
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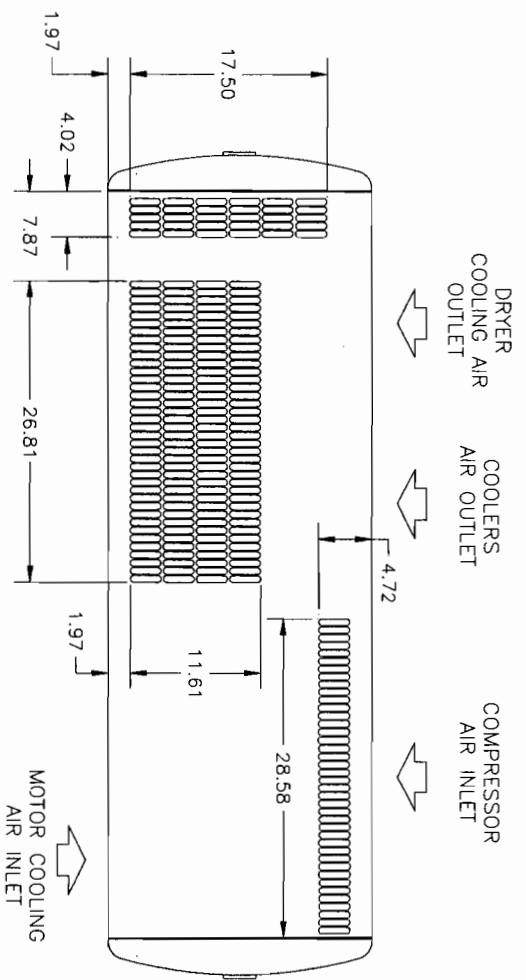
**Important:** Do not remove this label until

a final inspection of the premises has been completed and a certificate of compliance issued.

# 20417249  
Form 61 (Rev. 04/01)  
OK - final out

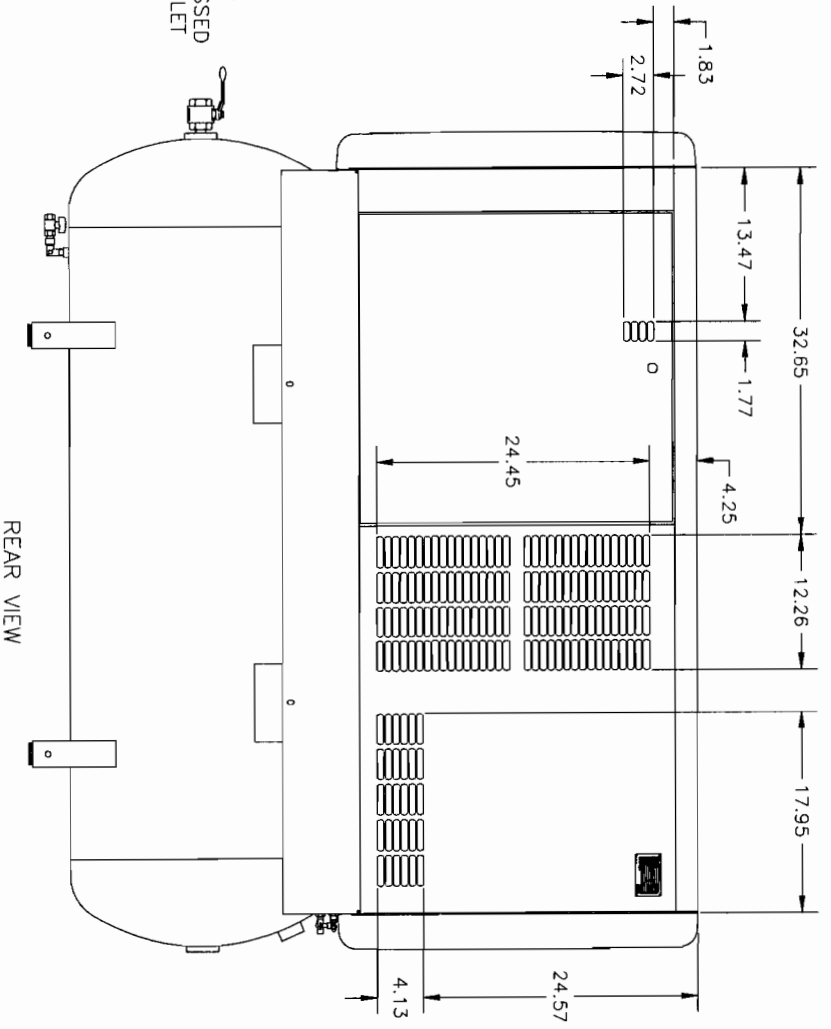
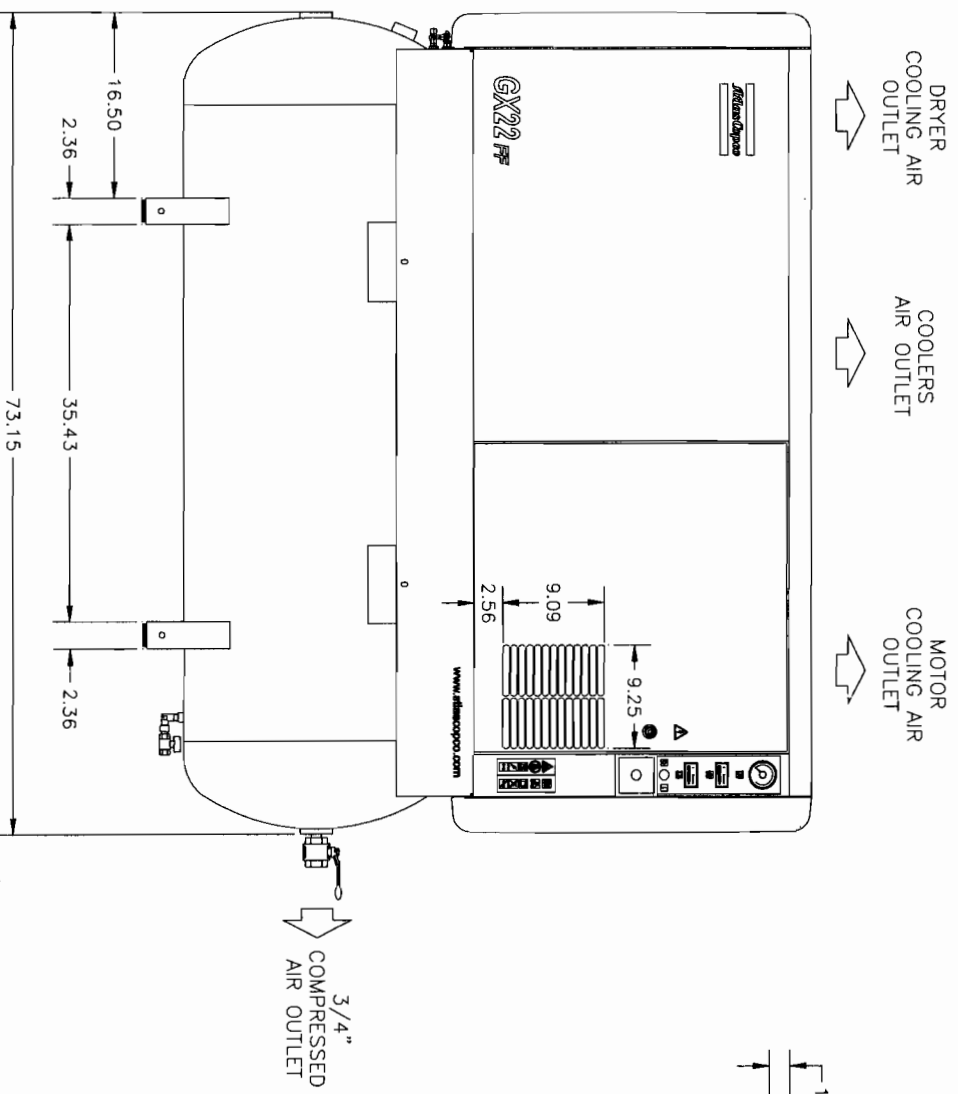
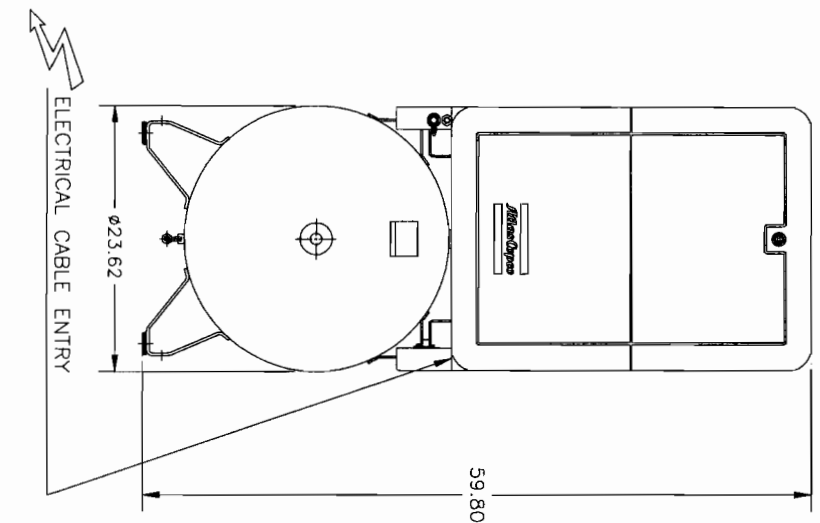






WEIGHT		
TYPE	FULL FEATURE	PACK
GX 15	930	780
GX 18	965	815
GX 22	990	840

WEIGHTS IN LBS. (OIL INCLUDED): ± 22 LBS.



1	ADDED INDIVIDUAL WEIGHTS IN TABLE	HOL 010577 00	01/12/19	JG
ED	DESCRIPTION	DN	DATE	BY

RELEASED  
COPY

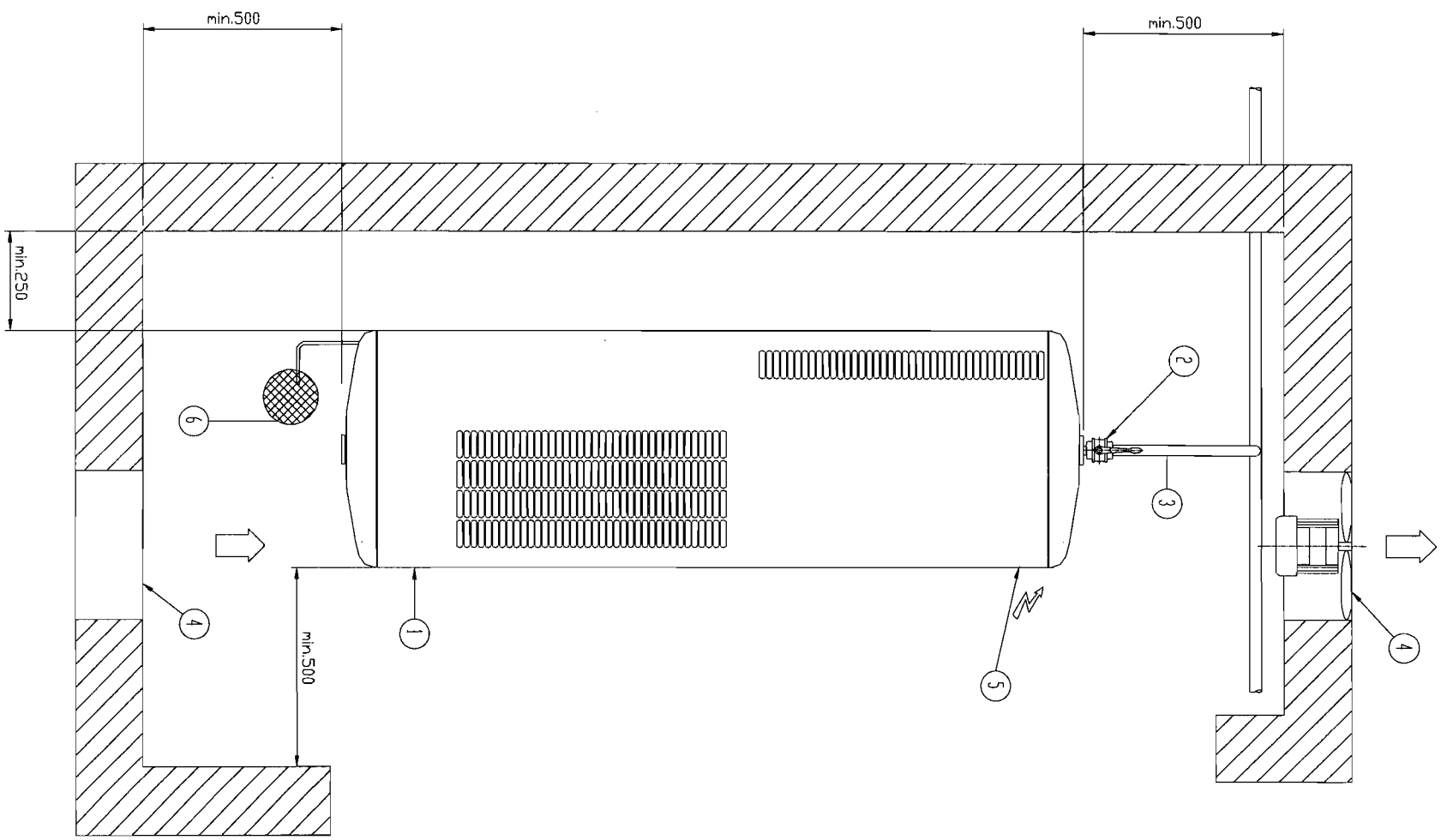
This document is our property and shall not without our permission be altered, copied, used for manufacturing or communication to any other person or company. GENERAL ARRANGEMENT GX15-22. Tank mounted, 120 GAL.

Scale	1:8	Family	Compress 9820 3525 00	Revision	ADO R14
Drawn by	JG	Checked by	1102 K/2	Drawn Date	01/20/11
Drawn Date	01/20/11	Approved	01/20/11	Sheet	1/1
Drawn From		Drawn Date		Drawn By	

1310 9083 08 01

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0	Post-ten	Gelijktijdig van Mediford from	Datum late	Ingev./Oorlog Invt./Appd.
---	----------	--------------------------------	------------	---------------------------



Main components

- 1 Compressor unit:  
The unit should be installed on a level floor capable of taking the weight of the compressor.  
Recommended minimum distance between top of unit and ceiling is 900 mm.  
Distances between units and walls stated are minimum.  
Air receiver may not be bolted onto the ground.
- 2 Compressed air outlet valve (can be located at both sides of the air receiver)
- 3 Delivery pipe:  
The maximum total pipe length can be calculated from:  
$$L = \frac{\Delta P \times d^5 \times P}{450 \times \rho_c \times T^{\frac{5}{2}}}$$
  
L is the length of the pipe (m)  
 $\Delta P$  is the max. allowable pressure drop (recommended 0.1 bar)  
d is the inner diameter of the pipe (mm)  
P is the absolute pressure at the compressor outlet (bar)  
 $\rho_c$  is the compressor FAD (l/s)
- 4 Ventilation:  
The inlet grids and ventilation fan should be installed in such a way that any recirculation of cooling air to the compressor is avoided. The air velocity to the grids has to be limited to 5 m/s. Cooling air ducts are not allowed.  
The maximum air temperature at the compressor intake opening is 40 °C, minimum 0 °C.  
The required ventilation to limit the compressor room temperature can be calculated from:  
$$Q_v = 0.92 N / \Delta T$$
  
Qv is the required ventilation capacity (m<sup>3</sup>/s)  
N is the shaft input of the compressor (kW)  
 $\Delta T$  is the compressor room temperature over the outdoor temperature ( °C)
- 5 Main cable entry.
- 6 Drain pipe to condensate collector. The drain pipe may not dip into the water of the collector.

Notes

-For more information concerning air nets, cooling systems, etc. refer to the compressor installation manual.  
 -All pipes should be installed stress-free to the compressor unit.  
 -For dimensions and air flow directions refer to the AHB dimension drawings.

Toleranties/verwijzen met aangegeven zijn volgens Technische specificaties niet te overschrijden		Een op/af/meting		Richting		Schaal		Laste	
ATLAS COPCO STANDARD/Klasseer/Klasse		135SK / 2		135D01K		135SK / C		135SK / B	
Benaming		INSTAL PREPARASAL		12043		1102 K / 3		1102 K / 3	
Model		SEE DRAWING		SEE DRAWING		SEE DRAWING		SEE DRAWING	
Materiaal		Staal		Staal		Staal		Staal	
Behandeling		Zink		Zink		Zink		Zink	
Verwerking		1:10		1:10		1:10		1:10	
Auteur		Mediford		Mediford		Mediford		Mediford	
Datum		2001-09-10		2001-09-10		2001-09-10		2001-09-10	
Tekennummer		9820		3532		00		00	

## GX 15-22 Series

Oil Injected Screw Compressors  
 Air Cooled 20 thru 30 Horsepower

MODEL	GX 15				GX 18				GX 22				
	100	125	150	175	100	125	150	175	100	125	150	175	
<b>General</b>													
Horsepower	HP	20				25				30			
Capacity-FAD <sup>1</sup>	CFM	94	85	77	65	114	104	94	82	134	122	112	103
Operating Pressure <sup>2</sup>	PSIG	100	125	150	175	100	125	150	175	100	125	150	175
Min Operating Pressure <sup>2</sup>	PSIG	58	58	58	58	58	58	58	58	58	58	58	58
Max Operating Pressure <sup>2</sup>	PSIG	107	132	157	181	107	132	157	181	107	132	157	181
Drive System		V-Belt				V-Belt				V-Belt			
<b>Power Requirements</b>													
Compressor	BHP	23.1	23.3	21.7	22.9	28.3	28.2	26.1	27.4	34.3	34.5	31.8	32.7
Compressor Fans	BHP	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Pack Unit (Total)	BHP	23.3	23.5	21.9	23.1	28.5	28.4	26.3	27.6	34.5	34.7	32.0	32.9
Compressor @ No Load	BHP	4.4	4.4	4.4	4.4	5.4	5.4	5.4	5.4	6.3	6.3	6.3	6.3
<b>Cooling</b>													
Cooling Medium		Air				Air				Air			
Maximum Ambient Temperature	°F	104				104				104			
Minimum Ambient Temperature	°F	32				32				32			
Package BTU Rejection													
Pack	BTU/hr	59,808				72,533				88,312			
Full Feature	BTU/hr	62,608				75,841				91,620			
Approach Temp													
No Aftercooler	°F	45				54				70			
With Aftercooler	°F	18				18				18			
Oil Capacity	Gal	2.9				2.9				2.9			
<b>Noise Level<sup>3</sup></b>													
Pack	dB(A)	72				73				74			
Full Feature	dB(A)	72				73				74			

1. FAD (Free Air Delivery) measured according to CAGI-PNEUROP PN2CPT/ISO1217, Ed. 3, Annex C-1996  
 2. Full Feature units, dryer module air pressure drops must be included  
 3. Noise level measured according to CAGI-PNEUROP PN8NTC2.2 test code

## GX 15-22 Series

Oil Injected Screw Compressors  
 Air Cooled 20 thru 30 Horsepower

MODEL	GX 15				GX 18				GX 22				
	100	125	150	175	100	125	150	175	100	125	150	175	
<b>Dimensions<sup>4</sup></b>													
Base Mtd (LxWxH)	in 73 x 24 x 37				73 x 24 x 37				73 x 24 x 37				
Tank Mtd 120 Gal. (LxWxH)	in 73 x 24 x 60				73 x 24 x 60				73 x 24 x 60				
<b>Discharge Valve Connection</b>													
Base Mtd	in NPT 3/4				3/4				3/4				
Tank Mtd	in NPT 3/4				3/4				3/4				
<b>Condensate Drain Connections</b>													
Manual outside/inside dia.	in 0.24 / 0.16				0.24 / 0.16				0.24 / 0.16				
Automatic outside/inside dia.	in 0.31 / 0.22				0.31 / 0.22				0.31 / 0.22				
<b>Weights (approximate)</b>													
<b>Base Mtd (Pack / Full Feature)</b>													
Net	lbs 525 / 675				560 / 710				585 / 735				
Shipping	lbs 750 / 900				785 / 935				810 / 960				
<b>Tank Mtd 120 Gallon (Pack / Full Feature)</b>													
Net	lbs 780 / 930				815 / 965				840 / 990				
Shipping	lbs 1020 / 1175				1055 / 1210				1080 / 1235				
<b>Refrigerated Dryer (Full Feature only)</b>													
Dryer module	ID 44				ID 66				ID 66				
Compressor rating (nominal)	HP 1.1				1.3				1.3				
Pressure dewpoint <sup>5</sup>	°F 35-39				35-39				35-39				
Pressure drop at nominal capacity	PSIG 2.9				2.9				2.9				
Cooling air flow	CFM 445				618				618				
Outlet temperature above ambient	°F 5.4				5.4				7.2				
Refrigerant type	R134a				R134a				R134a				
Refrigerant charge	lbs 2.1				2.1				2.1				
<b>Input power</b>													
Compressor	KW 0.62				0.8				0.8				
Fan Motor	KW 0.18				0.20				0.20				
<b>Recommended Filter<sup>6</sup></b>													
1.0 micron	DDp	44	44	32	32	60	44	44	32	120	60	44	44
1.0 micron / 0.1 PPM liquid	DD	44	44	32	32	60	44	44	32	120	60	44	44
0.01 micron / 0.01 PPM liquid	PD	44	44	32	32	60	44	44	32	120	60	44	44
0.003 PPM oil vapor	QD	44	44	32	32	60	44	44	32	120	60	44	44

4. Discharge valve adds approximately 5 inches to installed length

5. Dewpoint at standard Atlas Copco ref. Conditions

6. At standard filter inlet condition (Ref. Filter Price Book Section)

# Transmittal



To: Environmental Remediation & Recovery  
5719 Route 6N  
Edinboro PA 16412

DATE: February 3, 2005  
 Attention: Mike Waltz  
 Project: DASNY Gowanda IRM

Project No.: 1510509999

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**Atlas Copco Stationary Air Compressors**

GX5 - GX7 - GX11 – GX15 – GX18 – GX22

**Instruction book**

From serial number All-626 078 onwards

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This instruction book meets the requirements for instructions specified by the machinery directive 98/37/EC and is valid for CE as well as non-CE labeled machines.

**No. 2920 1499 00**

**Registration code:** APC GX 2001 / 38 / 995

2003-08

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This instruction book describes how to handle the machines to ensure safe operation, optimum efficiency and long service life.

**Read this book before putting the machine into operation** to ensure correct handling, operation and proper maintenance from the beginning. The maintenance schedule comprises measures for keeping the machine in good condition.

Keep the book available for the operator and make sure that the machine is operated and that maintenance is carried out according to the instructions. Record all operating data, maintenance performed, etc. in an operator's logbook available from Atlas Copco. Follow all relevant safety precautions, including those mentioned in this book.

Repairs must be carried out by trained personnel from Atlas Copco who can be contacted for any further information.

In all correspondence always mention the type and the serial number, shown on the data plate.

For all data not mentioned in the text, see sections "Preventive maintenance schedule" and "Principal data".

**The company reserves the right to make changes without prior notice.**



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## 1 General description (Figs. 1.1 up to 1.4)

GX5 up to GX22 are single-stage, oil-injected screw compressors. They are air-cooled and belt-driven by an electric motor. The compressors are enclosed in a sound-insulated bodywork. An easy-to-operate control panel (5) is provided, including the start/stop switch and the emergency stop button. A cabinet (4) housing the regulator, pressure switch and motor starter is integrated in the bodywork.

### Models

#### Floor-mounted

The compressors can be installed directly on the floor.

#### Tank-mounted

The compressors are mounted on a large air receiver (9):

- 270 l for GX5 up to GX11
- 500 l for GX15 up to GX22

### Variants

#### GX Full-Feature (FF)

An air cooler (6) and an air dryer (15) are integrated in the bodywork. A condensate drain system is provided including a valve for automatic draining during operation (8-Figs. 1.5 and 1.6) and a manual drain valve (9).

#### GX Pack

These variants are not provided with an air cooler, air dryer and condensate drain system as standard.

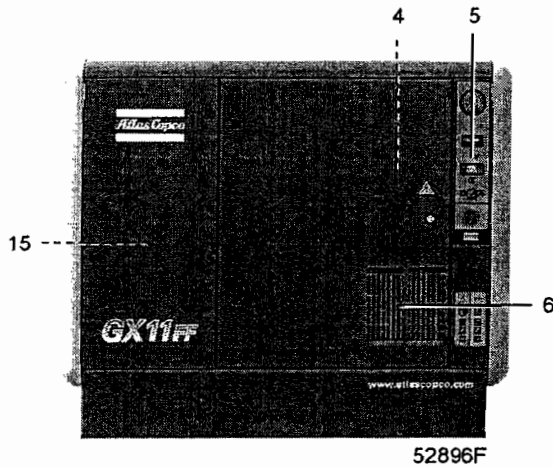


Fig. 1.1 Front view of GX11 FF floor-mounted

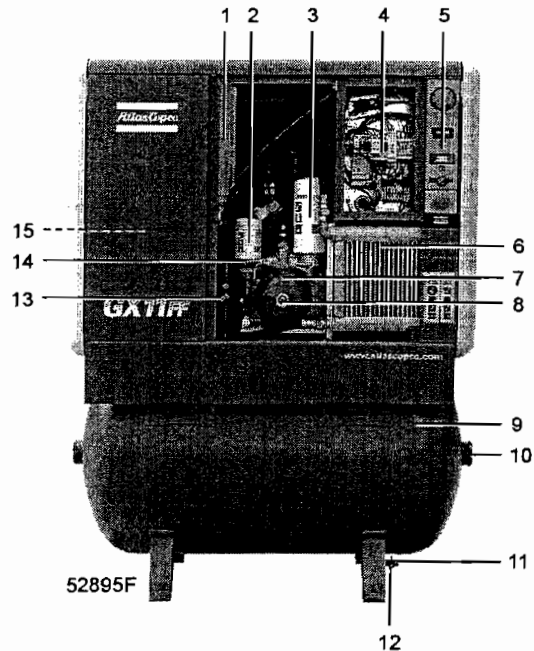


Fig. 1.2 Front view of GX11 FF tank-mounted

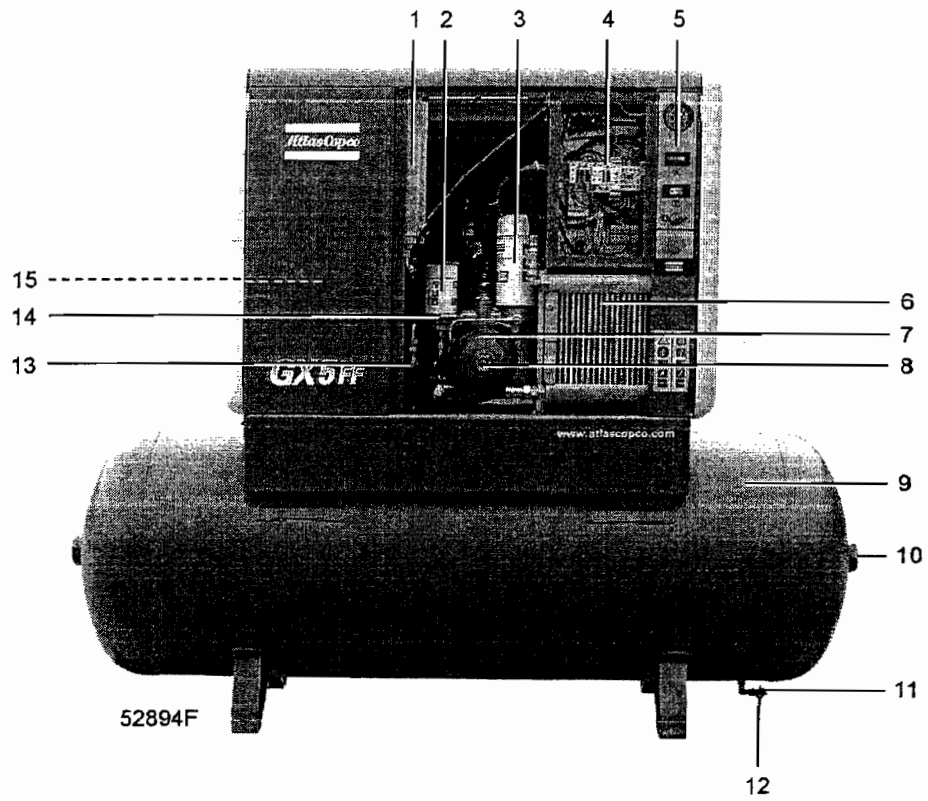


Fig. 1.3 Front view GX5 FF tank-mounted

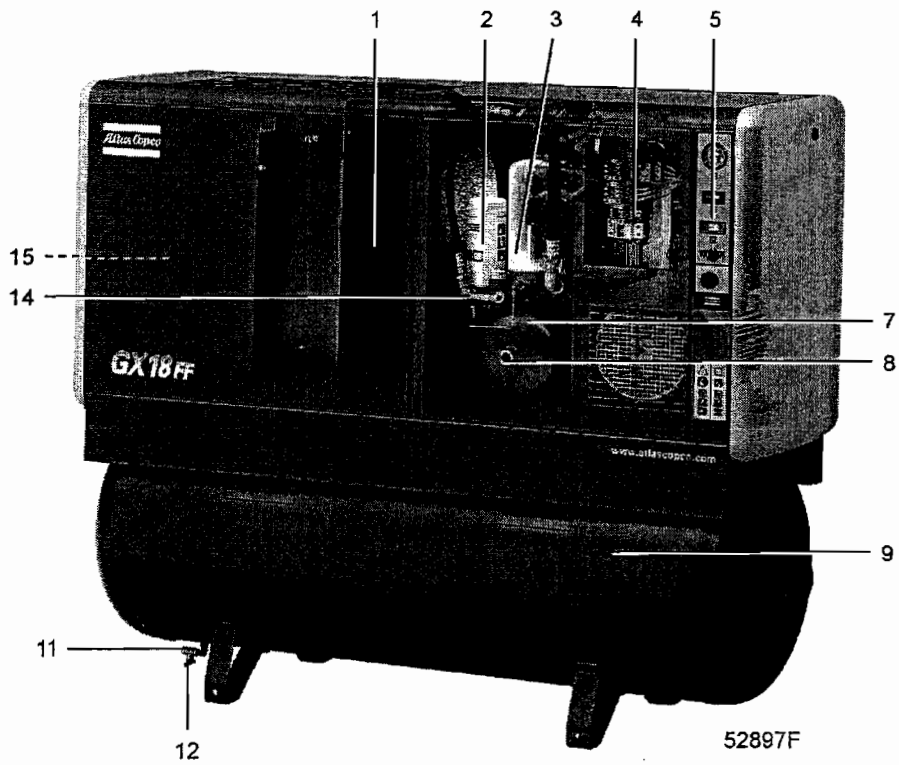


Fig. 1.4 Front view GX18 FF tank-mounted

- |                 |                                   |                           |
|-----------------|-----------------------------------|---------------------------|
| 1 Oil cooler    | 7 Oil separator/tank              | 12 Condensate drain valve |
| 2 Oil filter    | 8 Oil level sight-glass           | 13 Safety valve           |
| 3 Oil separator | 9 Receiver                        | 14 Safety valve           |
| 4 Cubicle       | 10 Air outlet                     | 15 Dryer                  |
| 5 Control panel | 11 Condensate outlet,<br>receiver |                           |
| 6 Air cooler    |                                   |                           |

Figs. 1.1 up to 1.4 Front views

### 1.1 Options

Description	Floor-mounted model	Tank-mounted model	Remarks
Timer drain	--	Option	Only for Pack
Integrated air cooler	Option	Option	Only for Pack
Integrated air cooler and condensate trap	Option	Option	Only for Pack
Oversized air receiver: - 500 l for GX5 up to GX11	Option	--	--
Integrated DD/PDX filters	Option	Option	Only for Full-Feature. See section 2.
Electronic water drain (EWD)	Option	Option	--

PDX are high-efficiency filters. The filters trap solid particles down to 0.01 micron with a max. oil carry-over of 0.01 mg/m<sup>3</sup>.

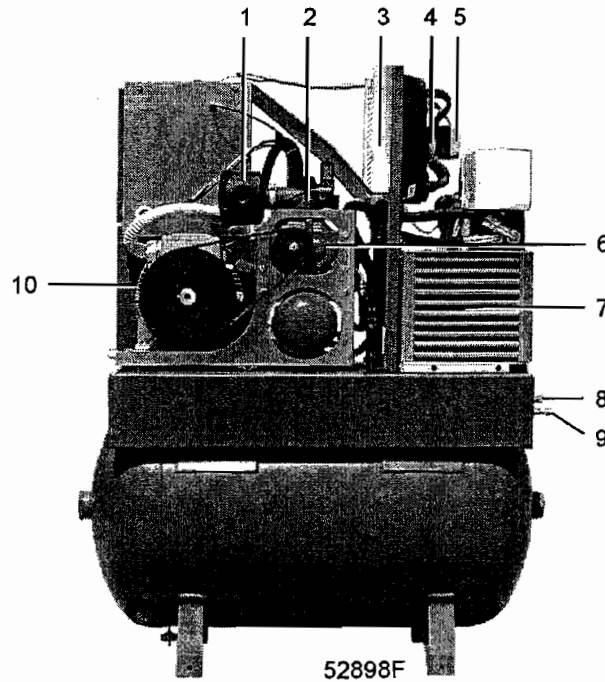


Fig. 1.5 Rear view GX11 FF tank-mounted

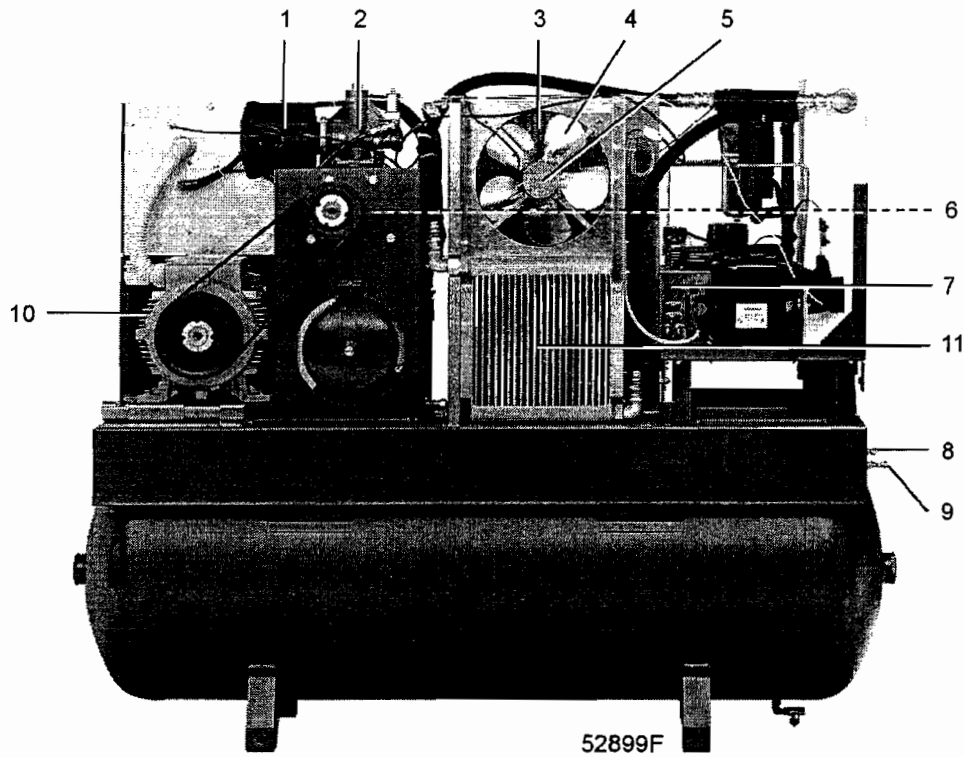


Fig. 1.6 Rear view GX18 FF tank-mounted

- |              |                         |                      |
|--------------|-------------------------|----------------------|
| 1 Air filter | 5 Fan motor             | 9 Manual drain valve |
| 2 Unloader   | 6 Compressor element    | 10 Drive motor       |
| 3 Oil cooler | 7 Refrigerant condenser | 11 Air cooler        |
| 4 Fan        | 8 Automatic drain       |                      |

Figs. 1.5 and 1.6 Rear views

## 1.2 Air flow – oil system (Figs. 1.7 and 1.8)

### 1.2.1 Air flow

Air drawn through filter (1) and open inlet valve (2) into compressor element (6) is compressed. Compressed air and oil flow into oil separator/tank (8). The air is discharged through outlet valve (20) via minimum pressure valve (11) and, depending on the model, air cooler (15) and dryer (16).

### 1.2.2 Oil system

Air pressure forces the oil from oil separator/tank (8) through oil cooler (14) and filter (12) to compressor element (6) and the lubrication points. In oil separator/tank (8), most of the oil is removed centrifugally; the balance is removed by separator (10).

The oil system has a temperature switch (7). Depending on the temperature of the oil, this switch will start a fan (13) to cool the oil.

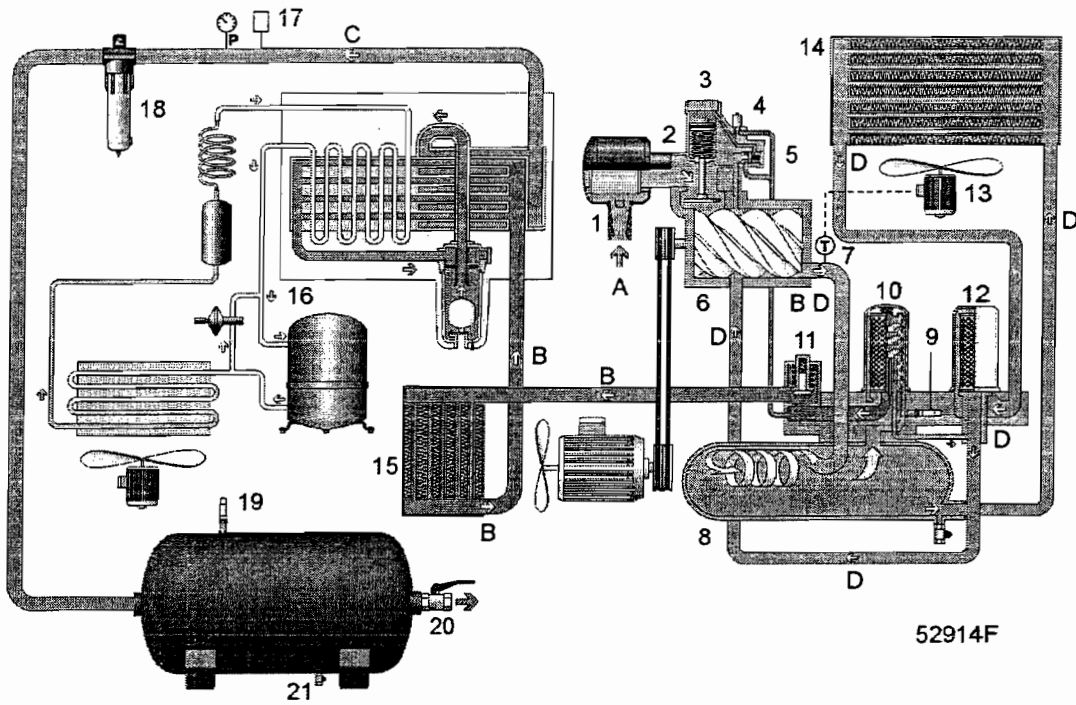


Fig. 1.7 Flow diagram GX5-11

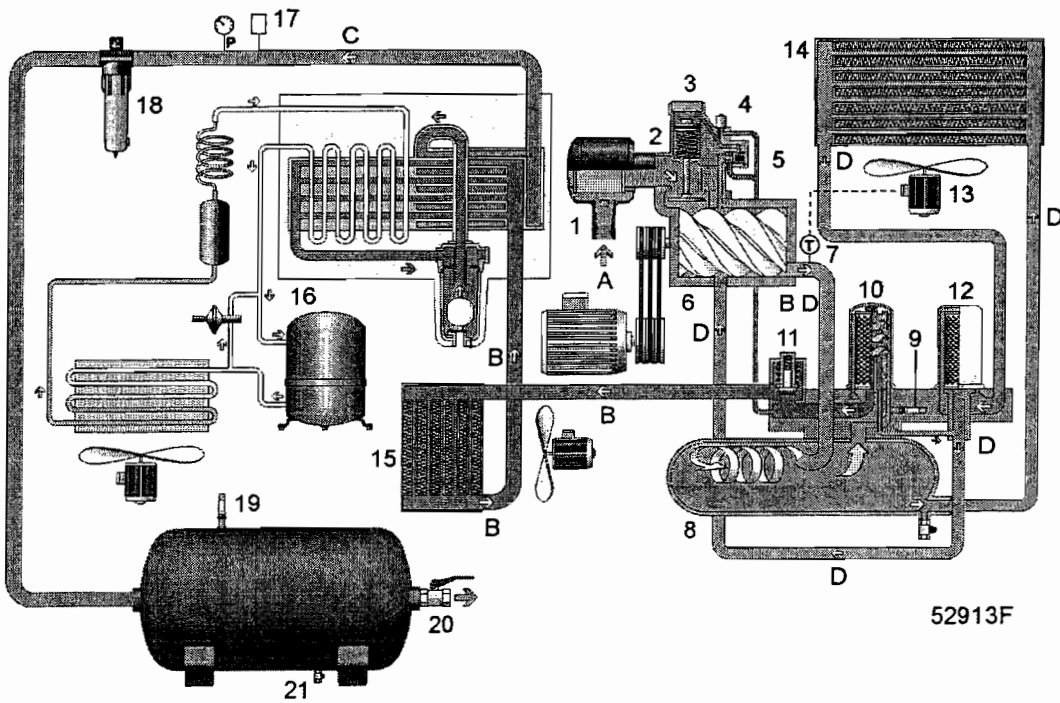


Fig. 1.8 Flow diagram GX15-22

A	Air inlet	6	Compressor element	15	Air cooler
B	Air flow	7	Temperature switch	16	Dryer
C	Compressed air outlet	8	Oil separator/tank	17	Pressure switch
D	Oil flow	9	Safety valve	18	PDX filter (option)
1	Air filter	10	Oil separator	19	Safety valve
2	Inlet valve	11	Minimum pressure valve	20	Air outlet valve
3	Unloader	12	Oil filter	21	Condensate drain valve
4	Solenoid valve	13	Fan, oil cooler		
5	Unloading valve	14	Oil cooler		

Figs. 1.7 and 1.8 Flow diagrams

### 1.3 Regulating system (Figs. 1.7 and 1.8)

#### 1.3.1 Main components

- pressure switch (17), which opens and closes at preset pressure limits
- unloader (3), including inlet valve (2) and unloading valve (5)
- loading solenoid valve (4)

#### 1.3.2 Operation

##### Loading

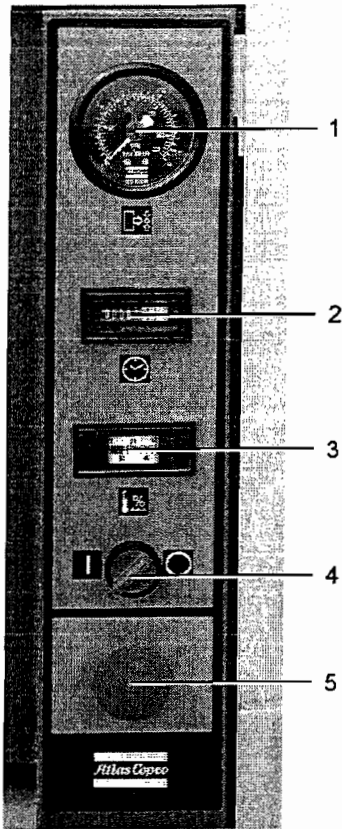
As long as the working pressure is below the maximum limit, the solenoid valve is energized allowing control air to flow to the unloader: the inlet valve opens completely and the unloading valve closes completely. The compressor will run fully loaded (100% output).

##### Unloading

If the working pressure reaches the maximum limit, the solenoid valve is de-energized venting the control air: the inlet valve closes completely and the unloading valve opens completely. The compressor will run fully unloaded (0% output).

In case the compressor keeps running unloaded for an uninterrupted period between 45 and 60 seconds, it will be stopped. The compressor will automatically restart when the net pressure drops to the minimum limit.

### 1.4 Control panel



52909F

Reference	Designation	Function
1	Working pressure	The white pointer indicates the actual working pressure. The red one indicates the maximum limit.
2	Hourmeter	Indicates the total running time.
3	Dewpoint gauge	Indicates the dewpoint temperature on Full-Feature.
4	Start/stop switch	To start or stop the compressor. After the stopping command, the compressor will run unloaded for a period between 45 up to 60 seconds and then stop.
4	Automatic operation lamp	<b>When alight, the lamp indicates that the regulator is automatically controlling the compressor:</b> the compressor is loaded, unloaded, stopped and restarted depending on the air consumption and the preset pressure limits. The lamp goes out after manually stopping.
5	Emergency stop button	To stop the compressor immediately; only to be used in case of emergency. Must be unlocked before starting by pulling it out.

Fig. 1.9 Control panel



### 1.5 Protection of compressor

Reference	Designation	Function
F21 (Figs. 1.10 and 1.11)	Motor overload relay	To shut down the compressor in case the motor current is too high
TSHH11 (6-Fig. 5.1). See also section 2.4.	Temperature shut-down switch	To shut down the compressor in case the temperature at the outlet of the compressor element is too high
13 and 14 (Figs. 1.2 up to 1.4)	Safety valves	To protect the air outlet system in case the outlet pressure exceeds the opening pressure of the valve

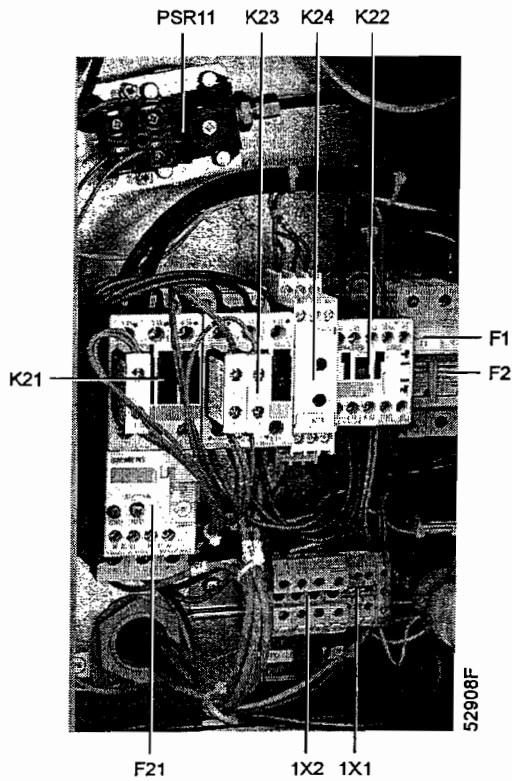


Fig. 1.10 Electric cubicle GX11 FF (typical example)

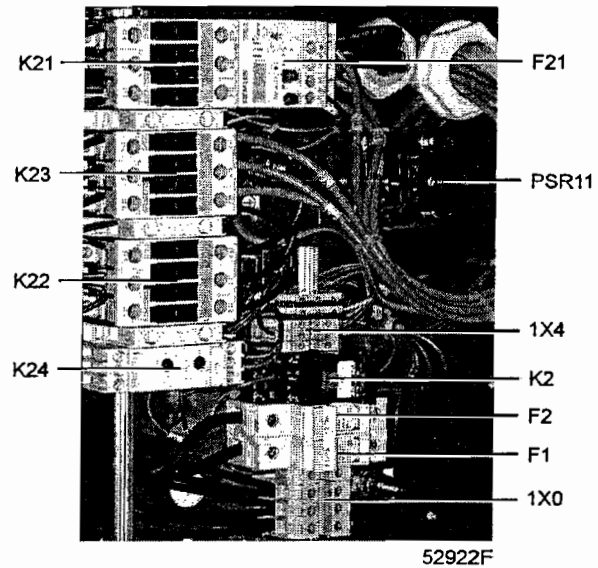


Fig. 1.11 Electric cubicle GX15 (typical example)

- |     |                 |       |                        |     |                         |
|-----|-----------------|-------|------------------------|-----|-------------------------|
| F1  | Fuse            | K22   | Star contactor         | 1X1 | Terminal strip, motor   |
| F2  | Fuse            | K23   | Delta contactor        | 1X2 | Terminal strip, dryer   |
| F21 | Overload relay  | K24   | Time relay             | 1X4 | Terminal strip, 230V/AC |
| K2  | Auxiliary relay | PSR11 | Pressure switch        |     |                         |
| K21 | Line contactor  | 1X0   | Terminal strip, supply |     |                         |

Figs. 1.10 and 1.11 Electric cubicles

### 1.6 Air dryer on GX Full-Feature (Figs. 1.12 and 1.13)

Wet compressed air (B) enters the dryer and is further cooled by the outgoing, dried air (11). Moisture in the incoming air condenses. The air then flows through heat exchanger (12) where refrigerant evaporates withdrawing heat from the air. The cold air then flows through condensate separator (2) which separates condensate from the air. The condensate is automatically drained. The cold, dried air then flows through heat exchanger (13), where it is warmed up by the incoming air (B).

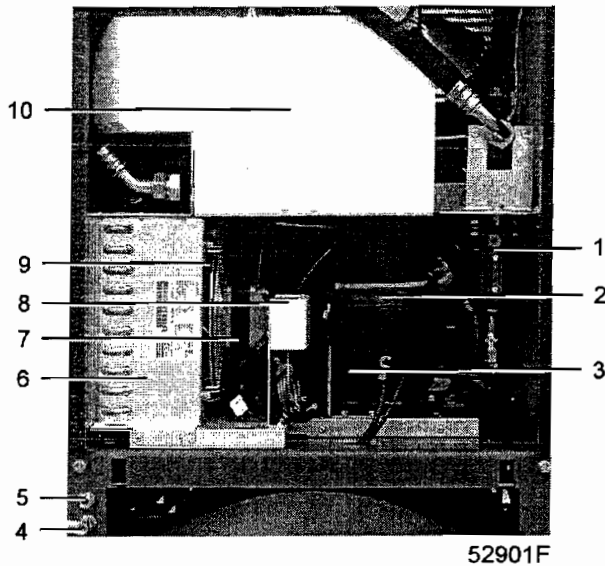


Fig. 1.12 View on dryer (typical example)

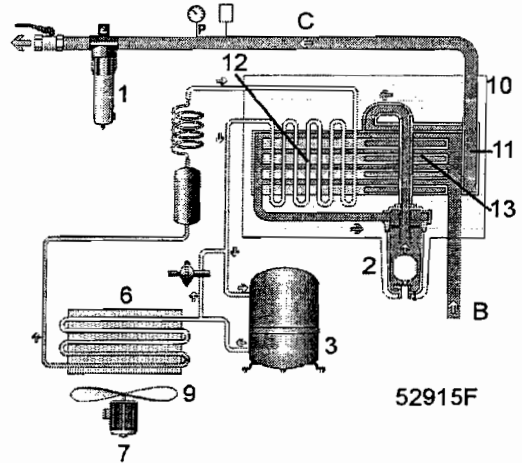


Fig. 1.13 Flow diagram of dryer

- |                          |                                |                                |
|--------------------------|--------------------------------|--------------------------------|
| B Wet compressed air     | 5 Automatic drain              | 10 Heat exchanger              |
| C Compressed air outlet  | 6 Refrigerant condenser        | 11 Dried air                   |
| 1 PDX filter (option)    | 7 Condenser fan motor          | 12 Heat exchanger, refrigerant |
| 2 Condensate separator   | 8 Pressure switch, fan control | 13 Heat exchanger, dried air   |
| 3 Refrigerant compressor | 9 Condenser cooling fan        |                                |
| 4 Manual drain valve     |                                |                                |

Figs. 1.12 and 1.13 Dryer

## 2 Installation

### 2.1 Dimension drawings (Figs. 2.1 up to 2.4)

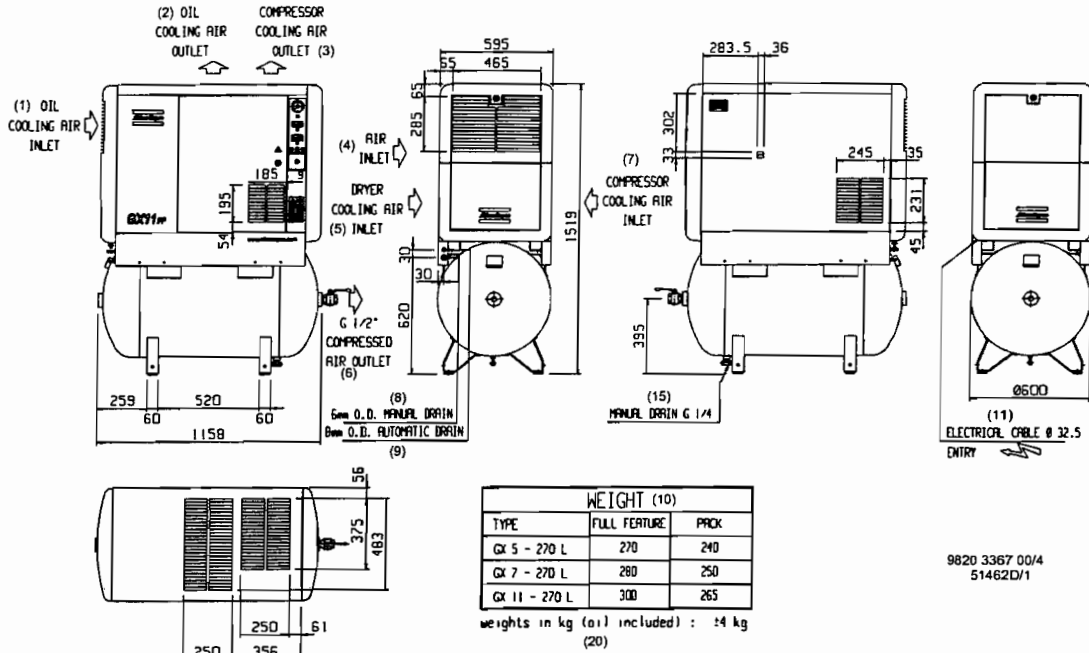


Fig. 2.1 GX5-11 tank-mounted

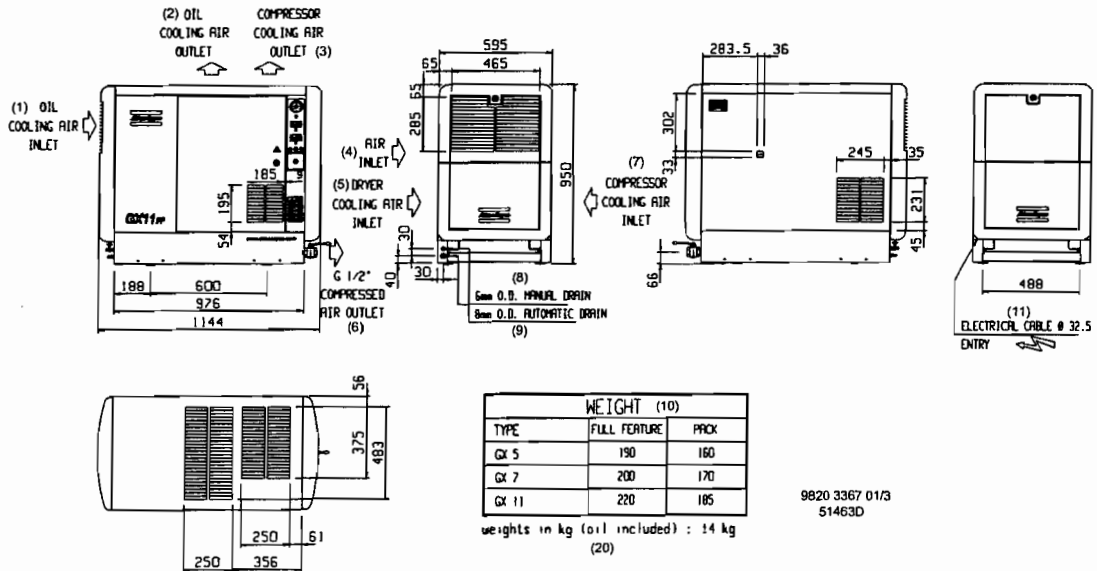


Fig. 2.2 GX5-11 floor-mounted

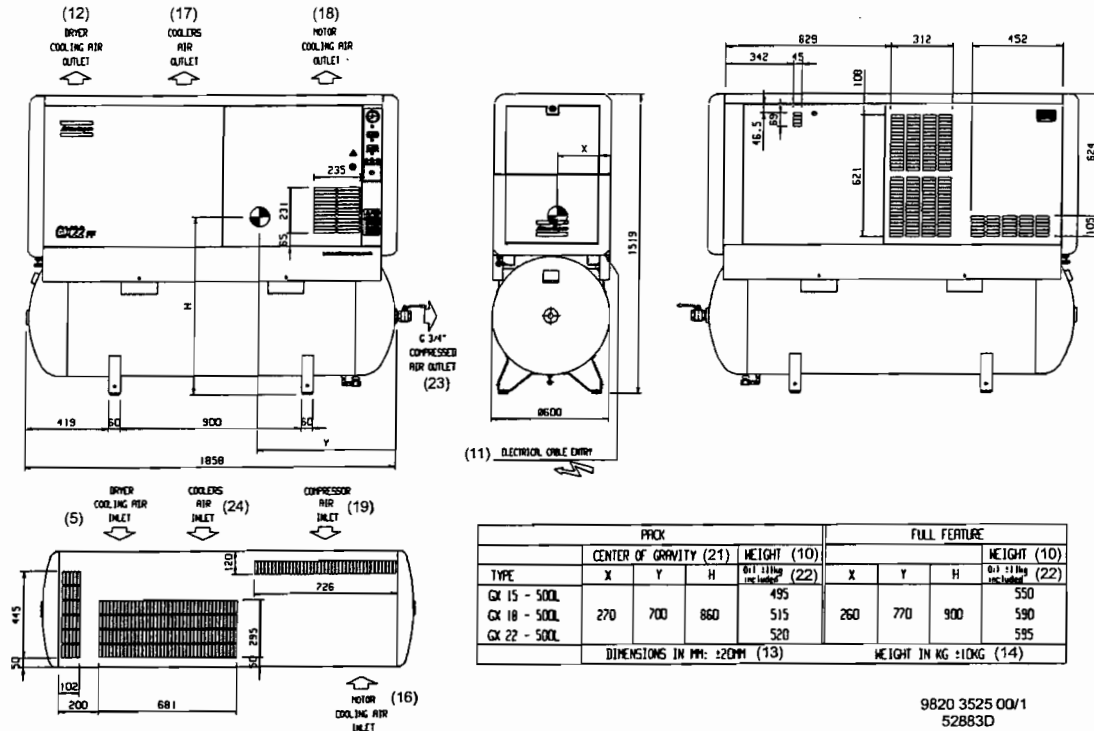


Fig. 2.3 GX15-22 tank-mounted

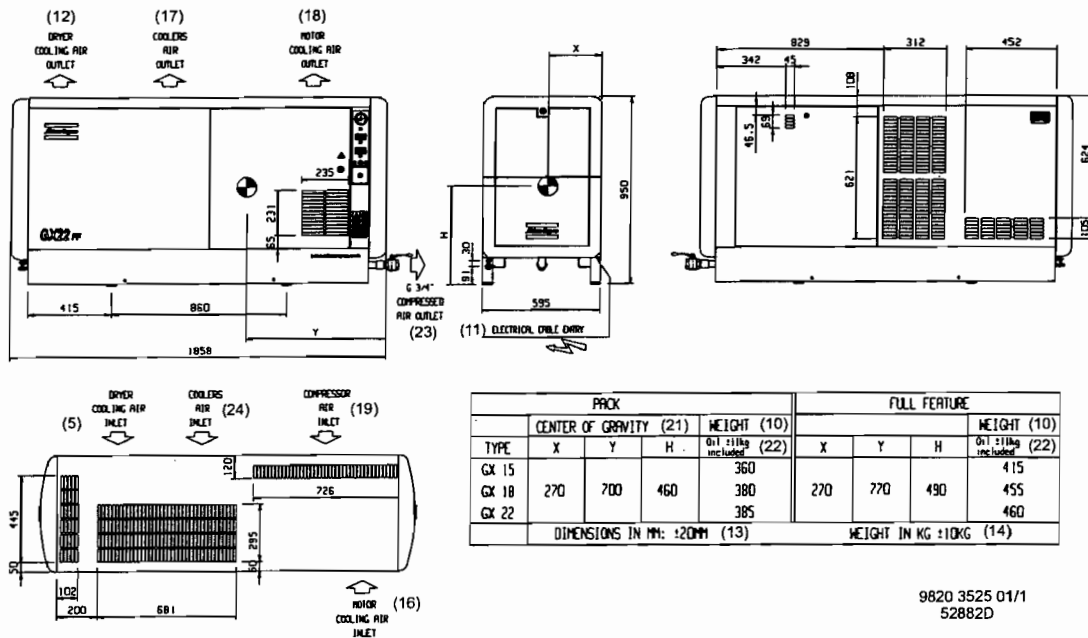


Fig. 2.4 GX15-22 floor-mounted

Text on Figs. 2.1 up to 2.4

- (1) Oil cooling air inlet
- (2) Oil cooling air outlet
- (3) Compressor cooling air outlet
- (4) Air inlet
- (5) Dryer cooling air inlet
- (6) Compressed air outlet G ½"
- (7) Compressor cooling air inlet
- (8) Manual drain 6 mm
- (9) Automatic drain 8 mm
- (10) Weight
- (11) Electrical cable entry
- (12) Dryer cooling air outlet
- (13) Dimensions in mm: ± 20 mm
- (14) Weight in kg ± 10 kg
- (15) Manual drain G ¼"
- (16) Motor cooling air inlet
- (17) Coolers air outlet
- (18) Motor cooling air outlet
- (19) Compressor air inlet
- (20) Weights in kg (oil included): ± 4 kg
- (21) Center of gravity
- (22) Oil ± 11 kg included
- (23) Compressed air outlet G ¾"
- (24) Coolers air inlet

**2.2 Installation proposals (Figs. 2.5 and 2.6)**

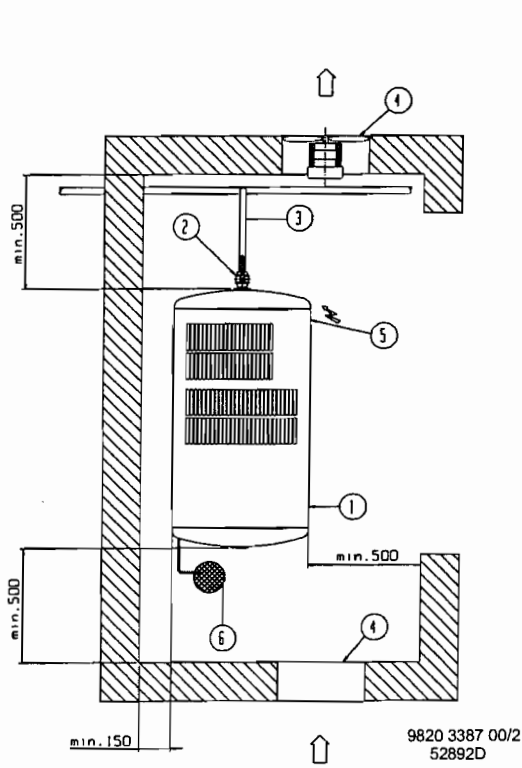


Fig. 2.5 Installation proposal GX5-11

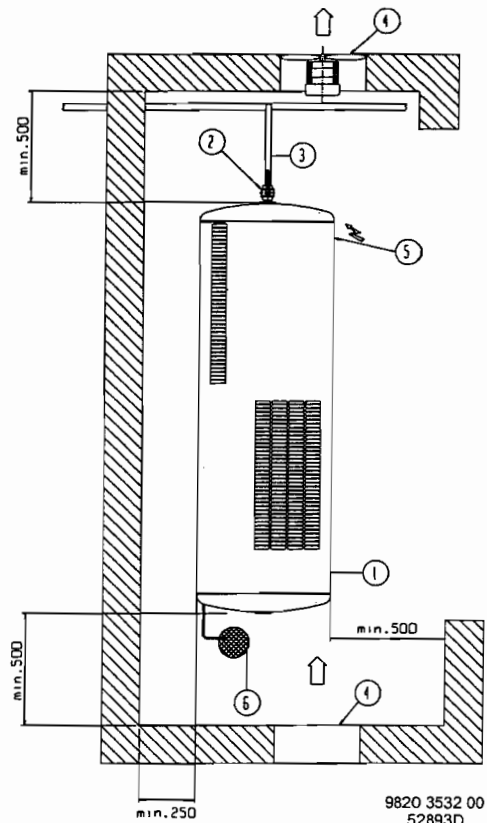


Fig. 2.6 Installation proposal GX15-22

## 2.2.1 Recommendations

### Important

To prevent a tank-mounted model from falling over during transport by a pallet truck: push the forks underneath the air receiver and provide a wooden beam (1-Fig. 2.7) (section approx. 4 x 6 cm) through the supports at both sides of the receiver. While holding the compressor, slowly lift the forks until the receiver is secured between the beams. Move the compressor smoothly.

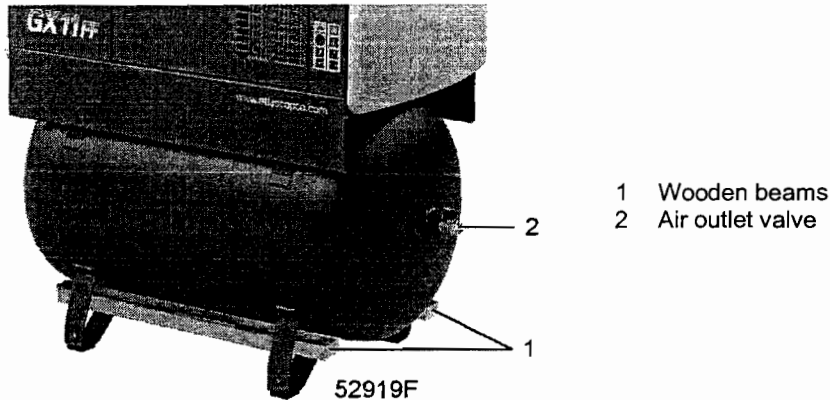


Fig. 2.7 Transport by a pallet truck

### Ref. Description/recommendation

- 1 Install the rubber pads (delivered loose with the compressor) to the compressor supports. Install the compressor on a solid, level floor suitable for taking the weight. The recommended minimum distance between the top of the unit and the ceiling is 900 mm. The air receiver must not be bolted to the floor. The minimum distance between the wall and the back of the compressor must be:
  - 150 mm for GX5 up to GX11
  - 250 mm for GX15 up to GX22
- 2 Position of the compressed air outlet valve. Close the valve. Connect the air net to the valve.
- 3 The pressure drop over the delivery pipe can be calculated as follows:

$$dp = (L \times 450 \times Qc^{1.85}) / (d^5 \times P)$$

dp = pressure drop (recommended maximum = 0.1 bar)

L = length of delivery pipe in m

d = inner diameter of the delivery pipe in mm

P = absolute pressure at the compressor outlet in bar(a)

Qc = free air delivery of the compressor in l/s

- 4 Ventilation: the inlet grids and ventilation fan should be installed in such a way that any re-circulation of cooling air to the compressor or dryer is avoided. The air velocity to the grids must be limited to 5 m/s.

The required ventilation capacity to limit the compressor room temperature can be calculated as follows:

$$Qv = 0.92 N / dT$$

Qv = required ventilation capacity in m<sup>3</sup>/s

N = nominal motor power of compressor in kW

dT = temperature increase in compressor room in °C

- 5 Position of the mains cable entry.
- 6 The drain pipes to the drain collector must not dip into the water of the drain collector.

### 2.3 Electric cable size

		GX5	GX7	GX11	GX15	GX18	GX22
Frequency (Hz)	Voltage (V)	Cable size	Cable size	Cable size	Cable size	Cable size	Cable size
		mm <sup>2</sup>	mm <sup>2</sup>	mm <sup>2</sup>	mm <sup>2</sup>	mm <sup>2</sup>	mm <sup>2</sup>
50/60	200/220	6	10	16	25	35	50
50	230	4	6	16	25	35	50
50	400	2.5	2.5	6	10	16	25
50	500	1.5	2.5	4	10	10	16
60	220/230	4	10	16	25	35	50
60	440/460	2.5	2.5	6	10	10	16
60	380	2.5	4	6	10	16	25
		AWG	AWG	AWG	AWG	AWG	AWG
60	200	8	6	4	3	1	2/0
60	220/230	8	6	4	3	2	1
60	440/460	10	10	8	6	6	4
60	575	12	10	8	8	8	6

#### Attention

- Local regulations remain applicable if they are stricter than the values proposed below.
- The voltage drop must not exceed 5% of the nominal voltage. It may be necessary to use cables with a larger section than those stated to comply with this requirement.

### 2.4 Electrical connections (Figs. 2.8 up to 2.13)

1. Provide an isolating switch nearby the compressor.
2. Check the fuses and the setting of overload relay (F21). See also sections 1.5 and 7.2.
3. If provided, check transformers (T1-3) for correct connection.
4. Check the settings of time relay (K24): Y-time (10 seconds) and idling time (between 45 and 60 seconds).
5. Connect the power supply cables to terminals L1, L2 and L3 (1X0) and the neutral conductor (if provided) to terminal (N). Connect the earth conductor to the earth bolt (PE).

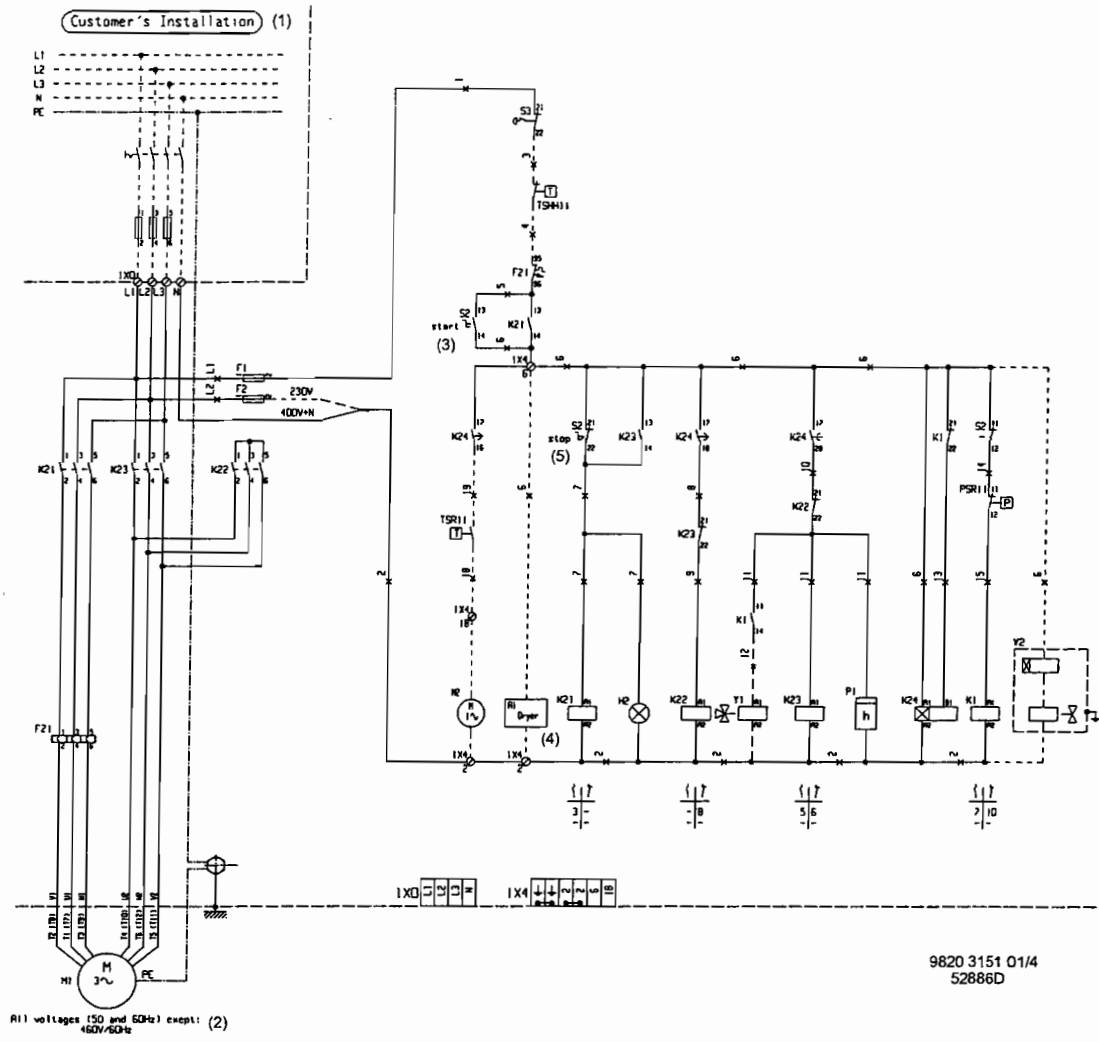


Fig. 2.8 GX5-11 IEC without transformer



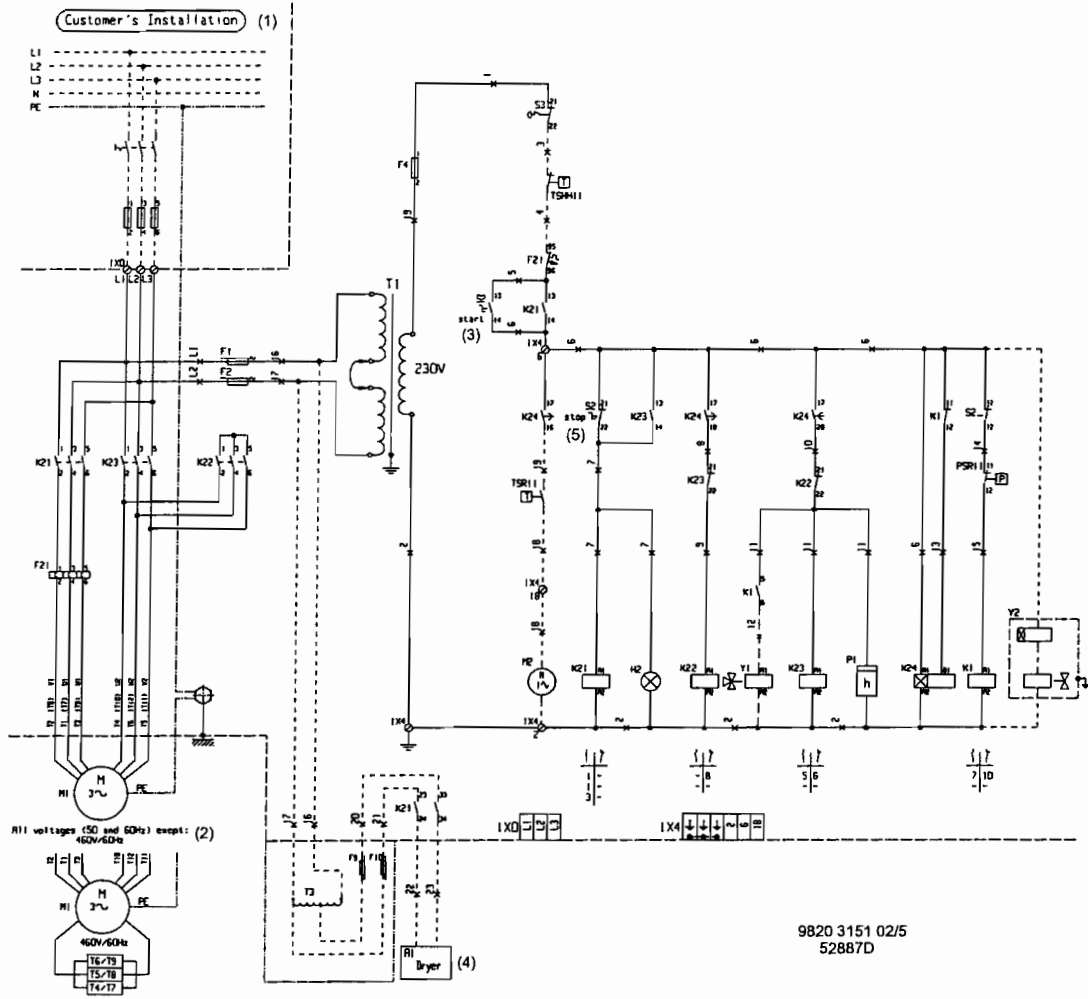
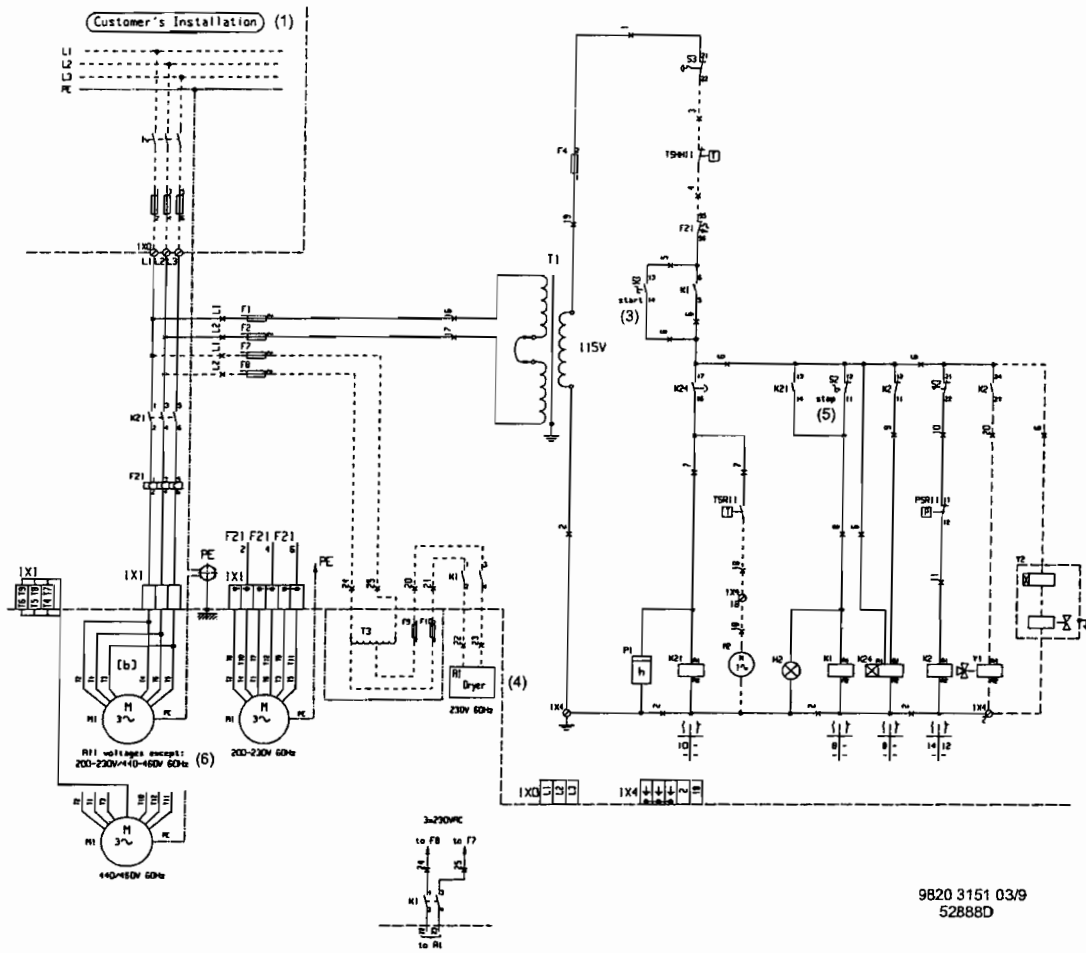


Fig. 2.9 GX5-11 IEC with transformer



9820 3151 03/9  
52888D

Fig. 2.10 GX5-11 CSA/UL with transformer

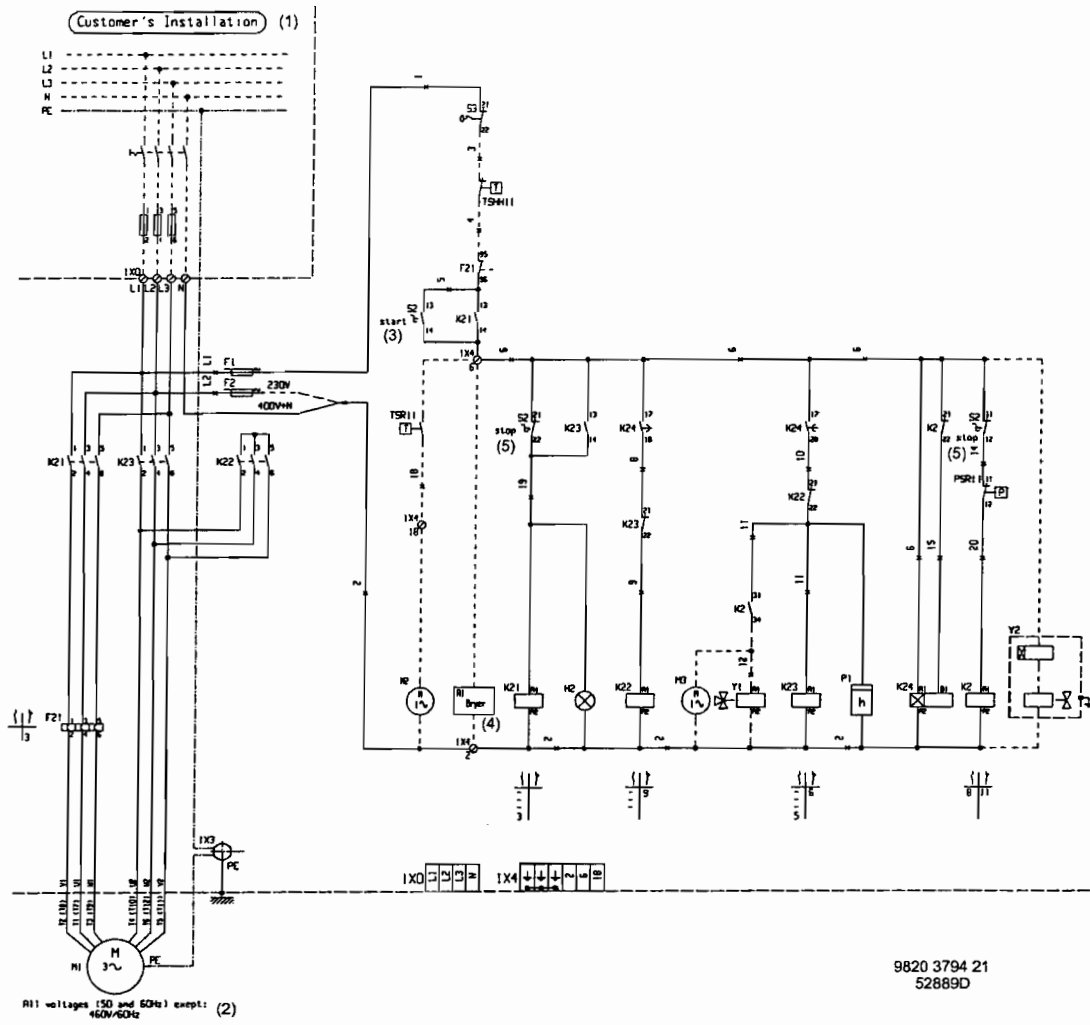


Fig. 2.11 GX15-22 IEC without transformer

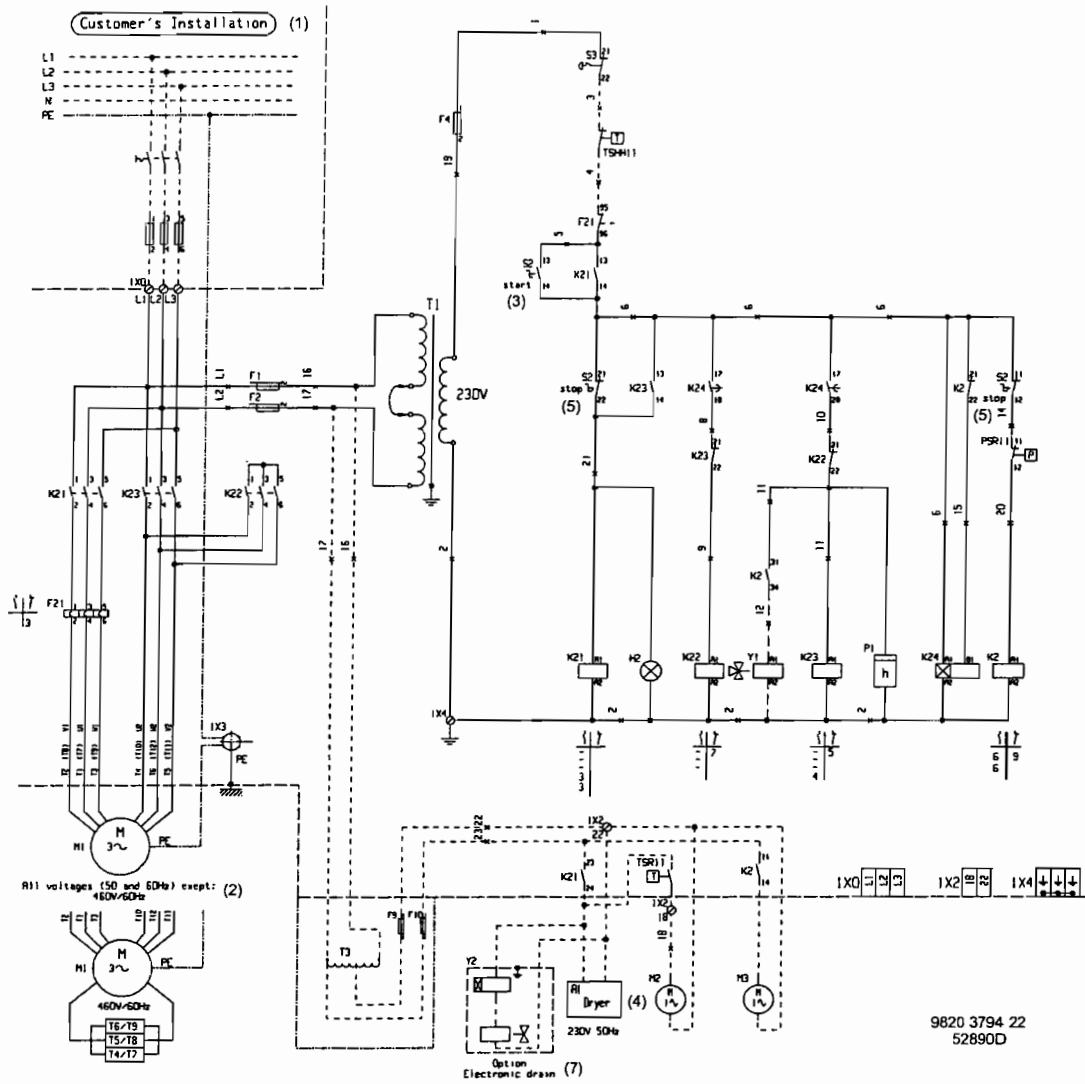
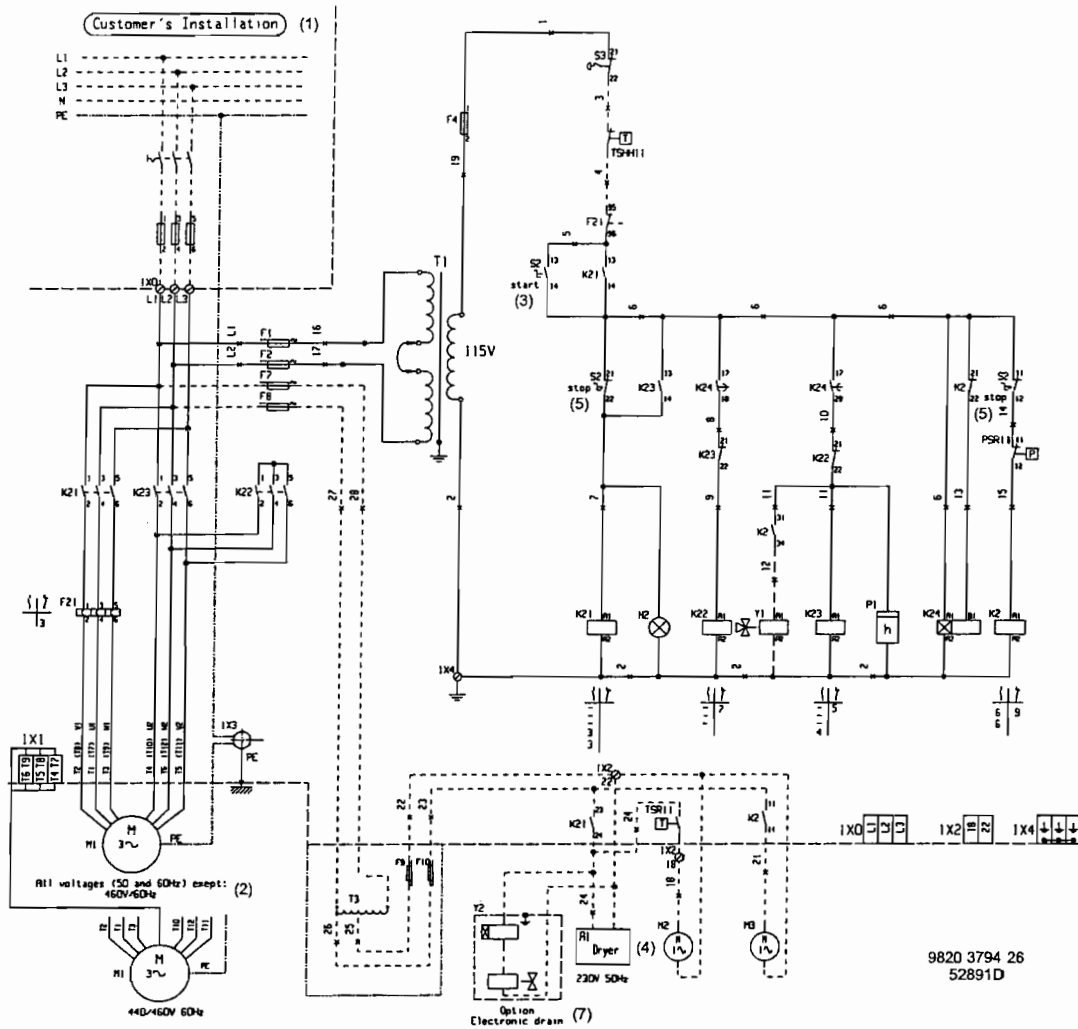


Fig. 2.12 GX15-22 IEC with transformer

9820 3794 22  
52890D



9820 3794 26  
52891D

Fig. 2.13 GX15-22 CSA/UL with transformer

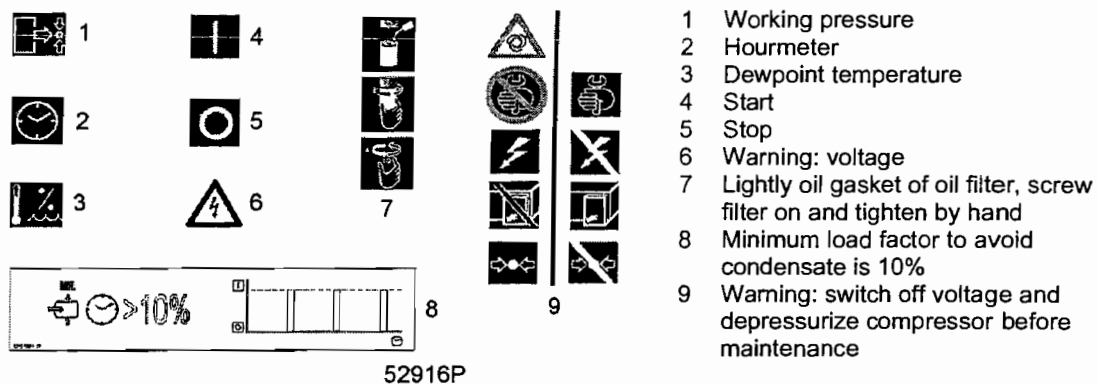
- |       |                                  |        |                                      |
|-------|----------------------------------|--------|--------------------------------------|
| A1    | Dryer (only Full-Feature units)  | M3     | Fan motor, air cooler                |
| F1-10 | Fuses                            | P1     | Hourmeter                            |
| F21   | Overload relay, compressor motor | PSR11  | Pressure switch                      |
| H2    | Lamp, automatic operation        | S2     | Start/stop switch                    |
| K1    | Auxiliary relay                  | S3     | Emergency stop button                |
| K2    | Auxiliary relay                  | T1-3   | Transformers                         |
| K21   | Line contactor                   | TSHH11 | Temperature shut-down switch         |
| K22   | Star contactor                   | TSR11  | Cooling fan switch                   |
| K23   | Delta contactor                  | Y1     | Loading solenoid valve               |
| K24   | Time relay                       | Y2     | Electronic condensate drain (option) |
| M1    | Drive motor                      | 1X0-4  | Terminal strips                      |
| M2    | Fan motor, oil cooler            |        |                                      |

Figs. 2.8 up to 2.13 Electrical diagrams

Text on Figs. 2.8 up to 2.13

- (1) Customer's installation
- (2) All voltages (50 and 60 Hz) except 460 V 60 Hz
- (3) Start
- (4) Dryer
- (5) Stop
- (6) All voltages except 200-230 V / 440-460 V 60 Hz
- (7) Electronic drain (option)

### 2.5 Pictographs (Fig. 2.14)



- 1 Working pressure
- 2 Hourmeter
- 3 Dewpoint temperature
- 4 Start
- 5 Stop
- 6 Warning: voltage
- 7 Lightly oil gasket of oil filter, screw filter on and tighten by hand
- 8 Minimum load factor to avoid condensate is 10%
- 9 Warning: switch off voltage and depressurize compressor before maintenance

Fig. 2.14 Pictographs

### 3 Operating instructions

#### Safety

The operator must apply all relevant safety precautions, including those mentioned in this book.

#### 3.1 Initial start-up

1. **For safely moving a tank-mounted model**, consult section 2.
2. **For GX5-11:** Unscrew the 3 bolts (1-Figs. 3.1 and 3.2) and remove the red transport spacers (2).
3. Consult the installation instructions in section 2.
4. Check that the electrical connections correspond to the local codes. The installation must be earthed and protected against short circuits by fuses in all phases. An isolating switch must be installed near the compressor.
5. Fit outlet valve (2-Fig. 2.7), close it and connect the air net to the valve. If provided, connect the condensate drain valves (9-Figs. 1.5 and 1.6 / 12-Figs. 1.2 up to 1.4) and automatic drain outlet (8-Figs. 1.5 and 1.6) to a drain collector. Close the valves.
6. The oil level sight-glass (8-Fig. 3.6) should be between 1/4 and 3/4 full.
7. Switch on the voltage. Start the compressor and stop it immediately. **Check the rotation direction of motor (4-Figs. 3.2 and 3.4) while the motor is coasting to a stop.** The correct rotation direction is indicated by arrow (3). If the rotation direction is wrong, switch off the voltage by opening the isolating switch and reverse two incoming electric lines.
8. Start and run the compressor for a few minutes. Check that the compressor operates normally.

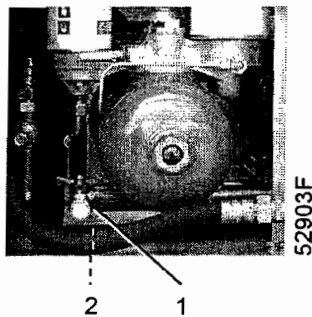


Fig. 3.1 Transport spacer GX5-11

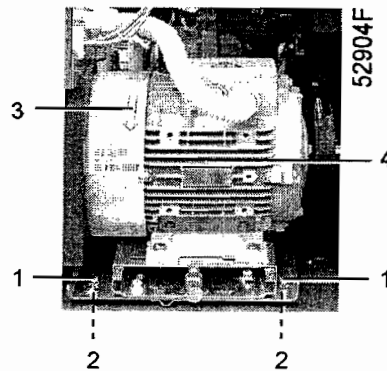


Fig. 3.2 Transport spacers GX5-11

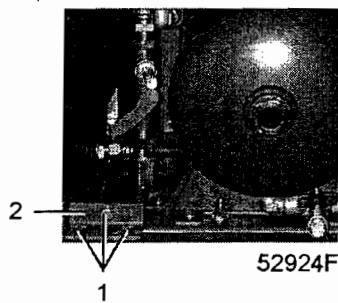


Fig. 3.3 Transport spacer GX15-22

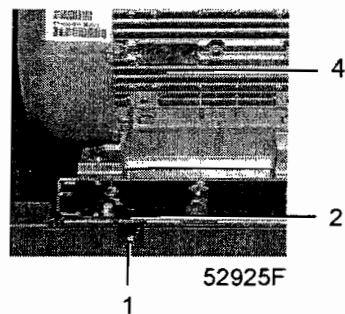
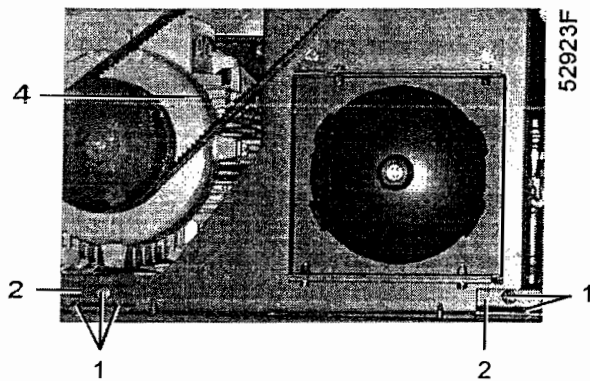


Fig. 3.4 Transport spacer GX15-22



- 1 Transport bolts
- 2 Transport spacers
- 3 Arrow, indicating rotation direction
- 4 Drive motor

Figs. 3.1 up to 3.5 Transport spacers

Fig. 3.5 Transport spacers GX15-22

### 3.2 Starting

1. Three minutes after stopping, the oil level sight-glass (8-Fig. 3.6) should be between 1/4 and 3/4 full.
2. Switch on the voltage.
3. Open air outlet valve (2-Fig. 2.7). If provided, check that the condensate drain valves (9-Figs. 1.5 and 1.6 / 12-Figs. 1.2 up to 1.4) are closed.
4. Move start/stop switch (4-Fig. 1.9) to position I; the switch will return automatically. The compressor starts running and automatic operation lamp (4) lights up. On compressors with a star-delta starter, the drive motor switches over from star to delta ten seconds after starting.

#### Attention

- The maximum number of motor starts must be limited to 20 starts per hour.
  - It is strongly recommended to operate the compressor with a load factor of more than 10% to avoid condensate in the oil.
5. Regularly check the oil level. Three minutes after stopping, the sight-glass (8-Fig. 3.6) should be between 1/4 and 3/4 full. If necessary, move start/stop switch (4-Fig. 1.9) to 0, wait until the compressor has stopped (between 45 and 60 seconds), depressurize the oil system by unscrewing oil filler plug (6-Fig. 3.6) **one turn** and wait a few minutes. Remove the plug and top up oil, until the sight-glass is 3/4 full. Fit and tighten plug (6).
  6. When automatic operation lamp (4-Fig. 1.9) is alight, the regulator is automatically controlling the compressor, i.e. loading, unloading, stopping of the motors and restarting.
  7. Regularly check the working pressure (1-Fig. 1.9) and (if applicable) the dewpoint gauge (3).
  8. For compressors with an air cooler (6-Figs. 1.1 up to 1.3), regularly check that condensate is drained (8-Figs. 1.5 and 1.6) during running.

### 3.3 Stopping

1. Move start/stop switch (4-Fig. 1.9) to position 0. The compressor switches to unloaded running for a period between 45 and 60 seconds and then stops. Lamp (4) goes out.
2. To stop the compressor immediately in case of emergency, press button (5) (to be avoided as much as possible). Lamp (4) goes out. After remedying the fault, unlock the button by pulling it out.
3. Close air outlet valve (2-Fig. 2.7) and switch off the voltage.
4. If provided, open condensate drain valves (9-Figs. 1.5 and 1.6 / 12-Figs. 1.2 up to 1.4) for a few seconds to drain possible condensate and then close the valves.

#### Attention

The air dryer, air receiver and DD/PDX filters (if provided) remain under pressure.



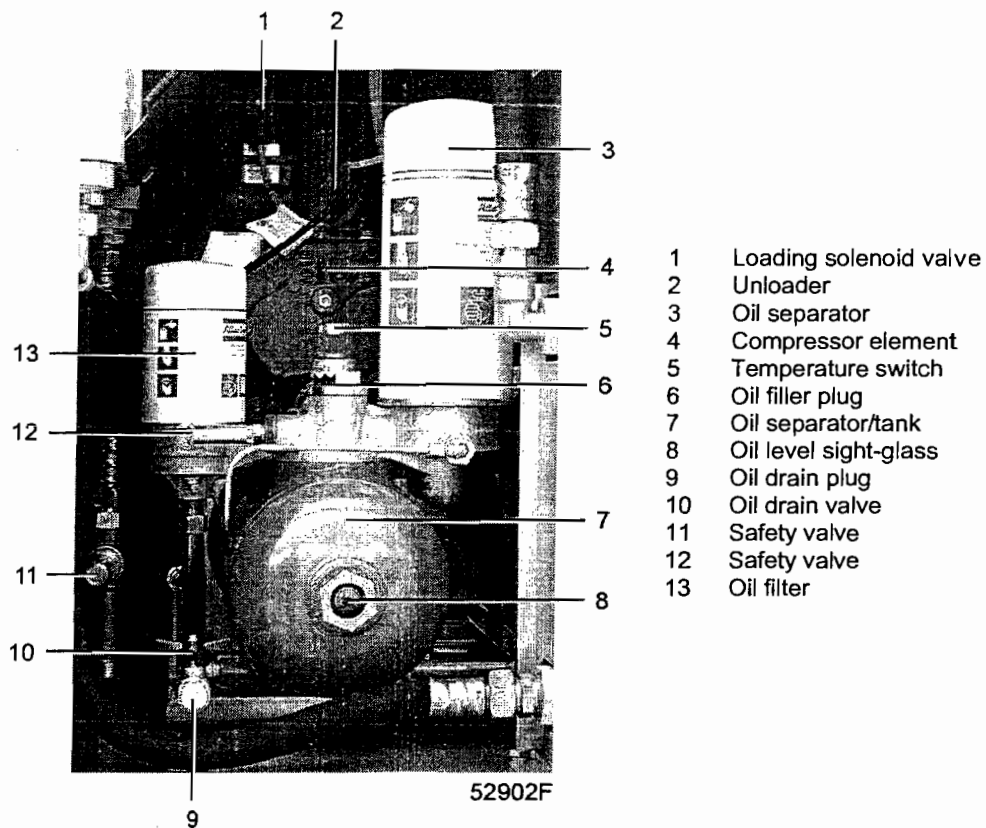


Fig. 3.6 View on oil system GX11 (typical example)

### 3.4 Taking out of operation at end of compressor service life

At the end of the service life of the compressor, proceed as follows:

1. Stop the compressor and close the air outlet valve.
2. Switch off the voltage and disconnect the compressor from the mains.
3. Depressurize the compressor by opening plug (6-Fig. 3.6) **one turn** and by opening condensate drain valves (9-Figs. 1.5 and 1.6 / 12-Figs. 1.2 up to 1.4).
4. Shut off and depressurize the part of the air net which is connected to the outlet valve. Disconnect the compressor air outlet valve from the air net.
5. Drain the oil and condensate circuits.
6. Disconnect the compressor condensate outlet and valve from the condensate net.

## 4 Maintenance

Use only authorized parts. Any damage or malfunction caused by the use of unauthorized parts is not covered by Warranty or Product Liability.

### Attention

1. Apply all relevant safety precautions, including those mentioned in this book.
2. Before carrying out any maintenance or repair on the compressor: move start/stop switch (4-Fig. 1.9) to position 0, wait until the compressor has stopped (between 45 and 60 seconds) and switch off the voltage. Open the isolating switch to prevent an accidental start.  
Close air outlet valve (2-Fig. 2.7) and depressurize the compressor by opening plug (6-Fig. 3.6) **one turn** and by opening condensate drain valves (9-Figs. 1.5 and 1.6 / 12-Figs. 1.2 up to 1.4).
3. The air outlet valve (2-Fig. 2.7) can be locked during maintenance or repair as follows:
  - Close the valve.
  - Remove the screw fixing the handle with the wrench delivered with the compressor.
  - Lift the handle and turn it until the slot of the handle fits over the blocking edge on the valve body.
  - Fit the screw.

### 4.1 Maintenance schedule

#### Attention

For overhauling or carrying out preventive maintenance, service kits are available (see section 4.3). **Atlas Copco offers also several types of Service contracts, relieving you of all preventive maintenance work.**

The **"longer interval"** checks must also include the **"shorter interval"** checks. When servicing, replace all disengaged packings, e.g. gaskets, O-rings, washers. Always use genuine Atlas Copco parts.

Whichever interval comes first. The local Sales Company may overrule the maintenance schedule, especially the service intervals, depending on the environmental and working conditions of the compressor.

Period	Running hours	See section	See notes below table	Operation
Daily	--	3.2/3.3	--	Check oil level before starting; drain condensate after stopping
3-monthly	--	--	4	Check for possible leaks
"	1000	5.9	1	Inspect coolers and condenser of dryer (Full-Feature); clean if necessary
"	1000	5.1	1/3	Inspect air filter
"	--	--	--	Inspect condensate trap; clean float valve if necessary
"	--	--	--	If installed, check service indicator on DD/PDX filter; replace filters if necessary
--	1000	5.4	--	Check tension and condition of belts. Adjust, if necessary
Yearly	--	--	--	Have safety valve tested
"	--	--	--	Have operation of electrical interlockings, motor breakers, etc. tested
"	--	--	--	Have temperature shut-down switch tested
"	2000	4.3/5.1	3	Replace air filter
"	2000	4.2/4.3/5.5	--	Replace oil filter and oil separator

Period	Running hours	See section	See notes below table	Operation
"	4000	4.2/4.3/5.5	2	If Atlas Copco Roto-Inject fluid is used, change oil
"	500	4.2/5.5	--	<b>13 bar units:</b> If mineral oil as specified in section 4.2 is used, change oil and oil filter
"	1000	4.2/5.5	--	<b>Units lower than 13 bar:</b> If mineral oil as specified in section 4.2 is used, change oil and oil filter
"	--	--	--	Clean compressor

**Notes**

1. More frequently when operating in a dusty atmosphere.
2. Recommended oil: Atlas Copco Roto-Inject fluid. For the change interval in extreme conditions of temperature, humidity or cooling air, consult Atlas Copco.
3. Replace the air filter element if damaged or heavily contaminated.
4. Any leak should be attended to immediately. Damaged flexibles must be replaced.

**4.2 Oil specifications**

**Attention**

Never mix oils of different brands or types.

**4.2.1 Atlas Copco Roto-Inject fluid**

It is strongly recommended to use Atlas Copco Roto-Inject fluid. This is special oil for scroll and screw compressors which keeps the compressor in excellent condition. Roto-Inject fluid can be used for compressors operating in ambient temperatures between 0 and 40 °C. See also section 4.3.

Although Roto-Inject fluid is recommended, mineral oil can be used after taking following precautions:

- the previously used oil should first be drained and the system flushed
- the oil filter and oil separator should be replaced
- the oil must meet the requirements as specified below

**4.2.2 Mineral oil**

Properties: high-quality, mineral oil with oxidation inhibitors and anti-foam and anti-wear properties. The viscosity grade must correspond to the ambient temperature and ISO 3448, as follows:

Ambient temperature	Viscosity grade	Viscosity index
Consistently above 25 °C	ISO VG 68	Minimum 95
Between 25 and 0 °C	ISO VG 46	Minimum 95

### 4.3 Service kits

Service kits are available offering the benefits of genuine Atlas Copco parts while keeping the maintenance budget low. The kits comprise all parts needed for servicing.

Service kits	Content	Ordering number GX5 - 11	Ordering number GX15 - 22
Filter kit	Air filter, oil filter and oil separator	2901 0919 00	2901 0866 00
Air filter kit	Filter cartridge	1613 9001 00	1613 8720 00
Oil filter kit	Filter cartridge	1513 0337 01	1613 6105 01
Oil separator kit	Filter cartridge	1622 0871 00	1622 0351 01
PDX kit	Filter cartridge	2901 0864 00	2901 0868 00
DD kit	Filter cartridge	2901 0526 00	2901 0532 00
Float kit	Drain (complete) O-rings for water separator	2901 0712 00	2901 0712 00
Roto-Inject fluid	5-litre can	2901 0245 01	2901 0245 01
Roto-Inject fluid	20-litre can	2901 0522 00	2901 0522 00

Belt sets	Content	Ordering number
GX5 - 7.5 bar	2 belts	1613 9032 02
GX5 - 10 bar	2 belts	1613 9032 04
GX5 - 13 bar	2 belts	1613 9032 04
GX7 -7.5 bar	2 belts	1613 9032 04
GX7 -10 bar	2 belts	1613 9032 08
GX7 -13 bar	2 belts	1613 9032 02
GX11 -7.5 bar	2 belts	1613 9032 06
GX11 -10 bar	2 belts	1613 9032 06
GX11 -13 bar	2 belts	1613 9032 05
GX5 -100 psi, -175 psi	2 belts	1613 9032 03
GX7 -100 psi, -175 psi	2 belts	1613 9032 04
GX11 -100 psi	2 belts	1613 9032 02
GX11 -125 psi, -175 psi	2 belts	1613 9032 05
GX15 -7.5 bar	3 belts	1613 9032 10
GX15 -10 bar	3 belts	1613 9032 18
GX15 -13 bar	3 belts	1613 9032 11
GX18 -7.5 bar	3 belts	1613 9032 11
GX18 -10 bar	3 belts	1613 9032 19
GX18 -13 bar	3 belts	1613 9032 12
GX22 -7.5 bar	3 belts	1613 9032 12
GX22 -10 bar	3 belts	1613 9032 20
GX22 -13 bar	3 belts	1613 9032 13
GX15 - 100 psi, - 125 psi	3 belts	1613 9032 09
GX15 - 150 psi, - 175 psi	3 belts	1613 9032 10
GX18 -100 psi	3 belts	1613 9032 10
GX18 -125 psi, -150 psi	3 belts	1613 9032 18
GX18 - 175 psi	3belts	1613 9032 11
GX22 -100 psi	3 belts	1613 9032 11
GX22 -125 psi, -150 psi	3 belts	1613 9032 19
GX22 -175 psi	3 belts	1613 9032 12

## 5 Adjustments and servicing procedures

### 5.1 Changing the air filter (Fig. 5.1)

1. Stop the compressor, close the air outlet valve and switch off the voltage. Remove the filter cover and the filter element (3). Discard the air filter element.
2. Fit the new element and the cover.

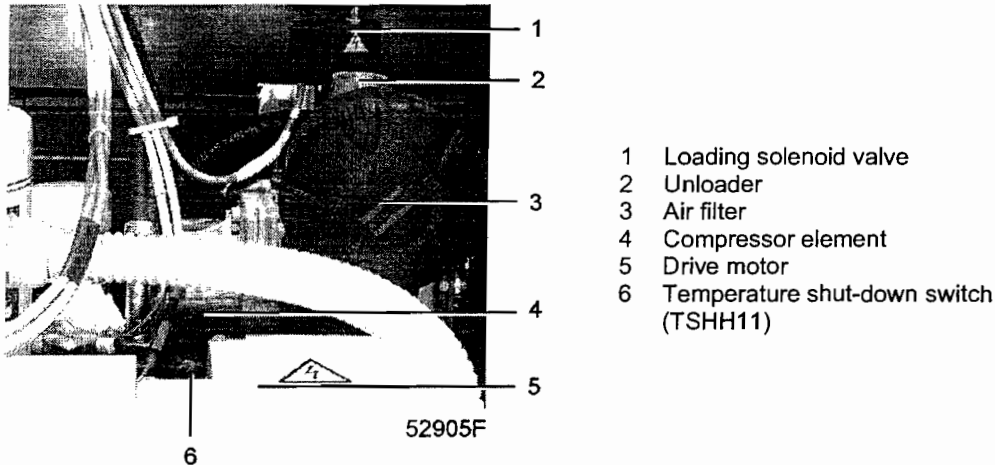


Fig. 5.1 View on air filter GX5

### 5.2 Safety valve

#### Testing

The valve can be tested on a separate compressed air line.

Before removing the valve: stop the compressor, close the air outlet valve, switch off the voltage, open drain valve (12-Figs. 1.2 up to 1.4) of the air receiver and unscrew filler plug (5-Fig. 5.3) **one turn** to permit any pressure in the system to escape.

If the valve does not open at the set pressure stamped on the valve, replace the valve.

#### Warning

No adjustments are allowed. Never run the compressor without safety valve.

### 5.3 Unload/stop pressure switch

The switch allows the operator to select the unloading/stopping pressure. See section 1.3. **Adjustment can only be carried out when the pressure switch is pressurized.**

The **unloading/stopping pressure** is controlled by adjusting screw (PSR11-Figs. 1.10 and 1.11). Turn the screw clockwise to raise the pressure, anti-clockwise to lower it.

The **pressure difference** between unloading/stopping and starting is a fixed setting of 2 bar.

### 5.4 Belt set exchange and tensioning (Fig. 5.2)

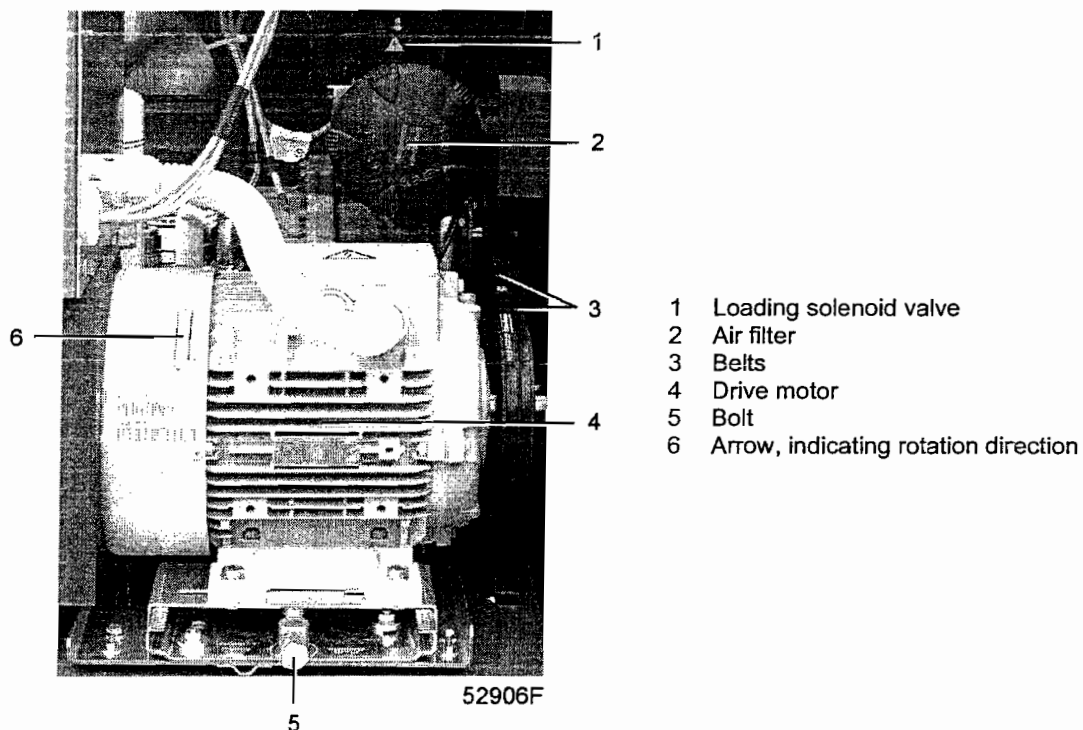


Fig. 5.2 Belt tensioning

The belts (3) must be replaced as a set, even if only one of them seems worn. Use genuine Atlas Copco belts only.

1. Stop the compressor, close the air outlet valve and switch off the voltage.
2. Loosen the tension of the belts by screwing bolt (5).
3. Replace the belts and then tension them by screwing bolt (5). Rotate the belts a few times by hand to equalize the belt tension.
4. The tension is correct if the deflection is 5 mm when exerting a force between 20 and 25 N on the belt midway between the pulleys.
5. Adjust the position of the sealing plate if necessary.
6. Check the belt tension after 50 running hours.

### 5.5 Oil, filter and separator change (Fig. 5.3)

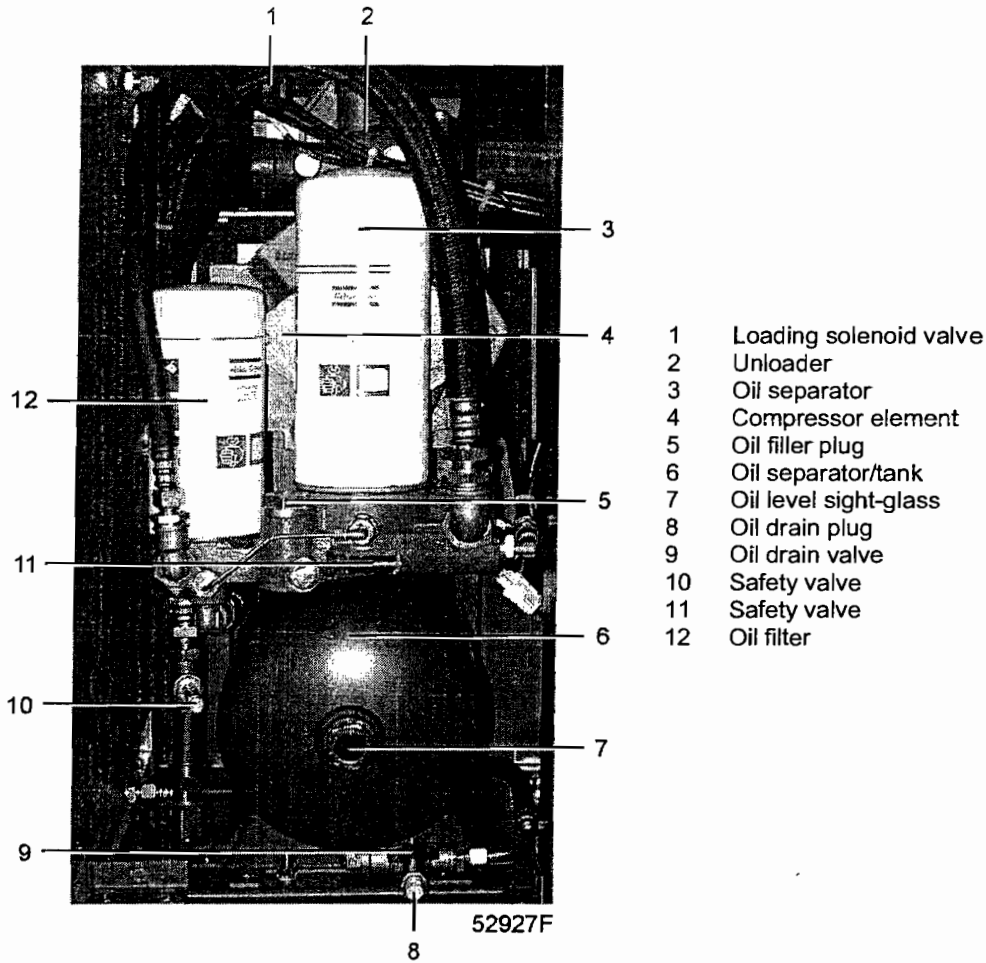


Fig. 5.3 Oil system GX15 (typical example)

1. Run the compressor until warm. Stop the compressor, close the air outlet valve, switch off the voltage and depressurize by unscrewing filler plug (5) **one turn** to permit any pressure in the system to escape. Depressurize the air receiver by opening drain valve (12-Figs. 1.2 up to 1.4).
2. Remove the plug (8). Drain the oil by opening drain valve (9). Close the valve after draining and fit the plug (8). Deliver the oil to the local oil collection service.
3. Remove oil filter (12) and separator (3). Clean the seats on the manifold. Oil the gaskets of the new filter and separator and screw them into place. Tighten firmly by hand.
4. Fill oil separator/tank (6) with oil until the level reaches the middle of sight-glass (7). Take care that no dirt drops into the system. Fit and tighten plug (5). Close drain valve (12-Figs. 1.2 up to 1.4) of the air receiver.
5. Run the compressor for a few minutes. Stop the compressor and wait a few minutes to allow the oil to settle. Depressurize the system by unscrewing filler plug (5) **one turn** to permit any pressure in the system to escape. Depressurize the air receiver by opening drain valve (12-Figs. 1.2 up to 1.4). Fill the separator/tank with oil until the sight-glass is 3/4 full. Tighten plug (5) and close drain valve (12-Figs. 1.2 up to 1.4) of the air receiver.

### 5.6 DD/PDX filter change

1. Stop the compressor, close the air outlet valve, switch off the voltage and depressurize by unscrewing filler plug (5-Fig. 5.3) **one turn** to permit any pressure in the system to escape. Depressurize the air receiver by opening drain valve (12-Figs. 1.2 up to 1.4).
2. Unscrew the bowl. A whistling noise will warn you if the bowl is not fully depressurized. If this occurs, the bowl should be screwed back. Wait until the system is fully depressurized. Unscrew the bowl once again.
3. Discard the filter element.
4. Clean the bowl and replace its O-ring.
5. Install the new filter element.
6. Reinstall the bowl.
7. Tighten filler plug (5-Fig. 5.3) and close drain valve (12-Figs. 1.2 up to 1.4).

### 5.7 Drive motor

The motor bearings are greased for life.

### 5.8 Storage after installation

If the compressor is stored without running from time to time, consult Atlas Copco as protective measures may be necessary.

### 5.9 Coolers

Keep the coolers (1 and 6 Figs. 1.1 up to 1.4) clean to maintain the cooling efficiency.

Stop the compressor, close the air outlet valve and switch off the voltage. Remove any dirt from the coolers with a fibre brush. Never use a wire brush or metal objects. Then clean by air jet.



## 6 Problem solving

### Attention

1. Apply all relevant safety precautions, including those mentioned in this book.
2. Before carrying out any maintenance or repair on the compressor: move start/stop switch (4-Fig. 1.9) to position 0, wait until the compressor has stopped (between 45 and 60 seconds) and switch off the voltage. Open the isolating switch to prevent an accidental start.  
Close air outlet valve (2-Fig. 2.7) and depressurize by opening the oil filler plug (5-Fig. 5.3) **one turn**, by opening condensate drain valve (9-Figs. 1.5 and 1.6) and by opening drain valve (12-Figs. 1.2 up to 1.4) of the air receiver.
3. The air outlet valve (2-Fig. 2.7) can be locked during maintenance or repair as follows:
  - Close the valve.
  - Remove the screw fixing the handle with the wrench delivered with the compressor.
  - Lift the handle and turn it until the slot of the handle fits over the blocking edge on the valve body.
  - Fit the screw.

For all references hereafter, consult the flow diagrams in section 1.2.

<b>1</b>	<b>Compressor starts running, but does not load after a delay time</b>
a	Solenoid valve (4) out of order
a	Replace valve
b	Inlet valve (2) stuck in closed position
b	Have valve checked
c	Leak in control air flexibles
c	Replace leaking flexible
d	Minimum pressure valve (11) leaking (when net is depressurized)
d	Have valve checked
e	Timer out of order
e	Replace timer
<b>2</b>	<b>If air cooler is provided: condensate is not discharged during loading</b>
a	Discharge flexible clogged
a	Check and correct as necessary
b	Float valve malfunctioning
b	Remove float valve assembly, clean or replace as necessary
<b>3</b>	<b>Compressor air output or pressure below normal</b>
a	Air consumption exceeds air output of compressor
a	Check equipment connected
b	Choked air inlet filter element (1)
b	Replace filter element
c	Solenoid valve (4) malfunctioning
c	Replace valve
d	Leak in control air flexibles
d	Replace leaking flexible
e	Inlet valve (2) does not fully open
e	Have valve checked
f	Oil separator (10) clogged
f	Replace separator element
g	Safety valve (9 and/or 19) leaking
g	Replace valve

<b>4</b>	<b>Air outlet temperature above normal</b>
a	Insufficient cooling air or cooling air temperature too high
a	Check for cooling air restriction or improve ventilation of compressor room. Avoid re-circulation of cooling air. If installed, check capacity of compressor room fan
b	Oil level too low
b	Check and correct as necessary
c	Oil cooler (14) clogged
c	Clean cooler
d	Temperature switch (7) malfunctioning
d	Have switch tested
e	Air cooler (15) clogged
e	Clean cooler
f	Compressor element (6) out of order
f	Consult Atlas Copco

## 7 Principal data

### 7.1 Readings on control panel 1)

#### 1-Fig. 1.9 Air outlet pressure

Reading: Modulates between preset unloading/stopping pressure and loading pressure

#### 3-Fig. 1.9 Dewpoint temperature

Reading: Approx. 3 °C 3)

### 7.2 Settings of overload relay and fuses

#### 7.2.1 GX5 up to GX11

		<b>GX5</b>	<b>GX5</b>	<b>GX7</b>	<b>GX7</b>	<b>GX11</b>	<b>GX11</b>
<b>Frequency (Hz)</b>	<b>Voltage (V)</b>	<b>Overload relay F21 (A)</b>	<b>Main fuses (A)</b>	<b>Overload relay F21 (A)</b>	<b>Main fuses (A)</b>	<b>Overload relay F21 (A)</b>	<b>Main fuses (A)</b>
<b>IEC</b>	<b>Star-delta</b>		<b>gL/gG</b>		<b>gL/gG</b>		<b>gL/gG</b>
50/60	200	15	32	20	50	31	63
50	230	13	25	17.5	32	27	63
50	400	7.5	20	10	20	15.5	32
50	500	6	16	8	20	12.5	25
60	220/230	13.5	25	18	50	26.5	63
60	440/460	7	20	9	20	13.5	32
60	380	8	20	10.5	25	15.5	32
<b>CSA/UL</b>	<b>DOL</b>		<b>CSA - UL</b>		<b>CSA - UL</b>		<b>CSA - UL</b>
60	200	25	30 - 30	33.5	40 - 40	48.5	60 - 60
60	220/230	23	25 - 30	31	35 - 35	45.5	50 - 50
60	440/460	11.5	15 - 15	15.5	20 - 20	23	30 - 30
60	575	9	15 - 15	12	20 - 20	18	25 - 25

### 7.2.2 GX15 up to GX22

		GX15	GX15	GX18	GX18	GX22	GX22
Frequency (Hz)	Voltage (V)	Overload relay F21 (A)	Main fuses (A)	Overload relay F21 (A)	Main fuses (A)	Overload relay F21 (A)	Main fuses (A)
IEC	Star-delta		gL/gG		gL/gG		gL/gG
50	200	38.8	80	47.1	100	57.5	125
60	200	38.2	80	46.9	100	55.6	125
50	230	34.2	80	40.9	100	50.7	125
50	400	19.7	50	23.6	63	29.2	80
50	500	15.8	50	19.0	50	23.2	63
60	220/230	34.6	80	42.6	100	52.0	125
60	440/460	17.3	50	21.3	50	26.0	63
60	380	20.2	50	24.9	63	31.4	80
CSA/UL	Star-delta		CSA - UL		CSA - UL		CSA - UL
60	200	38.2	90	47.6	110	60	125
60	220/230	34.6	80	42.6	100	52	125
60	440/460	17.3	40	21.3	50	26	60
60	575	13.4	30	16.2	35	20.9	50

### 7.3 Reference conditions

Air inlet pressure (absolute)	bar	1
Air inlet temperature	°C	20
Relative humidity	%	0
Working pressure	bar(e)	See nominal values in section 7.5

### 7.4 Limitations

Maximum working pressure	bar(e)	See maximum values in section 7.5
Minimum working pressure	bar(e)	4
Maximum air inlet temperature	°C	40
Minimum ambient temperature	°C	0

## 7.5 Specifications

### 7.5.1 GX5 up to GX11 1)

#### 50 Hz

Compressor type		GX5	GX7	GX11	GX5	GX7	GX11	GX5	GX7	GX11
Frequency	Hz	50	50	50	50	50	50	50	50	50
Maximum (unloading) pressure, Pack	bar(e)	7.5	7.5	7.5	10	10	10	13.0	13.0	13.0
Maximum (unloading) pressure, Full-Feature	bar(e)	7.25	7.25	7.25	9.75	9.75	9.75	12.75	12.75	12.75
Nominal working pressure	bar(e)	7.0	7.0	7.0	9.5	9.5	9.5	12.5	12.5	12.5
Temperature of air leaving outlet valve (approx.), Pack										
- Tank-mounted	°C	36	43	50	36	43	50	36	43	50
- Floor-mounted	°C	60	70	80	60	70	80	60	70	80
- with optional condensate separator (WSD)	°C	30	30	30	30	30	30	30	30	30
Temperature of air leaving outlet valve (approx.), Full-Feature	°C	23	23	24	23	23	24	23	23	24
Power input, Pack at maximum working pressure	kW	7.3	9.5	13.6	7.8	10.5	13.9	7.6	10.4	13.5
Power input, Full-Feature at maximum working pressure	kW	7.8	10.0	14.4	8.3	11	14.6	8.1	10.8	14.3
Oil capacity	l	5	5	5	5	5	5	5	5	5
Sound pressure level, Pack 2)	dB(A)	67	71	72	67	71	72	67	71	72
Sound pressure level, Full-Feature 2)	dB(A)	66	70	71	66	70	71	66	70	71

#### 60 Hz 100 - 125 psi 1)

Compressor type		GX5	GX7	GX11	GX5	GX7	GX11
Frequency	Hz	60	60	60	60	60	60
Maximum (unloading) pressure, Pack	bar(e)	7.4	7.4	7.4	9.1	9.1	9.1
Maximum (unloading) pressure, Full-Feature	bar(e)	7.15	7.15	7.15	8.85	8.85	8.85
Nominal working pressure	bar(e)	6.9	6.9	6.9	8.6	8.6	8.6
Temperature of air leaving outlet valve (approx.), Pack							
- Tank-mounted	°C	36	43	50	36	43	50
- Floor-mounted	°C	60	70	80	60	70	80
- with optional condensate separator (WSD)	°C	30	30	30	30	30	30
Temperature of air leaving outlet valve (approx.), Full-Feature	°C	23	23	24	23	23	24
Power input, Pack at maximum working pressure	kW	6.8	9.2	12.9	6.8	9.3	12.9
Power input, Full-Feature at maximum working pressure	kW	7.4	9.8	13.8	7.4	9.9	13.8
Oil capacity	l	5	5	5	5	5	5
Sound pressure level, Pack 2)	dB(A)	67	71	72	67	71	72
Sound pressure level, Full-Feature 2)	dB(A)	66	70	71	66	70	71

**60 Hz 150 - 175 psi 1)**

<b>Compressor type</b>		<b>GX5</b>	<b>GX7</b>	<b>GX11</b>	<b>GX5</b>	<b>GX7</b>	<b>GX11</b>
Frequency	Hz	60	60	60	60	60	60
Maximum (unloading) pressure, Pack	bar(e)	10.8	10.8	10.8	12.5	12.5	12.5
Maximum (unloading) pressure, Full-Feature	bar(e)	10.55	10.55	10.55	12.25	12.25	12.25
Nominal working pressure	bar(e)	10.3	10.3	10.3	12	12	12
Temperature of air leaving outlet valve (approx.), Pack							
- Tank-mounted	°C	36	43	50	36	43	50
- Floor-mounted	°C	60	70	80	60	70	80
- with optional condensate separator (WSD)	°C	30	30	30	30	30	30
Temperature of air leaving outlet valve (approx.), Full-Feature	°C	23	23	24	23	23	24
Power input, Pack at maximum working pressure	kW	6.4	9.0	12.7	6.2	8.8	12.9
Power input, Full-Feature at maximum working pressure	kW	7.0	9.7	13.6	6.8	9.3	13.8
Oil capacity	l	4.8	5	5	5	5	5
Sound pressure level, Pack 2)	dB(A)	67	71	72	67	71	72
Sound pressure level, Full-Feature 2)	dB(A)	66	70	71	66	70	71

**7.5.2 GX15 up to GX22 1)**

**50 Hz**

<b>Compressor type</b>		<b>GX15</b>	<b>GX18</b>	<b>GX22</b>	<b>GX15</b>	<b>GX18</b>	<b>GX22</b>	<b>GX15</b>	<b>GX18</b>	<b>GX22</b>
Frequency	Hz	50	50	50	50	50	50	50	50	50
Maximum (unloading) pressure, Pack	bar(e)	7.5	7.5	7.5	10	10	10	13.0	13.0	13.0
Maximum (unloading) pressure, Full-Feature	bar(e)	7.25	7.25	7.25	9.75	9.75	9.75	12.75	12.75	12.75
Nominal working pressure	bar(e)	7.0	7.0	7.0	9.5	9.5	9.5	12.5	12.5	12.5
Temperature of air leaving outlet valve (approx.), Pack										
- Tank-mounted	°C	45	50	59	45	50	59	45	50	59
- Floor-mounted	°C	70	78	91	70	78	91	70	78	91
- with optional condensate separator (WSD)	°C	30	30	30	30	30	30	30	30	30
Temperature of air leaving outlet valve (approx.), Full-Feature	°C	23	23	24	23	23	24	23	23	24
Power input, Pack at maximum working pressure	kW	19.8	23.9	28.7	18.6	22.2	26.5	19.5	23.1	27.5
Power input, Full-Feature at maximum working pressure	kW	21.1	25.6	30.9	19.9	23.9	28.8	20.4	24.2	28.8
Oil capacity	l	11	11	11	11	11	11	11	11	11
Sound pressure level 2)	dB(A)	72	73	74	72	73	74	72	73	74

**60 Hz 100 - 125 psi 1)**

<b>Compressor type</b>		<b>GX15</b>	<b>GX18</b>	<b>GX22</b>	<b>GX15</b>	<b>GX18</b>	<b>GX22</b>
Frequency	Hz	60	60	60	60	60	60
Maximum (unloading) pressure, Pack	bar(e)	7.4	7.4	7.4	9.1	9.1	9.1
Maximum (unloading) pressure, Full-Feature	bar(e)	7.15	7.15	7.15	8.85	8.85	8.85
Nominal working pressure	bar(e)	6.9	6.9	6.9	8.6	8.6	8.6
Temperature of air leaving outlet valve (approx.), Pack							
- Tank-mounted	°C	45	50	59	45	50	59
- Floor-mounted	°C	70	78	91	70	78	91
- with optional condensate separator (WSD)	°C	30	30	30	30	30	30
Temperature of air leaving outlet valve (approx.), Full-Feature	°C	23	23	24	23	23	24
Power input, Pack at maximum working pressure	kW	19.8	23.9	28.6	20.0	23.6	28.8
Power input, Full-Feature at maximum working pressure	kW	21.3	25.8	31.2	21.5	25.4	31.2
Oil capacity	l	11	11	11	11	11	11
Sound pressure level 2)	dB(A)	72	73	74	72	73	74

**60 Hz 150 - 175 psi 1)**

<b>Compressor type</b>		<b>GX15</b>	<b>GX18</b>	<b>GX22</b>	<b>GX15</b>	<b>GX18</b>	<b>GX22</b>
Frequency	Hz	60	60	60	60	60	60
Maximum (unloading) pressure, Pack	bar(e)	10.8	10.8	10.8	12.5	12.5	12.5
Maximum (unloading) pressure, Full-Feature	bar(e)	10.55	10.55	10.55	12.25	12.25	12.25
Nominal working pressure	bar(e)	10.3	10.3	10.3	12	12	12
Temperature of air leaving outlet valve (approx.), Pack							
- Tank-mounted	°C	45	50	59	45	50	59
- Floor-mounted	°C	70	78	91	70	78	91
- with optional condensate separator (WSD)	°C	30	30	30	30	30	30
Temperature of air leaving outlet valve (approx.), Full-Feature	°C	23	23	24	23	23	24
Power input, Pack at maximum working pressure	kW	18.6	22.2	26.5	19.5	23.1	27.5
Power input, Full-Feature at maximum working pressure	kW	20.0	24.1	29.0	20.5	24.4	29.1
Oil capacity	l	11	11	11	11	11	11
Sound pressure level 2)	dB(A)	72	73	74	72	72	72

## 7.6 Conversion list of SI units into US/British units

1 bar = 14.504 psi  
1 g = 0.035 oz  
1 kW = 1.341 hp (UK and US)  
1 l = 0.264 US gal  
1 l = 0.220 Imp gal (UK)  
1 l = 0.035 cu.ft  
1 l/s = 2.117 cfm  
1 mm = 0.039 in  
1 mbar = 0.401 in water column  
1 N = 0.225 lbf  
1 Nm = 0.738 lbf.ft  
x °C = (32 + 1.8 x) °F 4)

### Footnotes chapter 7

- 1) At reference conditions
- 2) According to PNEUROP PN8NTC2.2
- 3) At 20 °C ambient temperature / 100% relative humidity
- 4) A temperature difference of 1 °C = a temperature difference of 1.8 °F



## 8 Instructions for use of air receiver

1. This vessel can contain pressurized air; be aware of its potential danger in case of misuse.
2. This vessel shall only be used as compressed air/oil separator and be operated within the specified limits as mentioned on the data plate.
3. No alterations shall be made to this vessel by welding, drilling or other methods of mechanical work without written permission of the manufacturer.
4. Pressure and temperature of this vessel must be clearly indicated.
5. This vessel has been designed and built to guarantee an operational lifetime in excess of 20 years and an infinite number of pressure load cycles. Therefore, there is no intrinsic need for in service inspection of the vessel when used within the design limits and in its intended application. However, national legislation may require in service inspection.

## 9 PED (Pressure Equipment Directive)

### 9.1 Components subject to 97/23/EC Pressure Equipment Directive

Components subject to 97/23/EC Pressure Equipment Directive greater than or equal to category II

Part number	Description	PED Class
0830 1007 68	Safety valve	IV
0830 1007 70	Safety valve	IV
0830 1008 73	Safety valve	IV

### 9.2 Overall rating

The compressors are conform to PED category II.

## OWNERSHIP DATA

Compressor type: .....	Unit serial No. compressor: .....
Air dryer type: .....	Unit serial No. dryer: .....
Motor type: .....	Motor serial No.: .....
Delivery date: .....	First start-up date: .....
Service Plan: .....	Owner's machine No.: .....
Selected lubricants	
Compressor: .....	Capacity: .....
Beating grease type, electric motor: .....	Capacity: .....
Dryer gearbox: .....	
Printed Matter Nos.	
Atlas Copco compressor instruction book: .....	Atlas Copco air dryer instruction book: .....
Atlas Copco compressor parts list: .....	Atlas Copco air dryer parts list: .....
Atlas Copco logbook: .....	
Local Atlas Copco Representative	
Name: .....	
Address: .....	
Telephone: .....	Contact persons: Service: .....
Telex: .....	Parts: .....
E-mail: .....	

## SAFETY PRECAUTIONS

To be read attentively and acted accordingly before installing, operating or repairing the unit.

These recommendations apply to machinery processing or consuming air or inert gas. Processing of any other gas requires additional safety precautions typical to the application which are not included herein.

In addition to normal safety rules which should be observed with stationary air compressors and equipment, the following safety directions and precautions are of special importance.

When operating this unit, the operator must employ safe working practices and observe all related local work safety requirements and ordinances.

The owner is responsible for maintaining the unit in a safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.

Installation, operation, maintenance and repair shall only be performed by authorized, trained, competent personnel.

Normal ratings (pressures, temperatures, time settings, etc.) shall be durably marked.

Any modification on the compressor or air dryer shall only be performed in agreement with Atlas Copco and under supervision of authorized, competent personnel.

If any statement in this book, especially with regard to safety, does not comply with local legislation, the stricter of the two shall apply.

These precautions are general and cover several machine types and equipment; hence some statements may not apply to the unit(s) described in this book.

### Installation

Apart from general engineering practice in conformity with the local safety regulations, the following directives are specially stressed:

- 1 A compressor or air dryer shall be lifted only with adequate equipment in conformity with local safety rules.

Loose or pivoting parts shall be securely fastened before lifting. It is strictly forbidden to dwell or stay in the risk zone under a lifted load. Lifting acceleration and retardation shall be kept within safe limits.

Wear a safety helmet when working in the area of overhead or lifting equipment.

- 2 Any blanking flanges, plugs, caps and desiccant bags shall be removed before connecting up the pipes. Distribution pipes and connections shall be of correct size and suitable for the working pressure.
- 3 Place the unit where the ambient air is as cool and clean as possible.

If necessary, install a suction duct. Never obstruct the air inlet. Care shall be taken to minimize the entry of moisture with the inlet air.

- 4 The aspirated air shall be free from flammable fumes or vapours, e.g. paint solvents, that can lead to internal fire or explosion.
- 5 Air-cooled units shall be installed in such a way that an adequate flow of cooling air is available and that the exhausted air does not recirculate to the inlet.
- 6 Arrange the air intake so that loose clothing of people cannot be sucked in.
- 7 Ensure that the discharge pipe from the compressor to the aftercooler, air dryer or air net is free to expand under heat and that it is not in contact with or close to flammable material.
- 8 No external force may be exerted on the air outlet valve; the connected pipe must be free of strain.
- 9 If remote control is installed, the unit shall bear an obvious sign reading:

DANGER: This machine is remotely controlled and may start without warning.

As a further safeguard, persons switching on remotely controlled units shall take adequate precautions to ensure that there is no one checking or working on the machine. To this end, a suitable notice shall be affixed to the start equipment.

- 10 On units with automatic start-stop system, a sign stating "This machine may start without warning" shall be attached near the instrument panel.
- 11 In multiple compressor systems manual valves shall be installed to isolate each compressor. Non-return valves (check valves) shall not be relied upon for isolating pressure systems.
- 12 Never remove or tamper with the safety devices, guards or insulations fitted on the unit. Every pressure vessel or auxiliary installed outside the unit to contain air above atmospheric pressure shall be protected by a pressure-relieving device or devices as required.
- 13 Pipework or other parts with a temperature in excess of 80 degrees celsius and which may be accidentally touched by personnel in normal operation shall be guarded or insulated. Other high-temperature pipework shall be clearly marked.

## SAFETY PRECAUTIONS (continued)

14. If the ground is not level or can be subject to variable inclination, consult Atlas Copco.
15. The electrical connections shall correspond to the local codes. The units shall be grounded and protected against short circuits by fuses.
5. Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapours of cleaning liquids.
6. Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.

### Operation

1. Air hoses shall be of correct size and suitable for the working pressure. Never use frayed, damaged or deteriorated hoses. Use only the correct type and size of hose end fittings and connections. When blowing through a hose or air line, ensure that the open end is held securely. A free end will whip and may cause injury. Make sure that a hose is fully depressurized before disconnecting it.  
  
Never play with compressed air. Do not apply it to your skin or direct an air stream at people. Never use it to clean dirt from your clothes. When using it to clean equipment, do so with extreme caution and use eye protection.
2. The compressor is not considered as capable of producing air of breathing quality. For breathing air quality, the compressed air must be adequately purified according to local legislation and standards.
3. Never operate the units when there is a possibility of taking in flammable or toxic fumes.
4. Never operate the units at pressures below or in excess of their limit ratings as indicated on the Principal Data sheet.
5. Keep all bodywork doors shut during operation. The doors may be opened for short periods only, e.g. to carry out checks. Wear ear protectors when opening a door.
6. People staying in environments or rooms where the sound pressure level reaches or exceeds 90 dB(A) shall wear ear protectors.
7. Periodically check that:
  - a. All guards are in place and securely fastened
  - b. All hoses and/or pipes inside the unit are in good condition, secure and not rubbing
  - c. There are no leaks
  - d. All fasteners are tight
  - e. All electrical leads are secure and in good order
  - f. Safety valves and other pressure-relief devices are not obstructed by dirt or paint
  - g. Air outlet valve and air net, i.e. pipes, couplings, manifolds, valves, hoses, etc. are in good repair, free of wear or abuse
8. If warm cooling air from compressors is used in air heating systems, e.g. to warm up a workroom, take precautions against air pollution and possible contamination of the breathing air.
9. Do not remove any of, or tamper with, the sound-damping material.
5. Never weld or perform any operation involving heat near the oil system. Oil tanks must be completely purged, e.g. by steam-cleaning, before carrying out such operations.  
  
Never weld on, or in any way modify, pressure vessels.  
  
Whenever there is an indication or any suspicion that an internal part of a machine is overheated, the machine shall be stopped but no inspection covers shall be opened before sufficient cooling time has elapsed; this to avoid the risk of spontaneous ignition of the oil vapour when air is admitted.  
  
Never use a light source with open flame for inspecting the interior of a machine, pressure vessel, etc.
8. Make sure that no tools, loose parts or rags are left in or on the unit.
9. Before clearing the unit for use after maintenance or overhaul, check that operating pressures, temperatures and time settings are correct and that the control and shut-down devices function correctly. If removed, check that the coupling guard of the compressor drive shaft has been reinstalled.
10. Every time the separator element is renewed, examine the discharge pipe and the inside of the oil separator vessel for carbon deposits; if excessive, the deposits should be removed.
11. Protect the rotor, air filter, electrical and regulating components, etc. to prevent moisture from entering them, e.g. when steam-cleaning.
12. Make sure that all sound-damping material, e.g. on the bodywork and in the air inlet and outlet systems of the compressor, is in good condition. If damaged, replace it by genuine Atlas Copco material to prevent the sound pressure level from increasing.
13. Never use caustic solvents which can damage materials of the air net, e.g. polycarbonate bowls.
14. The following safety precautions are stressed when handling refrigerant:
  - a. Never inhale refrigerant vapours. Check that the working area is adequately ventilated; if required, use breathing protection.
  - b. Always wear special gloves. In case of refrigerant contact with the skin, rinse the skin with water. If liquid refrigerant contacts the skin through clothing, never tear off or remove the latter; flush abundantly with fresh water over the clothing until all refrigerant is flushed away; then seek medical first aid.
  - c. Always wear safety glasses.
15. Protect hands to avoid injury from hot machine parts, e.g. during draining of oil.

### Maintenance

Maintenance and repair work shall only be carried out under supervision of someone qualified for the job.

1. Use only the correct tools for maintenance and repair work.
2. Use only genuine spare parts.
3. All maintenance work, other than routine attention, shall only be undertaken when the unit is stopped, the main power supply is switched off and the machine has cooled down. Take positive precaution to ensure that the unit cannot be started inadvertently.  
  
In addition, a warning sign bearing a legend such as "work in progress; do not start" shall be attached to the starting equipment.
4. Before removing any pressurized component, effectively isolate the unit from all sources of pressure and relieve the entire system of pressure.
- Note: With stationary machine units driven by an internal combustion engine, allowance has to be made for extra safety precautions, e.g. spark arrestors, fuelling case, etc. Consult Atlas Copco.
- All responsibility for any damage or injury resulting from neglecting these precautions, or by non-observance of ordinary caution and due care required in handling, operating, maintenance or repair, even if not expressly mentioned in this book, will be disclaimed by Atlas Copco.

**DICHIARAZIONE DI CONFORMITA'**  
**DECLARATION DE CONFORMITE - DECLARATION OF CONFORMITY**  
**DECLARACION DE CONFORMIDAD - KONFORMITÄTSEKLRÄRUNG**

Noi AIR COM Srl - San Pietro Mosezzo, Italia -dichiariamo sotto la nostra responsabilità che  
Nous AIR COM Srl - San Pietro Mosezzo, Italie déclarons sous notre seule responsabilité que le reservoir  
We AIR COM Srl - San Pietro Mosezzo, Italy declare under our sole responsibility that the air receiver  
La empresa AIR COM Srl - San Pietro Mosezzo, Italia -declara,bajo su responsabilidad, que  
Wir AIR COM Srl - San Pietro Mosezzo, Italien - erklären in alleiniger Verantwortung, daß der Behälter

Tipo	Capacità l	Pressione di esercizio	Temperatura di esercizio	Pressione di prova	N° di lotto
Type	Capacité l	Pression de service	Temperature de service:	Pression d'épreuve	Numero
Type	Capacity l	Working pressure	Working temperature:	Hydrostatic test pressure	Batch N.
Modelo	Volumen	Presión de trabajo	Temperatura de trabajo:	Presión de prueba	N° du lot
Typ	Inhalt Ltr	Betriebsdruck bar	Betriebstemperatur:	Prüfüberdruck bar	los-Nr.
25QT1	16 l	15 bar	-10°C ÷ +120°C	22,5 bar	88

a cui si riferisce la presente dichiarazione, corrisponde ai seguenti documenti: Attestazione CE di tipo  
auquel se réfère cette déclaration est conforme à le document suivant: Attestation d'examen CE de Type  
to which this declaration relates is in conformity with the following document: EC Type-examination Certificate  
al que se refiere la presente declaración, corresponde a los siguientes documentos : Certificación CE de tipo  
auf dem sich diese Erklärung bezieht, mit dem folgendem Dokument übereinstimmt: EG - Baumuster

## TBy 105/3-1 CE0036

Conformemente alla direttiva : CE87/404  
conformément aux dispositions de la Directive : 87-404-CEE  
following the provisions of Directive : 87/404/EEC  
Conforme con la norma : CE87/404  
gemäß den Bestimmungen der Richtlinie : 87/404/EWG.

San Pietro Mosezzo, 09/07/2004

AIR COM S.r.l.

AIR COM S.r.l.Via Dante Alighieri,8/10 28060 San Pietro Mosezzo -Novara- Italy

Un corretto utilizzo del serbatoio a pressione d'aria compressa è premessa indispensabile per garantirne la sicurezza. A tale scopo l'utilizzatore deve ma non solo:

- 1) utilizzare correttamente il serbatoio nei limiti di pressione e di temperatura di progetto che sono riportati sulla targa del Costruttore e sulla dichiarazione di conformità che deve essere conservata con cura;
  - 2) evitare di effettuare saldature sulle parti esposte a pressione;
  - 3) garantirsi che il serbatoio sia sempre corredato di efficienti e sufficienti accessori di sicurezza e di controllo e provvedere in caso di necessità alla loro sostituzione con altri con equivalenti caratteristiche, sentito in merito il Costruttore. In particolare, la valvola di sicurezza deve essere applicata direttamente sul recipiente senza possibilità di interposizione, deve avere una capacità di scarico superiore alla quantità di aria che può essere immessa nel recipiente, essere tarata e piombata alla pressione di "A" bar sul manometro, l'indice di pressione di "A" bar deve essere indicato con un segno rosso;
  - 4) evitare scrupolosamente di collocare il serbatoio in locali non sufficientemente areati, in zone esposte a sorgenti di calore o nelle vicinanze di sostanze infiammabili; evitare che il serbatoio durante l'esercizio sia soggetto a vibrazioni che possono generare rotture per fatica;
  - 5) verificare regolarmente l'insorgere di eventuale corrosione interna nel serbatoio. Il sovrametallo di corrosione è di minimo 1 mm;
  - 6) l'utlavia, lo spessore effettivo del recipiente dopo corrosione non dovrà essere inferiore a mm "B" per il mantello e a mm "C" per il fondo;
  - 7) Nel corso del montaggio e messa in servizio del recipiente occorre verificare che la sicurezza di impiego sia garantita;
  - 8) Agire in ogni caso con senno e ponderatezza in analogia ai casi previsti;
- E' TASSATIVAMENTE VIETATA LA MANOMISSIONE DEL SERBATOIO E OGNI UTILIZZAZIONE IMPROPRIA.**
- Si rammenta all'utilizzatore che è comunque tenuto a rispettare le leggi sull'esercizio degli apparecchi a pressione in vigore nel Paese di utilizzo.

## NOTICES D'INSTRUCTION

L'utilisation adéquate de l'appareil à air comprimé est une condition préalable essentielle pour en garantir la sécurité. Dans ce but l'utilisateur doit:

- 1) employer l'appareil de façon appropriée dans les limites établies de pression et de température de service qui sont indiquées sur la plaque du Constructeur;
  - 2) éviter d'effectuer des soudures sur les parties à pression;
  - 3) vérifier que l'appareil soit équipé d'organes de sécurité (soupape de sécurité et pressostat) et de contrôle (manomètre) efficaces et suffisants et veiller à leur remplacement, en cas de nécessité, par d'autres organes ayant des caractéristiques équivalentes, après en avoir informé le Constructeur. En particulier, la soupape de sécurité doit être appliquée directement sur le réservoir sans possibilité d'interposition, doit avoir une capacité de décharge supérieure à la quantité d'air qui peut être admise dans le réservoir, être tarée et plombée à la pression de "A" bar. Sur le manomètre, l'index de pression de "A" bar doit être indiqué par un trait rouge;
  - 4) éviter scrupuleusement de placer l'appareil dans des locaux qui ne sont pas suffisamment aérés, dans des zones exposées à des sources de chaleur ou près de substances inflammables;
  - 5) équiper impérativement l'appareil de liaisons élastiques sur les supports inférieurs et quelque soit le modèle (fixe ou mobile) pendant son utilisation de façon à éviter des vibrations qui pourraient provoquer des ruptures par fatigues;
  - 6) éliminer tous les jours les condensations qui se forment à l'intérieur de l'appareil et chaque année, vérifier la formation de corrosion à l'intérieur; L'épaisseur effective du réservoir après corrosion ne devra pas être inférieure à mm "B" pour la virole et à mm "C" pour le fond;
  - 7) au cours du montage et de la mise en service du récipient, Vérifier que la sécurité d'emploi soit garantie;
  - 8) agir en tout cas avec bon sens pondération de manière analogue aux cas prévus;
- TOUTE MANIPULATION ET UTILISATION IMPROPRE DE L'APPAREIL SONT FORMELLEMENT INTERDITES.**
- Rappel à l'utilisateur que dans tous les cas, il est tenu de respecter la législation sur l'utilisation des appareils à pression du Pays où il en fait usage.

## INSTRUCTION FOR USE OF COMPRESSED AIR VESSELS

To ensure operation of compressed air vessels under safe conditions, the proper use of same must be guaranteed. To this purpose, the user should proceed as follows:

- 1) use the vessel properly, within the rated pressure and temperature limits stated on the constructor's plate and on the testing report, which must be kept with care;
  - 2) avoid welding on pressure parts;
  - 3) assure that the vessel is complete with suitable and adequate safety and control fittings and replace them with equivalent ones in case of necessity, prior to the Manufacturer's consent. In particular, the safety valve must be applied directly to the vessel, have a discharge capacity higher than the air intake and be set and leaded at pressure of "A" bar. The pressure value of "A" bar on the pressure gauge should be indicated with a red mark;
  - 4) avoid storing the vessel in badly ventilated rooms, near heating sources or inflammable substances;
  - 5) rule out vessel vibrations during operation, which could cause fatigue failures;
  - 6) drain condensate deposits from the vessel daily. Once a year shall be verified if internal corrosion exist;
  - 7) the actual wall thickness of the vessel after corrosion should not be smaller than "B" mm for the shell and "C" mm for the head;
  - 8) During assembly and commissioning of the pressure vessel, make sure that safe operating conditions be guaranteed;
  - 9) proceed sensibly and carefully, according to the existing prescriptions;
- TAMPERING AND IMPROPER USE OF THE VESSEL ARE FORDIDDEN.**
- The users must comply with the laws on the operation of pressure equipment in force in the relative countries.

## INSTRUCCIONES PARA EL USO

La condición indispensable para garantizar la seguridad es la utilización correcta del depósito a presión de aire comprimido. Para ello el usuario deberá observar las siguientes reglas:

- 1) utilizar de forma correcta el depósito teniendo en cuenta los límites de presión y temperatura para los que ha sido diseñado, valores que aparecen indicados en la placa del Constructor y en el documento de conformidad que debe ser cuidadosamente guardado;
  - 2) no efectuar soldaduras en las piezas a presión;
  - 3) cercionarse de que el depósito siempre vaya provisto de eficientes y suficientes accesorios de seguridad y control y en caso necesario substituirlos con otros de características equivalentes, tras conformidad del Constructor. En concreto, la valvula de seguridad debe ser aplicada directamente en el recipiente sin posibilidad de interposición, debe tener una capacidad de descarga superior a la cantidad de aire que puede ser introducida y debe ser calibrada y precintada a una presión de "A" bar. En el manometro el indice de presión de "A" bar debe estar indicado por una señal de color rojo;
  - 4) evitar cuidadosamente la colocación del depósito en locales no suficientemente ventilados, en zonas expuestas a fuentes de calor o cerca de substancias inflamables;
  - 5) evitar que el utilizo el deposito esté sujeto a vibraciones que pueden originar roturas por desgaste;
  - 6) eliminar cada día la condensa que se forma en el interior del depósito y verificar cada año la formación de eventuales corrosiones internas del mismo; De todas formas el espesor efectivo del recipiente tras la corrosión no deberá ser inferior a los "B" mm en la capa cilíndrica y a los "C" mm. en el fondo;
  - 7) Durante el montaje y puesta en función del recipiente es oportuno controlar que la seguridad de utilizo esté asegurada;
  - 8) actuar siempre con racionalidad y ponderación teniendo en cuenta los casos previstos;
- ESTA TAXATIVAMENTE PROHIBIDA LA MANIPOLACION DEL DEPOSITO Y TODA UTILIZACION INADECUADA.**
- Se recuerda que el usuario debe responder de las leyes de utilizo de las máquinas de presión vigentes en el País en el que se utilizan.

## BETRIEBSANWEISUNGEN

Die korrekte Bedienung des Druckluftbehälters ist eine unbedingbare Voraussetzung, um die Sicherheit zu gewährleisten. Zu diesem Zweck sollte der Anwender wie folgt vorgehen:

- 1) den Druckluftbehälter innerhalb der Nenn-Druck und Temperaturgrenzen verwenden, die auf dem Schild und Konformitätserklärung angegeben sind, die mit der größten Sorgfalt zu bewahren ist;
- 2) Keine Schweißungen auf drucktragenden Teilen durchführen;
- 3) sich vergewissen, daß der Behälter mit dem entsprechenden Sicherheits- und Prüfzubehör ausgestattet ist, das im Notfall durch gleichwertige Ausrüstung nach Rücksprache mit dem Hersteller zu ersetzen ist. Insbesondere muß das Sicherheitsventil unmittelbar auf den Behälter angebracht werden, eine höhere Abblasekapazität als der Lufteinlaß haben und auf einen Druck von "A" bar geeicht und plombiert werden. Auf dem Druckmesser muß der Druckwert von "A" bar in Rot gekennzeichnet sein;
- 4) sorgfältig vermeiden, daß der Druckluftbehälter in schlecht belüfteten Räumen gelagert bzw. Wärmequellen oder entflammaren Stoffen ausgesetzt wird;
- 5) ausschließen, daß der Behälter während des Betriebs Vibrationen ausgesetzt wird, die Dauerbrüche verursachen können;
- 6) das Kondensat täglich ablassen, das sich im Behälter gelegt hat und jährlich den Behälter auf innere Korrosion prüfen.
- 7) tatsächliche Wandstärke des korrodierten Behälters darf auf keinen Fall "B" mm am Mantel und "C" mm am Boden unterschreiten;
- 8) bei der Montage und Inbetriebnahme des Behälters prüfen, daß Betriebssicherheit gewährleistet ist;
- 9) immer sinnvoll und sorgfältig nach den bestehenden Vorschriften vorgehen;

**UNZUTWILLIGE BESCHÄDIGUNGEN UND MIßBRAUCH DES BEHÄLTERS SIND VERBOTEN.**

Die Anwender werden darauf hingewiesen, die im jeweiligen Land gültigen Gesetzesvorschriften über den Betrieb der Druckbehälter zu befolgen. Die Anwender werden darauf hingewiesen, die im jeweiligen Land gültigen Gesetzesvorschriften über den Betrieb der Druckbehälter zu befolgen.



# CERTIFICATE OF AUTHORIZATION

This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

**CONTROL DEVICES, INCORPORATED  
711 HANLEY INDUSTRIAL COURT  
ST. LOUIS, MISSOURI 63144**

SCOPE:

**MANUFACTURE OF PRESSURE VESSEL PRESSURE RELIEF VALVES AT THE ABOVE LOCATION ONLY (THIS AUTHORIZATION DOES NOT COVER WELDING OR BRAZING)**

AUTHORIZED: **NOVEMBER 14, 2001**  
EXPIRES: **JANUARY 20, 2005**  
CERTIFICATE NUMBER: **14,396**

A handwritten signature in cursive script, appearing to read 'Phil S. Gordon'.

CHAIRMAN OF THE BOILER  
AND PRESSURE VESSEL COMMITTEE

A handwritten signature in cursive script, appearing to read 'Alan Ba'.

DIRECTOR, ACCREDITATION AND CERTIFICATION





# CERTIFICATE OF AUTHORIZATION

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EXPIRES: **JANUARY 20, 2005**  
CERTIFICATE NUMBER: **14,396**

A handwritten signature in cursive script, appearing to read 'Richard S. Gardner'.

CHAIRMAN OF THE BOILER  
AND PRESSURE VESSEL COMMITTEE

A handwritten signature in cursive script, appearing to read 'Alan Ba'.

DIRECTOR, ACCREDITATION AND CERTIFICATION



**FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS**  
 (Alternative Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)  
 As Required by the Provision of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by AIR COM S.R.L. CSC S.R.L. - Via Cacciolo, N. 34 - 15030 Terruggia - ALESSANDRIA - ITALY  
 (Name and address of manufacturer)  
 Manufactured for ATLAS COPCO AIRPOWER N.V. - 2610 WILRIJK - BELGIUM  
 (Name and address of purchaser)  
 Location of installation Not known  
 (Name and address)

4. Type Horiz. pressure vessel T 02508 to T 02537 n.a. ULAT01CF0A0 Rev. 7 2298 to 2327 2004  
 (Horiz. or vert., tank) (Mfgr's serial Nos.) (CRN) (Drawing No.) (Natl. Bd. Nos.) (Year built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSELS CODE. The design, construction, and workmanship conform to ASME Rules, Section VIII, Division 1 2001  
 Year

to 2003 n.a. n.a.  
 Addenda (Date) Code Case Nos. Special Service per UG 120(d)

6. Shell: SA/EN 10028-2 P295GH 0.197 in. 0.010 in. 1 ft. 11.23 in. 4 ft. 8.693 in.  
 Matl. (Spec. No., Grade) Nom. Thk. (in.) Corr. Allow. (in.) Diam I.D. (ft. & in.) Length (overall) (ft. & in.)

7. Seams: UW 12 Tp. 1 No 70% No No UW 12 Tp. 2 No 1  
 Long. (Welded, Dbl., Sngl., Lap, Butt) RT (Spot or full) Eff. (%) H.T. Temp. (°F) Time (hr.) Girth (Welded, Dbl., Sngl., Lap, Butt) RT (Spot No. of Courses Partial or Full)

8. Heads: (a) Matl. SA/EN 10028-2 P295GH (b) Matl. SA/EN 10028-2 P295GH  
 (Spec. No., Grade) (Spec. No., Grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to pressure (Convex or Concave)
(a)	End	0.185 in.	0.010 in.	—	—	1.87:1	—	—	—	Concave
(b)	End	0.185 in.	0.010 in.	—	—	1.87:1	—	—	—	Concave

If removable, bolts used (describe other fastenings): n.a.  
 (Matl. Spec No., Gr., Size, No.)

9. MAWP 200 200 psi at max temp. 250 °F  
 Min. design metal temp. 18 °F at 200 psi. Hydro., Pneu., or comb. test pressure 260 psi.

10. Nozzles, Inspection and safety valve openings:

Purpose (Inlet, Outlet Drain)	No.	Diam. or Size	Type	Matl.	Nom. Thk.	Reinforcement Matl.	How Attached	Location
Inspection	2	G 2"	Coupling	SA 106 Gr. B	0.263 in.	n.a.	UW 16.1 (J)	Ends
Inlet, Outlet And Drain	1	G 3/4"	Coupling	SA 106 Gr. B	0.137 in.	n.a.	UW 16.2 (L)	Shell
	1	G 3/8"	Coupling	SA 106 Gr. B	0.197 in.	n.a.	UW 16.2 (L)	Shell

11. Supports: Skirt No Lugs No Legs 4 Other 4 Support Attached welded on shell  
 (Yes or No) (No.) (No.) (Describe) (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report  
 (Name of part, Item number, Mfgr's name and identifying stamp)

Safety valve not supplied. It is responsibility of the user  
 Girth seams: Joggle in heads UW 13.1(k)  
 Threaded couplings  
 Impact test exemption per UG 20 (f)

**CERTIFICATE OF SHOP/FIELD COMPLIANCE**

We certify that the statements made in this report are correct and that all details of design, material, construction and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1.  
 "U" Certificate of Authorization No. 33.458 Expires August 06, 2005.  
 Date 14 Sept. 2004 Company name AIR COM S.r.l. Signed Q.C. Coord.  
 (Manufacturer) (Representative)

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**CERTIFICATE OF SHOP/FIELD INSPECTION**

Vessels constructed by AIR COM S.R.L. CSC S.R.L. at Terruggia - Alessandria - ITALY.  
 I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and the State or Province of PA and employed by L.R. Insurance, Delaware have inspected the component described in this Manufacturer's Data Report on 14 Sept. 2004 and state that to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with the ASME Code Section VIII, Division 1.  
 By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in the Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 14 Sept. 2004 Signed A. BIANCHIN Commissions NB 11462 (A) - PA2679  
 (Authorized Inspector) (Natl Board (incl. endorsement), State, Prov. and No.)



**FORM U-3 MANUFACTURER'S CERTIFICATE OF COMPLIANCE**  
**COVERING PRESSURE VESSELS TO BE STAMPED WITH THE UM SYMBOL. SEE U - 1 (j)**  
**As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1**

1. Manufactured and certified by AIR COM S.r.l. - Via D. Alighieri, N. 8 - S. Pietro Mosezzo - NOVARA - ITALY  
 (Name and address of manufacturer)  
 Manufactured for ATLAS COPCO AIRPOWER N.V. - 2610 WILRIJK - BELGIUM  
 (Name and address of purchaser)  
 Location of installation Not known  
 (Name and address)

4. Type Horizontal Oil Separator 16 Liters 236297 to 236496  
 (Horiz., Vert., or Sphere) (Tank, Separator, etc.) (Capacity) (Mfg's. serial Nos.)  
n.a. OUCAT01625QT12 Rev. 1 2004  
 (CRN) (Drawing No.) (Year built)

5 ASME Code, Section VIII, Div. 1 Edition 2001 Addenda 2003 n.a.  
 [Edition and Addenda (Date)] (Code Case No.)

6. Shell (a) No. of course(s) 1 (b) Overall length (ft. & in.) 1 ft. 3.591 in.

No.	Course(s)		Material	Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A,B & C)			Heat treatment	
	Diameter O.D. (in.)	Length (ft & in.)	Specification Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
1	8.503 in.	1 ft. 3.591 in.	SA 516 Gr. 60	0.157 in.	0 in.	UW 12 Tp. 1	None	70%	UW 12 Tp. 2	None	65%	n.a.	n.a.

7. Heads (a) SA 516 Gr.60 (b) SA 516 Gr. 60  
 (Mat'l. Spec. No., Grade or Type) (H.T. - Time & Temp.) (Mat'l. Spec. No., Grade or Type) (H.T. - Time & Temp.)

	Location (Top, Bottom, Ends)	Thickness		Radius		Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to pressure		Category A		
		Min.	Corr.	Crown	Knuckle					Concave	Convex	Type	Full, Spot, None	Eff.
(a)	End	0.138 in.	0 in.	8.268 in.	1.181 in.	---	---	---	---	Concave	---	---	---	---
(b)	End	0.138 in.	0 in.	8.268 in.	1.181 in.	---	---	---	---	Concave	---	---	---	---

If removable, bolts used (describe other fastening): n.a.  
 (Mat'l. Spec No., Gr., Size, No.)

8. Type of jacket None Jacket closure n.a.  
 (Describe as ogee & weld, bar, etc.)

If bar, give dimensions; if bolted, describe or sketch

9. MAWP 216 No psi at max. temp. 250 No °F. Min. design temp. 18 °F at 216 psi  
 Internal External Internal External

10. Impact test No at test temperature of --- °F.  
 (Indicate yes or no and the component(s) impact tested)

Hydro., pneu., or comb. test press. Hydro at 281 PSI Proof test No

Nozzles, inspection and safety valve openings:

Purpose Inlet, outlet and drain	No.	Diameter or size	Type	Material	Nominal thickness	Corrosion allowance	Reinforcement material	How attached	Location
Inspection	1	G 1/2"	Coupling	SA 105	0.217 in.	0 in.	n.a.	UW 16.2 (K)	End
Inspection	1	G 1"	Coupling	SA 106 Gr. B	0.176 in.	0 in.	n.a.	UW 16.2 (K)	End
Inlet, outlet and drain	1	G 1/2"	Coupling	SA 105	0.217 in.	0 in.	n.a.	UW 16.2 (K)	Shell
	1	4.724 in O.D.	Fitting	SA 105	0.492 in.	0 in.	n.a.	UW 16.1 (I)	Shell

13. Supports: Skirt No Lugs No Legs 1 Other 1 Support Attached Welded on shell and on end  
 (Yes or No) (No.) (No.) (Describe) (Where and how)

14. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of this Report n.a.  
 (List the name of part, item number, Mfg's name and identifying number)

15 Remarks Safety valve not supplied. It is responsibility of the user  
 Girth seam: Joggle in head UW 13.1(k)  
 Threaded couplings  
 Impact test exemption per UG 20 (f)  
 Corrosion allowance not required per UG 25(d) (Non corrosive service)  
 Tested in horizontal position

**CERTIFICATE OF SHOP COMPLIANCE**

We certify that the statement made in this report are correct and that all details of design, material, construction and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII Division 1.

"UM" Certificate of Authorization No. 26,672 Expires October 22, 2004.

Date 09 July 2004 Name AIR COM S.r.l. Signed [Signature] Q.C. Coord.  
 (Manufacturer)

Certified Individual

(Representative)

‘

‘

‘

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

# Speedaire® Regulators

Refer to Form 554348 for General Safety Information and Warranty

## Description

Speedaire air pressure regulators are self-relieving, high capacity, heavy-duty units designed for commercial/industrial applications. These regulators provide high flow with minimum pressure drop (deviation between set pressure and actual outlet pressure).

## General Safety Information

Air line regulators are utilized in a variety of air system applications. Because the air line regulator and other components (compressor, spray gun, filters, lubricators, hoses, etc.) make up a high pressure pumping system, the following safety precautions should be observed at all times.

1. Read the instruction manuals for each component carefully before attempting to assemble, disassemble, or operate your particular system.
2. Do not exceed the pressure rating of any component in the system.
3. Protect material lines and air lines from damage or puncture.
4. Never point a spray gun at oneself or any other person. Accidental discharge may result in serious injury.
5. Check hoses for weak or worn condition before each use, making certain that all connections are secure.
6. Release all pressures within the system before attempting to service any component.

## Materials

Body: Aluminum  
 Bonnet: Aluminum  
 Valve: Aluminum and nylon  
 Elastomers: Nitrile  
 Bottom plug: Acetal

## Installation

1. Shut OFF air pressure. Install regulator in air line with air flow in direction of arrow on body, upstream of lubricators and cycling valves, as close as possible to the device being serviced, at any angle.
2. Connect piping to proper ports using pipe thread sealant on male threads only. Do not allow sealant to enter interior of regulator.

## Specifications

Model	Max. Inlet Press.	Temp. Range*	Max. CFM **	Main Ports	Gauge Ports	Pressure Adjustment Range	Wt. (lbs)
4ZM09	300 psi	0 to 175°F	440 cfm	3/4"	3/4"	5 to 125 psi	2.31
4ZM10	300	0 to 175	480	1	1	5 to 125	2.02
4ZM11	300	0 to 175	440	1-1/2	1-1/2	5 to 125	2.59

\* Air supply must be dry enough to avoid ice formation below +35°F.

\*\* At 150 psi inlet pressure, set pressure of 90 psi, and a 15 psi pressure drop.

## Assembly (See Figure 2)

1. Lubricate o-rings, bore in bottom plug (Ref. No. 5), valve stem (Ref. No. 10), tip of adjusting screw and adjusting screw threads inside bonnets (Ref. Nos. 1 & 17) with a light coat of good quality o-ring grease.
2. Assemble the unit as shown on Figure 2.

Torque Table Ref. No.	Inch Pounds (N-m)
12, 17 (Bonnet)	30 to 35 (3.4 to 3.9)
6 (Bottom plug)	Hand tight

3. Install a pressure gauge or plug the gauge ports. Gauge ports can also be used as additional outlets for regulated air.
4. Install a Speedaire air line filter upstream of the regulator.

## Operation (See Figure 2)

1. Before applying inlet pressure to regulator, turn adjustment (Ref. No. 1) counterclockwise to remove all force on regulating spring (Ref. No. 2).
2. Apply inlet pressure, then turn adjustment clockwise to increase and counterclockwise to decrease pressure setting.
3. Always approach the desired pressure from a lower pressure. When reducing from a higher to a lower setting, first reduce to some pressure less than that desired, then bring up to the desired pressure.
4. Push locking on knob downward to lock pressure setting; pull up to release.

## Disassembly (See Figure 2)

1. Regulator can be disassembled without removal from air line.
2. Shut OFF inlet pressure. Reduce pressure in inlet and outlet lines to zero.
3. Turn adjustment fully counterclockwise.
4. Disassemble in general accordance with the item numbers on Figure 2.

## Cleaning (See Figure 2)

1. Clean parts with warm water and soap. Do not submerge knob type bonnets in solution, as lubricant will be removed.
2. Rinse and dry parts. Blow out internal passages in body with clean, dry compressed air.
3. Inspect parts. Replace those found to be damaged.

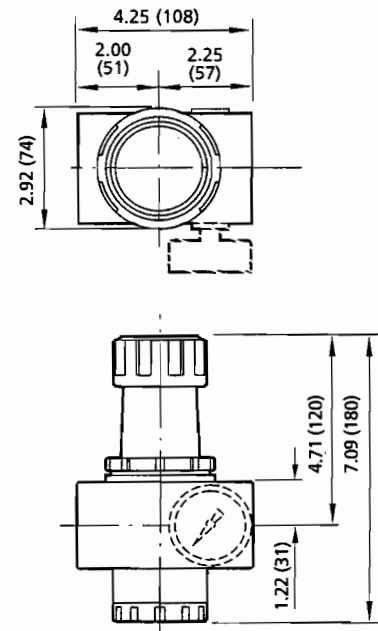


Figure 1 - Dimensions in inches (mm)

Por favor lea y guarde estas instrucciones. Léalas cuidadosamente antes de tratar de montar, instalar, operar o dar mantenimiento al producto aquí descrito. Protéjase usted mismo y a los demás observando toda la información de seguridad. ¡El no cumplir con las instrucciones puede ocasionar daños tanto personales como a la propiedad! Guarde estas instrucciones para referencia en el futuro.

# Reguladores Speedaire®

Refiérase al formulario 554348 para obtener información de seguridad y de garantía generales

## Descripción

Los reguladores de presión de aire Speedaire son unidades de autodescarga, servicio pesado y gran capacidad que han sido diseñadas para aplicaciones industriales y comerciales. Estos reguladores proporcionan un flujo elevado con caída de presión mínima (diferencia entre la presión de ajuste y la presión de salida real).

## Información general de seguridad

Los reguladores para líneas de aire se aplican a múltiples usos de los sistemas aéreos. Debido a que el regulador para líneas de aire y el resto de los componentes (compresores, filtros, reguladores, lubricadores, pulverizadores, mangueras, etc.) conforman un sistema de bombeo de alta presión, se deben tomar por seguridad las siguientes precauciones en todo momento.

1. Lea cuidadosamente los manuales de instrucciones de cada componente antes de montar, desmontar y usar su propio sistema.
2. No sobrepase las especificaciones de presión de ningún componente.
3. Proteja las líneas de material y las líneas de aire para evitar daños o perforaciones.
4. No dirija nunca el pulverizador hacia usted mismo ni hacia ninguna otra persona. Una descarga accidental podría ocasionar lesiones graves.
5. Antes de usar, verifique en cada ocasión que las mangueras no estén debilitadas ni desgastadas y asegúrese de que todas las conexiones estén fijas.
6. Alívie todas las presiones internas del sistema antes de hacerle mantenimiento a cualquier componente.

## Materiales

Cuerpo: Aluminio  
Sombbrero: Aluminio  
Válvula: Aluminio y nílón  
Elastómeros: Nitrilo  
Tapón inferior: Acetal

## Instalación

1. **INTERRUMPA** la presión de aire. Instale el regulador en la línea de aire de modo que el sentido del flujo de aire coincida con la flecha en el cuerpo del filtro, contracorriente de los lubricadores y

válvulas cíclicas, tan cerca como sea posible del dispositivo al cual se le hace mantenimiento, a cualquier ángulo.

2. Conecte la tubería al orificio de conexión correspondiente y aplíquelo compuesto obturador para roscas de tubería sólo a las roscas exteriores. No permita que el compuesto pase al interior del regulador.
3. Instale un manómetro u obture los orificios de medición. Estos se pueden utilizar también como salidas adicionales de aire regulado.
4. Instale un filtro para líneas de aire Speedaire contracorriente del regulador.

## Funcionamiento (véase la Figura 2)

1. Antes de aplicarle presión de entrada al regulador, gire el ajuste (Ref. No. 1) en sentido contrario a las manecillas del reloj para anular la fuerza sobre el resorte de regulación (Ref. No. 2).
2. Aplique presión de entrada, luego gire el ajuste en el sentido de las manecillas del reloj para aumentar y en sentido contrario a las manecillas del reloj para disminuir el ajuste de presión.
3. Debe siempre alcanzar el valor de presión deseado partiendo de uno inferior. Cuando reduzca el ajuste de presión, reduzca primero a un valor inferior al deseado y entonces aumente hasta alcanzar la presión deseada.
4. Empuje hacia abajo el anillo de fijación ubicado en la perilla a fin de fijar el ajuste de presión; suéltelo para aliviar la presión.

## Desmontaje (véase la Figura 2)

1. El regulador se puede desmontar sin necesidad de retirarlo de la línea de aire.
2. **INTERRUMPA** la presión de entrada. Reduzca a cero la presión de las líneas de entrada y salida.
3. Gire el ajuste completamente en sentido contrario a las manecillas del reloj.

4. Desmonte siguiendo en general la numeración indicada en la Figura 2.

## Limpieza (véase la Figura 2)

1. Limpie las piezas con agua tibia y jabón. No sumerja los sombreretes tipo perilla en ningún tipo de solución ya que eliminará el lubricante.
2. Enjuague y seque todas las partes. Limpie con aire comprimido limpio y seco los conductos internos del cuerpo.
3. Inspeccione las partes. Reemplace aquellas en mal estado.

## Montaje (véase la Figura 2)

1. Lubrique los anillos O, el diámetro interior del tapón inferior (Ref. No. 5), el vástago de la válvula (Ref. No. 10), las roscas y el extremo del tornillo de ajuste ubicadas en el interior de los sombreretes (Refs. No. 1 y 17) utilizando una ligera capa de grasa de buena calidad para anillos O.
2. Monte la unidad como se muestra en la Figura 2.

No. de Referencia	Nm (pulg./lbs.)
12, 17 (Sombbrero)	3,4 a 3,9 (30 a 35)
6 (Tapón inferior)	Apriete manual

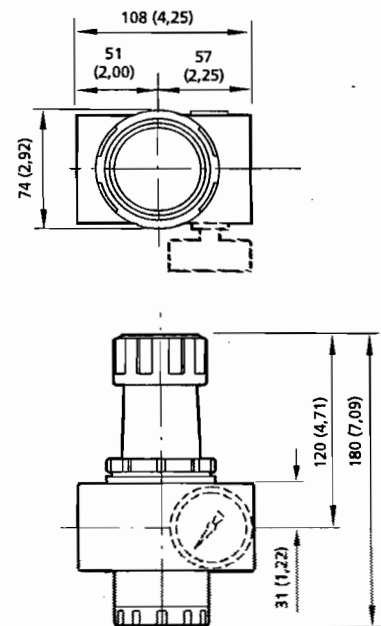


Figura 1 – Dimensiones en mm (pulg.)

## Especificaciones

Modelo	Presión entrada máx.	Gama temp.*	Valor máx. MCM **	Orificios principales	Orificios medición	Gama ajuste presión	Peso (kg)
4ZM09	2.069 kPa	-17,8 a 79,4°C	12,5 mcm	3/4 pulg.	3/4 pulg.	35 a 862 kPa	1,05
4ZM10	2.069	-17,8 a 79,4	13,6	1	1	35 a 862	0,92
4ZM11	2.069	-17,8 a 79,4	12,5	1-1/2	1-1/2	35 a 862	1,17

\* El suministro de aire debe estar suficientemente seco a fin de impedir la formación de hielo a temperaturas inferiores a 1,7°C.

\*\* A 1034 kPa de presión interna, presión establecida a 621 kPa, y 103 kPa de caída de presión.

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

## Speedaire® Air Line Filters, Regulators, Lubricators, Lockout Valves, Drains, Silencers

**IMPORTANT:** Refer to separate manual enclosed for specific product information.

**WARNING** These products are intended for use in industrial compressed air systems only, and must not be used with fluids other than air, for nonindustrial applications, or for life support systems.

Do not use these products where pressures and temperatures can exceed those listed on the product label.

Polycarbonate plastic bowls can be damaged and possibly burst if exposed to such substances as certain solvents, strong

alkalies, compressor oils containing ester-based additives, or synthetic oils. Fumes of these substances in contact with the polycarbonate bowl, externally or internally, can also result in damage. Clean with warm water only.

Use metal bowl in applications where a plastic bowl might be exposed to substances that are incompatible with polycarbonate.

If outlet pressure in excess of the regulator pressure setting could cause

downstream equipment to rupture or malfunction, install a pressure relief device downstream of the regulator. The relief pressure and flow capacity of the relief device must be greater than the maximum possible flow rate of the system connected to the inlet of the relief valve.

In lubrication applications, some oil mist may escape from the point of the use in to the surrounding atmosphere. Users are referred to safety and health standards for limiting oil mist contamination and utilization of protecting equipment.

Por favor lea y guarde estas instrucciones. Léalas cuidadosamente antes de tratar de montar, instalar, operar o dar mantenimiento al producto aquí descrito. Protéjase usted mismo y a los demás observando toda la información de seguridad. ¡El no cumplir con las instrucciones puede ocasionar daños tanto personales como a la propiedad! Guarde estas instrucciones para referencia en el futuro.

## Filtros de línea de aire, reguladores, lubricadores, válvulas de cierre, válvulas de vaciado y silenciadores Speedaire®

**IMPORTANTE:** Refiérase al manual adjunto para obtener información específica acerca del producto.

**ADVERTENCIA** Estos productos fueron fabricados exclusivamente para uso en sistemas industriales de aire comprimido y no se deben usar con ningún otro tipo de fluido que sea aire, en aplicaciones no industriales ni en sistemas de mantenimiento artificial de la vida.

No utilice estos productos cuando la presión y la temperatura excedan aquellas indicadas en la etiqueta del producto.

Los cubiletes plásticos de policarbonato pueden dañarse y explotar si se exponen a sustancias tales como solventes, álcalis

fuertes, aceites compresibles con aditivos a base de ésteres, o aceites sintéticos. Si los vapores producidos por estas sustancias entran en contacto con la parte interior o exterior del cubilete de policarbonato, se pueden producir daños. Limpie con agua tibia solamente.

Utilice el cubilete metálico en aplicaciones donde el cubilete plástico pudiera quedar expuesto a sustancias incompatibles con el policarbonato.

Si el exceso de presión de salida respecto al ajuste de presión del regulador pudiera romper o averiar el equipo aguas abajo,

instale un dispositivo de alivio de presión aguas abajo del regulador. La presión de alivio y la capacidad de conducción del dispositivo de alivio deben ser mayores que el caudal máximo del sistema conectado a la entrada de la válvula de alivio.

En aplicaciones de lubricación, podría escaparse a la atmósfera aceite en forma de aerosol. Los usuarios deben consultar las normas de salud y seguridad acerca del uso de equipo de protección y las alternativas para reducir la contaminación por aerosol de aceite.

Veillez lire et conserver ces instructions. Lire attentivement avant de commencer à assembler, installer, faire fonctionner ou entretenir l'appareil décrit. Portégez-vous et les autres en observant toutes les informations sur la sécurité. Négliger d'appliquer ces instructions peut résulter en des blessures corporelles et/ou en des dommages matériels! Conserver ces instructions pour références ultérieures.

## Filtres pour conduites d'air, régulateurs, lubrificateurs, clapets de verrouillage, drains, silencieux Speedaire®

**IMPORTANT :** Consulter le manuel spécialisé fourni avec le produit pour des informations plus détaillées.

**AVERTISSEMENT** Ces produits sont conçus pour être utilisés uniquement avec des systèmes industriels de compression d'air et non avec des fluides autres que l'air, des applications non industrielles ou des systèmes de soutien vital.

Ne pas utiliser ces produits là où les pressions et les températures peuvent excéder celles indiquées sur l'étiquette du produit.

Les cuvettes en plastique de polycarbonate peuvent être endommagées et même exploser si elles entrent en contact avec des substances telles que certains solvants, des

alkali puissants, des huiles à compresseur contenant des additifs à base d'ester ou des huiles synthétiques. Les émanations des ces substances qui entrent en contact avec la cuvette de polycarbonate, à l'extérieur ou à l'intérieur, peuvent entraîner des dommages. Nettoyer uniquement avec de l'eau chaude.

Utiliser une cuvette métallique dans des applications où les cuvettes en plastique peuvent être exposées à des substances incompatibles avec le polycarbonate.

Si la pression de sortie dépassant celle du réglage du régulateur peut entraîner des ruptures ou des malfonctions de l'équipe-

ment en aval, installer un limiteur de pression en aval du régulateur. La pression de décharge et la capacité de débit du limiteur de pression doivent excéder le débit maximum possible du système connecté à l'entrée du clapet de décharge.

Dans les applications à lubrification, un brouillard d'huile peut s'échapper du point d'utilisation et se propager dans l'atmosphère environnante. Les utilisateurs se doivent de s'informer des standards d'hygiène et de sécurité, afin de limiter la contamination par un brouillard d'huile et utiliser de l'équipement de protection.

**DAYTON ONE-YEAR LIMITED WARRANTY.** Speedaire® Air Line Filters, Regulators, Lubricators, Lockout Valves, Exhaust Reclassifiers, and Drip Leg Drains covered in this manual, are warranted by Dayton Electric Mfg. Co. (Dayton) to the original user against defects in workmanship or materials under normal use for one year after date of purchase. Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at Dayton's option. For limited warranty claim procedures, see **PROMPT DISPOSITION** below. This limited warranty gives purchasers specific legal rights which vary from jurisdiction to jurisdiction.

**LIMITATION OF LIABILITY.** To the extent allowable under applicable law, Dayton's liability for consequential and incidental damages is expressly disclaimed. Dayton's liability in all events is limited to and shall not exceed the purchase price paid.

**WARRANTY DISCLAIMER.** Dayton has made a diligent effort to provide product information and illustrate the products in this literature accurately; however, such information and illustrations are for the sole purpose of identification, and do not express or imply a warranty that the products are **MERCHANTABLE**, or **FIT FOR A PARTICULAR PURPOSE**, or that the products will necessarily conform to the illustrations or descriptions. Except as provided below, no warranty or affirmation of fact, expressed or implied, other than as stated in the **"LIMITED WARRANTY"** above is made or authorized by Dayton.

**PRODUCT SUITABILITY.** Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While Dayton attempts to assure that its products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this limited warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

**PROMPT DISPOSITION.** Dayton will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.

**GARANTIA LIMITADA DE DAYTON POR UN AÑO.** Dayton Electric Mfg. Co., Dayton le garantiza al usuario original que los modelos tratados en este manual Filtros de línea de aire, reguladores, lubricadores, válvulas de cierre, válvulas de vaciado y silenciadores Speedaire® están libres de defectos en la mano de obra o el material, cuando se les somete a uso normal, por un año a partir de la fecha de compra. Cualquier parte que se encuentre defectuosa, tanto en el material como en la mano de obra, y sea devuelta a un lugar de servicio autorizado designado por Dayton, con los costos de envío pagados por adelantado, será reparada o reemplazada a la discreción de Dayton como remedio exclusivo. Para obtener la información sobre los procedimientos de reclamo cubiertos en la garantía limitada vea **ATENCIÓN OPORTUNA** a continuación. Esta garantía limitada confiere a los compradores derechos legales específicos que varían de jurisdicción a jurisdicción.

**LIMITES DE RESPONSABILIDAD.** Hasta el punto que las leyes aplicables lo permitan, la responsabilidad de Dayton por los daños emergentes o incidentales está expresamente excluida. La responsabilidad de Dayton expresamente está limitada y no puede exceder el precio de compra pagado por el artículo.

**EXCLUSIÓN DE RESPONSABILIDAD DE LA GARANTÍA.** Dayton se ha esforzado diligentemente para proporcionar información sobre el producto en esta literatura en forma apropiada; sin embargo, tal información y las ilustraciones y descripciones tienen como único propósito la identificación del producto y no expresan ni implican garantía de que los productos son **VENDIBLES** o **ADECUADOS PARA UN PROPOSITO EN PARTICULAR** o que se ajustan necesariamente a las ilustraciones o descripciones. Con excepción de lo que se establece a continuación, Dayton no hace ni autoriza ninguna garantía o afirmación de hecho, expresa o implícita, que no sea estipulada en la **GARANTÍA LIMITADA** anterior.

**ADAPTACIÓN DEL PRODUCTO.** Muchas jurisdicciones tienen códigos o reglamentos que rigen las ventas, la construcción, la instalación y/o el uso del producto para ciertos propósitos que pueden variar con respecto a los aplicables a las zonas vecinas. Si bien Dayton trata de que sus productos cumplan con dichos códigos, no puede garantizar su conformidad y no puede hacerse responsable por la forma en que su producto se instala o usa. Antes de comprar y usar el producto, revise su aplicación y todos los códigos y regulaciones nacionales y locales aplicables, y asegúrese que el producto, la instalación y el uso los cumplan.

Ciertos aspectos de limitación de responsabilidad no se aplican a los productos del consumidor; es decir (a) algunas jurisdicciones no permiten la exclusión o la limitación de daños incidentales o emergentes, de modo que las limitaciones o exclusiones anteriores puede que no se apliquen en su caso; (b) también, algunas jurisdicciones no permiten limitar el tiempo que una garantía implícita dura, por lo tanto, la limitación anterior puede que no se aplique en su caso; y (c) por ley, durante el período que dura esta garantía limitada, las garantías implícitas de comercialización o de adecuación para un propósito en particular aplicables a los productos del consumidor comprados por consumidores no pueden ser excluidas o no pueden excluirse de la responsabilidad en alguna otra forma.

**ATENCIÓN OPORTUNA.** Dayton hará un esfuerzo de buena fe para corregir puntualmente, o hacer otros ajustes, con respecto a cualquier producto que resulte defectuoso dentro de los términos de esta garantía limitada. En el caso de que encuentre un producto defectuoso y que esté cubierto dentro de los límites de esta garantía haga el favor de escribir primero, o llame, al distribuidor de quien compró el producto. El distribuidor le dará las instrucciones adicionales. Si no puede resolver el problema en forma satisfactoria, escriba a Dayton a la dirección a continuación, dando el nombre del distribuidor, su dirección, la fecha y el número de la factura del distribuidor y describa la naturaleza del defecto. La propiedad del artículo y el riesgo de pérdida pasan al comprador en el momento de la entrega del artículo a la compañía de transporte. Si el producto se daña durante el transporte debe presentar su reclamo a la compañía de transporte.

**GARANTIE DAYTON LIMITÉE À UN AN.** Les modèles couverts dans ce manuel – Filtres pour conduites d'air, régulateurs, lubrificateurs, clapets de verrouillage, drains, silencieux Speedaire® Branco sont garantis par Dayton Electric Mfg. Co. (Dayton) à l'utilisateur d'origine contre tout défaut de matières premières ou de manutention sous usage normal, pendant un an à compter de la date d'achat. Toute pièce qui est déclarée défectueuse en matière première ou en manutention et qui est renvoyée à un lieu de service autorisé, désigné par Dayton, en port payé sera, en seule option, réparée ou remplacée au choix de Dayton. Pour le procédé de réclamation sous garantie limitée, voir **DISPOSITION RAPIDE** ci-dessous. Cette garantie limitée donne aux acheteurs des droits légaux spécifiques qui varient de juridiction à juridiction.

**LIMITES DE RESPONSABILITÉ.** La responsabilité de Dayton, dans les limites permises par la loi, pour les dommages indirects ou fortuits est expressément déniée. Dans tous les cas la responsabilité de Dayton est limitée et ne dépassera pas la valeur du prix d'achat payé.

**DÉSISTEMENT DE GARANTIE.** Dayton a fait de diligents efforts pour fournir avec précision les informations et illustrations des produits décrits dans cette brochure; cependant, de telles informations et illustrations sont pour la seule raison d'identification, et n'expriment ni n'impliquent que les produits sont **COMMERCIALISABLES**, ou **ADAPTÉS À UN BESOIN PARTICULIER**, ni que ces produits sont nécessairement conformes aux illustrations ou descriptions. Sauf pour ce qui suit, aucune garantie ou affirmation de fait, énoncée ou impliquée, autre que ce qui est énoncé dans la **"GARANTIE LIMITÉE"** ci-dessus n'est faite ou autorisée par Dayton.

**CONFORMITÉ DU PRODUIT.** De nombreuses juridictions ont des codes et règlements qui gouvernent les ventes, constructions, installation et/ou usage de produits pour certains usages qui peuvent varier par rapport à une zone voisine. Pendant que Dayton essaie de s'assurer que ses produits s'accordent avec ces codes, il ne peut pas garantir cet accord, et ne peut pas être responsable de la façon dont le produit est installé ou utilisé. Avant l'achat et l'usage d'un produit, revoir les applications de ce produit, ainsi que tous les codes et règlements nationaux et locaux applicables, et s'assurer que le produit, son installation et son usage sont en accord avec eux.

Certains aspects de désistement ne sont pas applicables aux produits pour consommateur; ex: (a) certaines juridictions ne permettent pas l'exclusion ou la limitation des dommages indirects ou fortuits et donc la limitation ou exclusion ci-dessus peut ne pas s'appliquer dans le cas présent; (b) également, certaines juridictions n'autorisent pas de limitations de durée de la garantie implicite, en conséquence, la limitation ci-dessus peut ne pas s'appliquer dans le cas présent; et (c) par force de loi, pendant la période de cette garantie limitée, toutes garanties implicites de commercialité ou d'adaptabilité à un besoin particulier applicables aux produits de consommateurs achetés par des consommateurs, peuvent ne pas être exclues ni autrement désistées.

**DISPOSITION RAPIDE.** Dayton fera un effort de bonne foi pour corriger ou ajuster rapidement tout produit prouvé défectueux pendant la période de la garantie limitée. Pour tout produit considéré défectueux pendant la période de garantie limitée, écrire ou appeler tout d'abord le concessionnaire où l'appareil a été acheté. Le concessionnaire doit donner des instructions supplémentaires. S'il est impossible de résoudre le problème de façon satisfaisante, écrire à Dayton à l'adresse ci-dessous, en indiquant le nom et l'adresse du concessionnaire, la date et le numéro de la facture du concessionnaire, et en décrivant la nature du défaut. Le titre et le risque de perte passent à l'acheteur au moment de la livraison par le transporteur. Si le produit a été endommagé pendant le transport réclamation doit être faite auprès du transport.

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Manufactured for:  
Fabricado para:  
Fabriqué pour :

Dayton Electric Mfg. Co.  
Niles, Illinois 60714 U.S.A.

**SPEEDAIRE®**

Veillez lire et conserver ces instructions. Lire attentivement avant de commencer à assembler, installer, faire fonctionner ou entretenir l'appareil décrit. Portégez-vous et les autres en observant toutes les informations sur la sécurité. Négliger d'appliquer ces instructions peut résulter en des blessures corporelles et/ou en des dommages matériels! Conserver ces instructions pour références ultérieures.

# Régulateurs Speedaire®

Consultez le formulaire 5S4348 pour les directives générales concernant la sécurité et la garantie appropriée

## Description

Les régulateurs de pression d'air de Speedaire sont des appareils à auto-décharge, à grande performance et de standard industriel, conçus pour un usage commercial et industriel. Ces régulateurs assurent un grand débit accompagné d'une chute minimale de pression (décalage entre la pression de tarage et la pression de sortie réelle).

## Informations générales sur la sécurité

Les régulateurs pour conduites d'air sont utilisés dans plusieurs types de systèmes d'air. Comme les régulateurs à conduites d'air et les autres éléments (compresseur, pistolet vaporisateur, filtres, lubrificateurs, tuyaux flexibles etc.) constituent un système de pompage d'air à haute pression, observer en tout temps les mesures de sécurité suivantes.

1. Lire attentivement le manuel d'instructions pour chaque élément avant de tenter de monter, de déposer ou d'utiliser un système particulier.
2. Ne pas dépasser la pression nominale de tout élément du système.
3. Protéger les conduites de matières ou d'air contre les dommages ou la perforation.
4. Ne jamais pointer un pistolet vers soi ou vers une autre personne. Une projection accidentelle peut entraîner des blessures graves.
5. Vérifier l'état des boyaux avant chaque utilisation en recherchant les points faibles ou les traces d'usure et s'assurer que les raccords sont sûrs.
6. Dépressuriser le système avant de réparer un élément.

## Matériaux

Corps : Aluminium  
Chapeau : Aluminium  
Clapet : Aluminium et nylon  
Élastomères : Nitrile  
Bouchon inférieur : Acétal

## Installation

1. COUPER l'alimentation en air comprimé. Installer le régulateur dans la conduite d'air pour que le débit aille dans la direction de la flèche située sur le corps, en amont des lubrificateurs et des clapets de recyclage, aussi près que possible de l'appareil concerné, dans n'importe quel angle.

## Spécifications

Modèle	Entrée de pression maximum	Plage de* température	MCM ** maximum	Orifices principaux	Jauge Orifices	Plage de réglage de pression	Poids (kg)
4ZM09	2.069 kPa	-17,8 à 79,4 °C	12,5 mcm	3/4 po	3/4 po	35 à 862 kPa	1,05
4ZM10	2.069	-17,8 à 79,4 °C	13,6	1	1	35 à 862	0,92
4ZM11	2.069	-17,8 à 79,4 °C	12,5	1-1/2	1-1/2	35 à 862	1,17

\* L'air d'alimentation doit être suffisamment sec pour empêcher la formation de glace lorsque la température chute sous 1,7 °C

\*\* À 1034 kPa (150 psi) de pression d'entrée, régler la pression à 621 kPa (90 psi) et la baisse de pression à 103 kPa (15 psi).

## Nettoyage (Voir la figure 2)

1. Nettoyer toutes les pièces avec de l'eau tiède et du savon. Ne pas submerger les chapeaux de type poignée dans la solution, ce qui enlèverait le lubrifiant.
2. Rincer et sécher les pièces. Envoyer un jet d'air propre, sec et comprimé dans les parties internes du corps.
3. Examiner les pièces. Remplacer celles qui sont endommagées.

## Montage (Voir la figure 2)

1. Lubrifier les joints toriques, l'alésage du bouchon inférieur, (n° de réf. 5), la tige de clapet (n° de réf. 10) l'extrémité de la vis de réglage et ses filets à l'intérieur du bonnet (n° de réf. 1 et 17) avec une mince couche de graisse de bonne qualité.
2. Monter l'appareil tel qu'indiqué à la figure 2.

N° de réf.	N-m (Pouce livres)
12, 17 (chapeau)	3,4 à 3,9 (30 à 35)
6 (Bouchon inférieur)	Serrage à la main

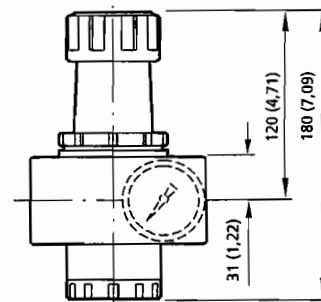
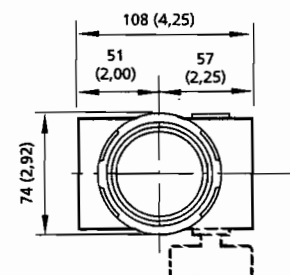


Figure 1 - Dimensions en mm (pouces)

**For Replacement Parts,  
 call 1-800-323-0620**

**24 hours a day - 365 days a year**  
 Please provide following information:

- Model number
- Serial number (if any)
- Part description and number as shown in parts list

**Para obtener repuestos,  
 en EE.UU. llame al 1-800-323-0600  
 en México llame al 95-800-527-2331**  
**Servicio permanente, 24 horas al día al año**  
 Por favor proporciónenos la siguiente información:

- Número de Modelo
- Número de Serie (si lo tiene)
- Descripción de la Parte y Número que le Corresponde en la Lista de Partes

**Pour des pièces de rechange,  
 composez le 1-800-323-0620**  
**24 heures sur 24, 365 jours par année**  
 S'il vous plaît fournir les informations suivantes :

- Numéro de modèle
- Numéro de série (s'il y en a un)
- Description de la pièce et son numéro sur la liste

**Address parts correspondence to:  
 Envíe correspondencia relacionada con  
 pedidos de partes a:  
 Correspondance :**

Grainger Parts  
 P.O. Box 3074  
 1657 Shermer Road  
 Northbrook, IL 60065-3074 U.S.A.

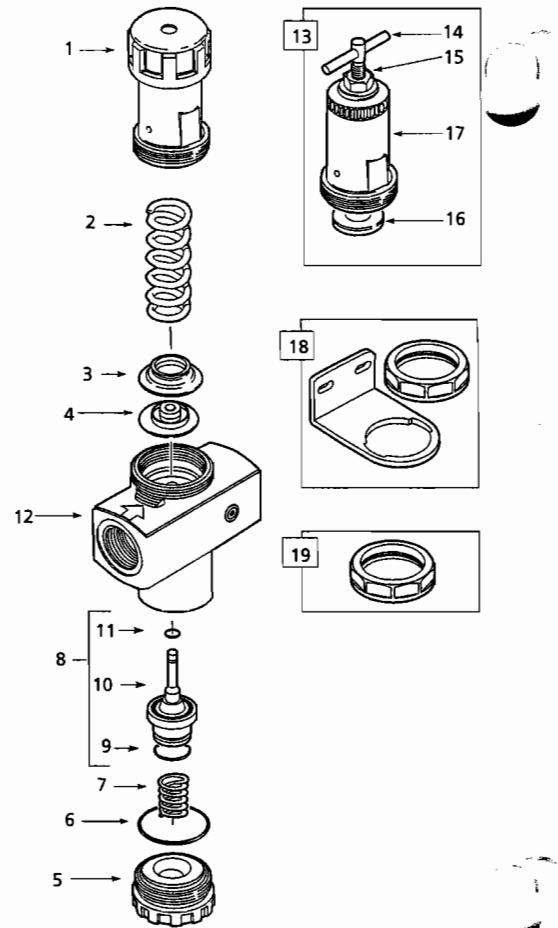


Figure 2 / Figura 2 / Figure 2

**Replacement Parts List / Lista de partes de repuesto / Liste de pièces de rechange**

Reference Number	English Description	Español Descripción	Français Description	Part Number No. de parte N° de pièce	Qty
1	Bonnet	Sombrerete	Chapeau	5663-52	1
2	Regulating spring	Resorte de regulación	Ressort de régulation	5219-01	4
3	Slipring	Anillo de frotamiento	Bague glissante	5681-89	1
4	Diaphragm	Diafragma	Diaphragme	5228-56	1
5	Bottom plug	Tapón inferior	Bouchon inférieur	5263-88	1
6	O-ring	Anillo O	Joint torique	2306-31 ▲	1
7	Valve spring	Resorte de válvula	Ressort de clapet	5264-01 ▲	1
8	Valve assy	Unidad de válvula	Ensemble de clapet	5258-52 ▲	1
9	O-ring	Anillo O	Joint torique	2370-20 ▲	1
10	Valve	Válvula	Clapet	▲	1
11	O-ring	Anillo O	Joint torique	706-01 ▲	1
12	Body	Cuerpo	Corps	■	1
13	T-handle kit	Juego de empuñadura en T	Kit de poignée en T	42K64	1
14	T-handle	Empuñadura en T	Poignée en T	1094-03	1
15	Nut	Tuerca	Écrou	1305-01	1
16	Springrest	Descanso del resorte	Appui de ressort	5297-89	1
17	Bonnet	Sombrerete	Chapeau	5663-01	1
18	Wall bracket & panel nut	Apoyo empotrado y tuerca de tablero	Support mural et écrou de panneau	42K63	1
19	Panel nut	Tuerca de tablero	Écrou de panneau	42K59	2
▲	Service kit	Juego de servicio	Kit d'entretien	5578-02	

■ Not Available as a Replacement Part.

■ No disponible como parte de repuesto.

■ Non offert en pièce de rechange.

ENGLISH

ESPAÑOL

FRANÇAIS

Manufactured for:  
 Fabricado para:  
 Fabriqué pour :

Dayton Electric Mfg. Co.  
 Niles, Illinois 60714 U.S.A.



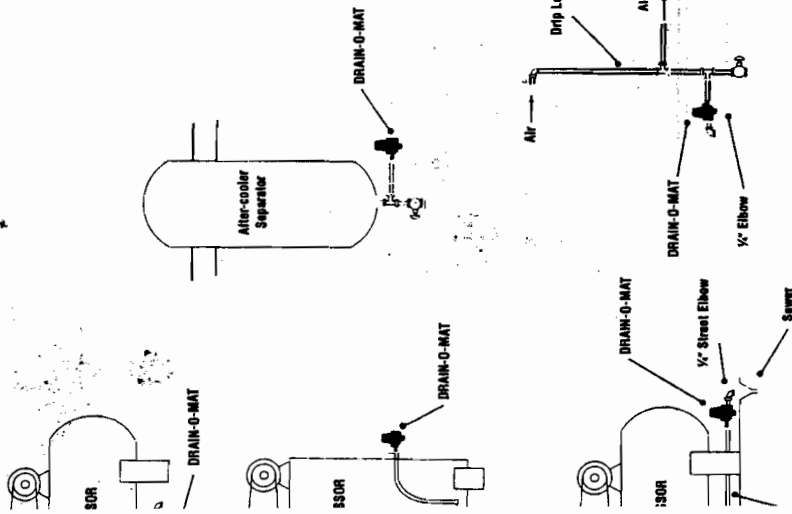




Air Compressor  
Drain

**INSTALLATIONS**

*with dome up only*



U.S. Patent No. 3,175,572  
 French Patent No. 1,384,517  
 British Patent No. 1,045,954

**Drain-O-Mat WARRANTY**

Drain-O-Mat is unconditionally guaranteed for a period of one year. During that time, should any part prove defective, it will be repaired or replaced without charge upon receipt at our factory at Hicksville, NY, transportation charges prepaid.

Our obligation under this warranty is limited to putting in proper operating condition any part or parts returned to us and which our examination shall disclose to have been defective.

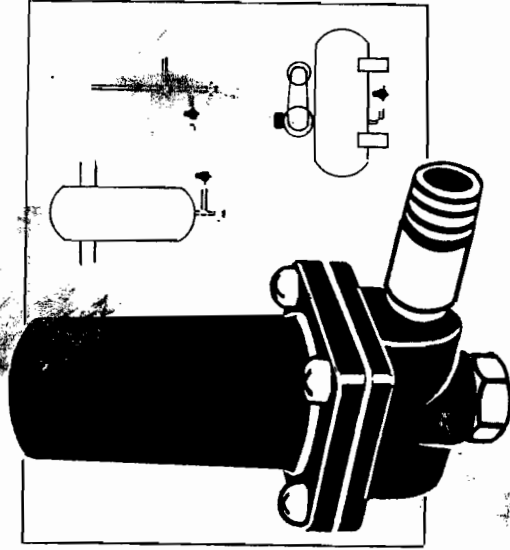
This warranty does not apply to damage due to misuse or careless handling. Air Techniques, Inc. is not liable for indirect or consequential damage or loss of any nature in connection with equipment sold by them. No charge for labor or expense required to repair defective goods or damage occasioned by them will be allowed.

This warranty is in lieu of all other warranties expressed or implied, and no representative or person is authorized to assume for us any other liability in connection with the sale of our equipment.

# DRAIN-O-MAT™

Automatic Drain Valve

Installation and Service



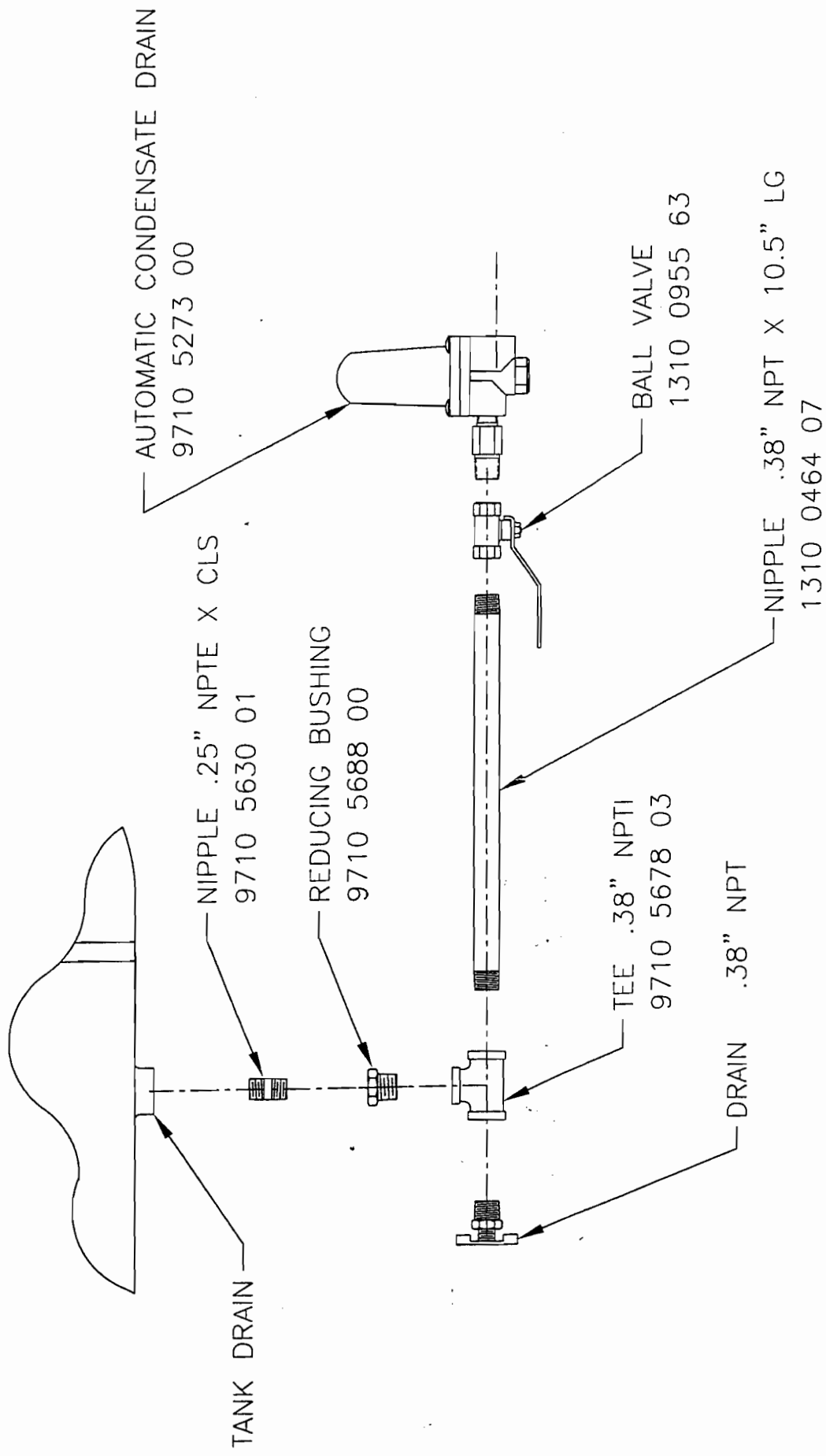
**CORPORATE HEADQUARTERS**  
 70 Caniligue Rock Rd., P.O. Box 870, Hicksville, NY 11801  
 516/433-7676 Fax 516/433-7683

**WESTERN DIVISION**  
 1591 Sunland Lane, Costa Mesa, CA 92626  
 714/435-7930 Fax 714/435-1163

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AUTOMATIC CONDENSATE DRAIN  
9710 5273 00

NIPPLE .25" NPTE X CLS  
9710 5630 01

REDUCING BUSHING  
9710 5688 00

TEE .38" NPTI  
9710 5678 03

DRAIN .38" NPT

BALL VALVE  
1310 0955 63

NIPPLE .38" NPT X 10.5" LG  
1310 0464 07

TANK DRAIN

1

2

3

MVP IV & MVP Controllerless Pump

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Version 1.4

# Operator's Manual

DURHAM GEO-ENTERPRISES

# Operating Instructions

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2175 West Park Court • PO Box 870907  
Stone Mountain, GA 30087 USA  
Telephone 770.465.7557 • Fax 770.465.7447  
Visit our Web site: [www.durhamgeo.com](http://www.durhamgeo.com)  
Printed in the USA



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# MVP IV & MVP

## INTRODUCTION

The Durham Geo-Enterprises MVP IV and MVP controllerless pneumatic pump is available with a bottom-loading feature, or in a top loading only version to deliver fluids to the surface. The pump is designed to fit in groundwater wells as small as 4 inches (102mm) in diameter. The pump uses a mechanically operated valve system to cycle the pump automatically, maintaining a constant groundwater depression level.

This manual introduces the MVP IV and MVP and provides step-by-step guidelines for successful installation and operation. **Please read this information carefully before using the pump and keep the manual handy for field reference. Failure to read this manual prior to installation and operation may result in voiding the warranty.** If you have any questions about the installation or use of these pumps or the contents of this manual, contact Durham Geo-Enterprises at:

**1-800-837-0864**

**or**

**770-465-7557**

## System Specifications

- Pump Dimensions - 3.5 in OD x 40 1/8 in Length (Top Loading)  
(89 x 1019 mm)  
3.5 in OD x 42 1/8 in Length (Bottom Loading)  
(89 x 1070 mm)

- Pump Weight – MVP IV 27 lbs. (12.3 kg) MVP 17 lbs. (7.71 kg)
- Operating Pressure - 10 psi minimum (6.9 kPa) to 100 psi maximum (689 kPa)
- Operating Temperature - 200° F maximum (49° C)
- Air Requirements - none: suggest 5 micron filtered, dry air (dew point 0° F (-17° C))
- Pumping Volume - 9 gpm @ 10 psi TDH (18 L/min @ 6.9 kPa) Top Loading  
11.0 gpm @ 10 psi TDH (38 L/min @ 6.9 kPa) Bottom Loading
- Maximum Operating Depth - 225 ft (68 m)
- Materials - T303 Stainless, with Nylon intake and discharge check balls, Delrin plastic, Buna-N bottom inlet check ball, epoxy float, Viton O-rings.

## SYSTEM COMPONENTS

This unit has been packed to help insure that it arrives at your job site ready to go. However, occasionally circumstances beyond our control may result in damage to the equipment during shipment. Please examine all packages for signs of external damage as you unpack the contents. Make a note of any damage, and contact Durham Geo-Enterprises immediately.

As you unpack the MVPIV/MVP, you will find the following components:

1. MVPIV/MVP pump
2. 4 inch (102 mm) diameter Well Clincher (optional)
3. 5-micron filter regulator assembly (optional)
4. spanner wrenches
5. manual

Available Accessories include:

1. Pre-cut bundled hose for easy installation ( Part Number TR-777)
2. SVE Attachment (919801)
3. Pulse Counter (TR-778) \* Minimum 30 p.s.i. required for pulse counter operation.

If you are missing any components or want to place an order for an accessory, please contact your Durham Geo-Enterprises representative or call our Stone Mountain office at:

**1-800-837-0864**

**or**

**770-465-7557**

### MVP IV / MVP

This manual addresses both the top loading and bottom loading MVP IV/MVP pumps (all stainless or Delrin plastic and stainless). Any references to bottom loading functions should be taken as referring to that configuration only. With the exception of the bottom, these pumps are identical in size and function and all instructions refer to both pumps unless otherwise noted.

The MVP IV consists of a stainless steel pump assembly with intake ports at the top and bottom (TR - 776), or at the top only (TR-775). The MVP consists of Delrin plastic top and bottom with a stainless body (TR-803 – bottom load, TR-802 – top load). The intake port on the top of the MVP utilizes a nylon check valve to seal at operating pressures as low as 10 psi (69 kPa). The fluid intake port at the bottom consists of a Buna-N check ball in a stainless steel seat. An Epoxy float riding on a stainless steel carrier provides the mechanical system that cycles the pump.

### WELL CLINCHER

The MVP IV/MVP pump system comes standard with a 4" (102 mm) pipe diameter Well Clincher which is used at the well head for pump support, air supply and fluid discharge connections. For larger diameter wells, 6", 8", and 12" Well Clinchers are also available. The clincher provides a seal, isolating the well from surface contaminants.

The Well Clincher is made of machined PVC so that the inner diameter matches the outer diameter of 4"

(102 mm) PVC well monitor pipe. It comes complete with all the brass fittings required to connect to the MVP IV/MVP pump system, as well as a stainless steel chain and connector to attach a support cable.

## HOSES

The following is a description of the hoses required to operate the MVP IV/MVP pump system:

1. The down-hole hose assembly (TR-770) includes:
  - a *white* 1/4-inch (6.4 mm) nylon supply hose
  - a *black* 3/4-inch (19 mm) ID Nitrile (Buna-N) discharge hose
  - a *black* 3/8-inch (9.5 mm) ID Nitrile (Buna-N) air exhaust hose

\* NOTE: Nylon coated stainless restraint cable can be ordered separately (918702).

2. The 1/4" (6.4 mm) air supply and 3/4" (19 mm) fluid discharge connections on the Well Clincher are sized to work with the Durham Geo-Enterprises tubing.

## AIR SOURCE

The air consumption rate of the MVP IV/MVP pump system will depend on several site-specific variables including operating air pressure and total fluid recovery rate. A worksheet in Appendix A shows the air consumption for the pump system. Once the air consumption rate has been determined, a local air compressor dealer will be able to specify the appropriate size compressor (and air dryer if applicable).

The MVP IV/MVP pump system uses compressed air to displace the water in the pump and force it to the surface. Due to the wide variation in compressor requirements for each site, an air source is not included with the MVP IV/MVP pump system. When determining the appropriate size for your system compressor, you need to consider the following factors:

1. The number of pumps to be installed
2. The total length of air line running to the pumps and the diameter of the air lines

3. The system operating pressure
4. Other air requirements that the complete remediation system will impose
5. Operational depth of the pumps

For more information refer to Appendix A or contact Durham Geo-Enterprises's technical service staff. By walking through questions similar to those above, we can help size a compressor appropriate for your needs.

#### **Notice**

**Durham Geo-Enterprises recommends using clean, dry air to prolong the life of the MVP IV/ MVP and to prevent further contamination in the groundwater. In freezing temperatures, the addition of an air dryer is recommended to prevent the air lines from freezing.**

#### AIR FILTRATION

A 5-micron particulate filter with auto drain assembly is included with each MVP IV/MVP pump system. **This assembly should never be submerged in water.** It should be installed at the well head to supply proper working pressures of 10 psi (69 kPa) to 125 psi (861 kPa).

#### **CAUTION**

**Air pressures greater than 125 psi (861 kPa) applied to the MVP IV/MVP may damage the mechanical system and result in voiding the warranty.**

## PRINCIPLES OF OPERATION

The MVP IV/MVP pumps fluids by air displacement with compressed air forcing the fluids out of the pump chamber to the surface.

The MVP IV/MVP operates in two stages: the ON, or discharge stage, and the OFF, or filling stage. The stages are controlled by a float that rides on top of the fluid inside the pump chamber. When the pump is in the OFF stage, the bottom and top inlet valves are open and fluid is entering the chamber. As the chamber fills, the float reaches the top of its travel, mechanically opening the air inlet valve putting the pump in the ON or discharge stage. During the ON stage, pressurized air closes the top and bottom inlet valves forcing the fluid to evacuate the pump chamber through the discharge pipe.

When all of the fluid has been pumped from the chamber, the float, which has now reached its lower limit, simultaneously closing the air inlet valve and opening the air exhaust valve to stop pressurizing the chamber. This allows the chamber to exhaust, opening the inlets and beginning the OFF stage.

This cycle is repeated as rapidly as the pump fills up with fluid; this is how the MVP IV/MVP automatically determines its own pumping rate. If needed, the pumping rate can be decreased by regulating the air pressure, or restricting the air exhaust or discharge lines.

The MVP IV/MVP is designed to maintain a drawn down fluid level in the well, level with the top of the pump. This level is 34 inches (864 mm) from the bottom of the pump and is located approximately at the seam that separates the pump top from the pump chamber. If the MVP IV/MVP is being used in the "top loading only" configuration, the fluid level will be maintained 40 1/8 inches (1019 mm) from the bottom of the pump, flush with the top of the pump (at the level of the inlet valve).

The standard MVP IV/MVP pump system, configured for bottom loading, is designed to pump a

maximum of 11.0 gpm (42 L/min). The MVP IV/MVP with the top-loading only feature will pump a maximum of 9 gpm (34 L/min).



## **INSTALLATION AND OPERATION**

The MVP IV/MVP may be used to remove fluids from wells that are 4 inches (102 mm) in diameter or larger. The location of the pump relative to the air supply and the recovery system on the surface will differ from site to site. Similarly, the length of discharge and air hoses required to connect the pump may vary. Otherwise, the installation and operation of the MVP IV/MVP are essentially the same for any application.

### **WARNING:**

**Any electrical components used in an explosive atmosphere must be located in compliance with Chapter 5 of the National Electrical Code and any other local codes. This would apply to electrically powered air compressors as well.**

### **INSTALLATION PROCEDURE \*\*\*Be Sure Packing Bubble Wrap Is Removed From Inside Pump Prior To Installation.**

1. Determine at what depth the pump will be installed. Measure from the top of the pump head (at the depth that the pump will be set) to the top of the well casing and add 6 inches to the cut hose length.
2. Be sure the riser pipe has a minimum of 6" (152 mm) stick up and is cut square.

### **Connecting to the Pump**

1. Discharge- Push the 3/4" (19 mm) discharge hose over the Push-Loc barb ("D"). Lubricating the barb with soap or silicone prior to pushing the hose on will simplify this process. Push the hose until it stops against the yellow collar.
2. Air supply- Attach the 1/4" (6.4 mm) nylon tubing to the Push-In fitting ("A"). Push the tube firmly into the fitting until it bottoms out into the fitting. Pull the hose to insure that it is secure.

3. Air Exhaust- Push the 3/8" (9.5 mm) hose over the Push-Loc barb ("E"). Lubricating the barb with soap or silicone prior to pushing the hose on will simplify this process. Push the hose on until it stops against the shoulder barb. No hose clamp is required.
4. Safety cable- Connect the safety cable to the eye bolt on top of the pump. Use the quick connect provided to make this connection.

## Connect to the Well Clincher

1. Discharge- Push the 3/4" (19 mm) nylon tubing to the Push-Loc barb on the bottom side of the clincher. Push the hose on until it stops against the yellow collar. No clamp is required. Lubricating the hose prior to sliding it over the barb will simplify this process.
2. Air supply- Attach the 1/4" (6.4 mm) nylon tubing into the Push-In fitting closest to the outside of the well clincher. Push the tube in until it bottoms out. Pull to insure the tubing is secure.
3. Safety cable- Pull the cable tight and form a loop using the cable clamps provided. Attach this cable to the SS chain using the quick connect link. The cable must carry the weight of the pump.
4. Air exhaust- In most installations the pump will exhaust into the well. For this application cut the exhaust hose off 1 foot (30.5 cm) from the bottom of the well clincher. Attach the 180 degree assembly to the hose to direct the exhaust down the well. Should it be necessary to exhaust to atmosphere, connect the hose to the 3/8" (9.5 mm) barb on the bottom side of the well clincher.
5. Place the pump into the well and place the Clincher on top of the well.

## Connection above the well

1. Attach the filter/regulator mount to the top of the Clincher using the two screws that is threaded into the top of the Clincher. Mount the filter into the mount.
2. Discharge- Connect a 3/4" (19 mm) discharge hose to the 3/4" (19 mm) 90 degree fitting on top of the well clincher. Slide the hose on until it stops against the yellow collar. Connect the other end of the hose to the discharge line.
3. Air Supply- Attach a 12" (304 mm) piece of 1/4" (6.4 mm) nylon tubing to the Push-In fitting closest to

the edge of the well Clincher. Attach the opposite end into the Push-in fitting on the outlet side of the filter regulator. Push into the fitting until the tube bottoms out. Pull to insure it is secure.

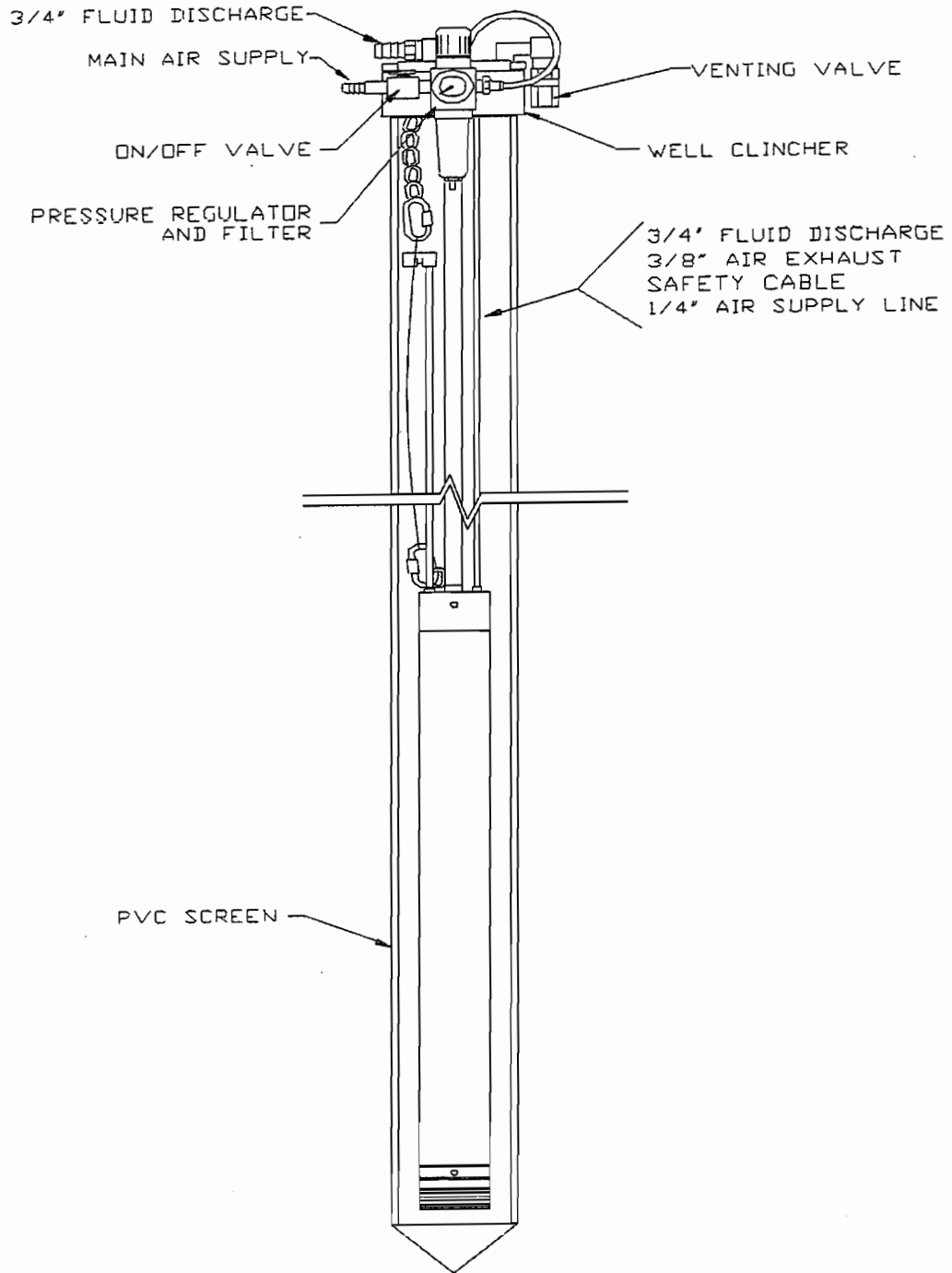
4. Connect the main air supply line to the inlet of the filter regulator. Purging the air line is recommended prior to making this connection to remove all moisture and debris. After all external well connections have been made, turn on air supply and adjust to the desired pressure. Minimum 10 PSI (69 kPa).
5. Pump purge line- This will remain plugged unless a purge line is utilized at the well. If purge line is being used, remove plug and insert air supply line when emptying pump. Also, an additional ¼" line will have to be run to the port labeled "c" on pump head.
6. Instructions for Pulse Counter (TR-778)- Install ¼" line from filter/regulator output to Pulse Counter port labeled "air in". Then connect ¼" line from port labeled "to pump" to the Well Clincher fitting. Install brass tee provided with Pulse Counter between the pressure gauge and the filter regulator body. Finally, install an additional ¼" line from pushlock fitting in tee to port labeled "to regulator" on Pulse Counter.

#### **WARNING**

**THE PUMP IS NOT DESIGNED TO BE AN AIR RESERVOIR. DO NOT PRESSURIZE PUMP OUTSIDE OF WELL.**

NOTE: The MVP requires between 20 to 100 PSI air pressure (30 minimum with pulse counter). For best results, operate at lowest pressure necessary.

MPV IV PUMP  
TOP/BOTTOM LOADING



## Maintenance and Troubleshooting

### MAINTENANCE

Maintenance of the MVP IV/MVP actually occurs during system specification and set-up. The most important things you can do to insure trouble-free operations of your pumps are:

1. Correctly size the compressor for your installation
2. Specify an air drier in climates that pose freezing conditions.
3. Install the Filter/Regulator assembly above the level where water would collect in the well vault.
4. Due to minerals in the fluid being pumped, the pump may need to be removed from the well, disassembled, and cleaned to remove the iron or calcium build-up.

### TROUBLESHOOTING (See Page 19 for Adjusting Float)

Even the best installations can sometimes experience start-up problems. The following section provides some tips for troubleshooting potential problems.

#### **Problem** - Pump not operating

- Is proper air pressure applied to the pump?
- Be sure all lines are connected to the clincher and pump correctly.
- Check for crimped lines from clincher to pump.
- Is discharge line restricted?
- Check upper intake on top loading pump. Is it clogged or sticking?
- Check for sticking float (clean SS tubes inside of pump)
- Check adjustment

#### **Problem** -Pump blowing air into discharge line momentarily at end of pump cycle

- Lower operating pressure of the pump.

**Problem** – Air coming from Exhaust continuously. Pump not operating.

- Check Adjustment
- Check Air Valve Opening

**Problem** - Pump blowing air into discharge line continuously

- Check that the air valve is seating properly (pg. 19)
- Check for sticking float (clean SS tubes inside of pump).
- Check adjustment

**Problem** - Air blowing up the well continuously

- Upper intake valve may not be closing on the pump (foreign object in upper intake).
- Check for loose or broken air line above the pump.
- Check the gauge on the filter regulator assembly. The operating pressure should not drop below 10 psi (69 kPa) during operation.

## APPENDIX A

### **AIR CONSUMPTION**

The MVP IV/MVP pump uses compressed air to transport fluid from a recovery well to the surface. The volume of compressed air required to operate the pumps will be primarily dependent on three factors:

1. Number of MVP IV/MVP pumps
2. Operating air pressure of the pumps
3. Pumping rates (gallons or liters per minute)

As the number of pumps increases, the compressed air consumption rate will also increase.

As the operating air pressure of the pump is increased, the volume of air consumed during each pump cycle increases. The following table outlines the air consumption rate per cycle of the pump at different operating air pressures.

**TABLE A-1**

<i>OPERATING AIR PRESSURE</i>		<i>COMPRESSED AIR CONSUMPTION RATE</i>	
<u>PSI</u>	<u>kPa</u>	<u>(ft<sup>3</sup>/gal. pumped)</u>	<u>m<sup>3</sup>/gal. pumped</u>
60	414	.75	.021
70	483	.80	.022
80	552	.85	.024
90	620	.87	.025
100	690	.90	.026

Very few sites will require an operating air pressure of 125 psi (690 kPa), but it is recommended that the highest air consumption rate, .90 ft<sup>3</sup>/gal (.026 m<sup>3</sup>/gal), be used when determining the total compressed air consumption for the site.

The pumping rate required to achieve the desired water table depression will directly influence the compressed air consumption rate. The MVP IV/MVP pumps .30 to .45 US gallons per cycle (1.1 to 1.7 liters per cycle). Each pump has a maximum fluid flow rate of 11.0 gpm (42 L/min) with the bottom-loading version. The pumping rate of each recovery well should be determined so that the total pumping rate of

the site can be calculated.

The following questions will help determine the compressed air consumption rate:

1. How many recovery wells will be used on the site?
2. What is the pumping rate for each recovery well?
3. What is the total pumping rate for this site? (add pumping rates from question 2.)
4. Use the total pumping rate calculated in question 3 in the following formula to determine the air consumption rate.

AIR CONSUMPTION [ft<sup>3</sup>/min] = Total Pumping Rate [gal/min] x Air consumption per gal. pumped  
(ft<sup>3</sup>) at operating pressure\*

AIR CONSUMPTION [m<sup>3</sup>/min] = Total Pumping Rate [L/min] x Air consumption per gal. pumped  
(m<sup>3</sup>) at operating pressure \*

The operating air pressure will depend on the amount of force the MVP IV/MVP will need to push the water from the pump to the remediation equipment on the surface (total dynamic head). As the operating air pressure is set higher, more air will be consumed with each cycle of the pump due to the physical characteristics of compressed air.

For example, at an operating pressure of 60 psi (413 kPa), the MVP IV/MVP will consume 0.75 ft<sup>3</sup> of air/gal. pumped. At an operating pressure of 100 psi (689 kPa), the pump will consume .90 ft<sup>3</sup> of air/gal. pumped. The total water recovery rate will dictate how often the pump cycles.

If you have any questions about sizing compressors, number of pumps required for your site, etc., please

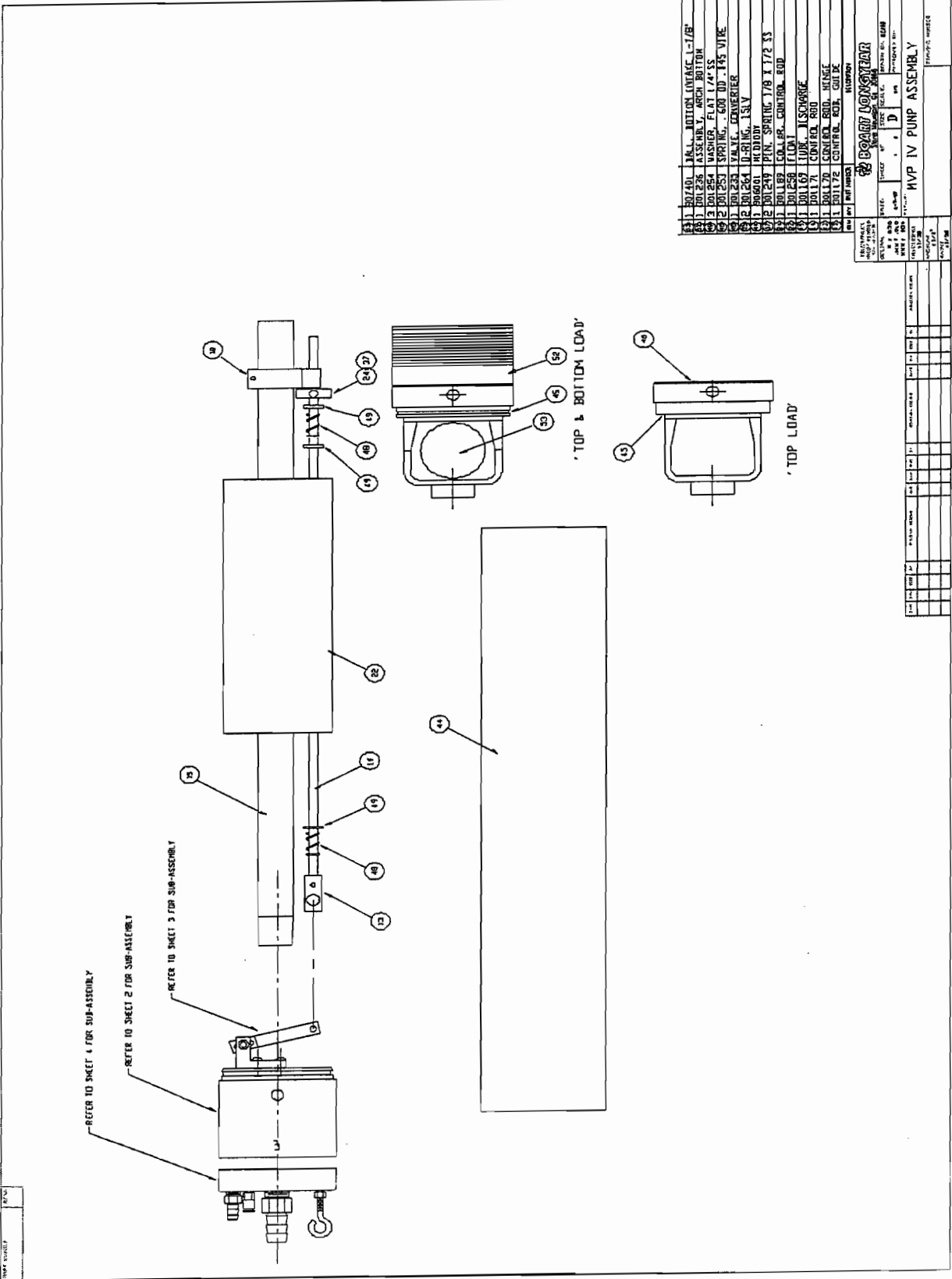


call Durham Geo-Enterprises's technical service staff in Stone Mountain. They can be reached at:

**1-800-837-0864**

or

**770-465-7557**

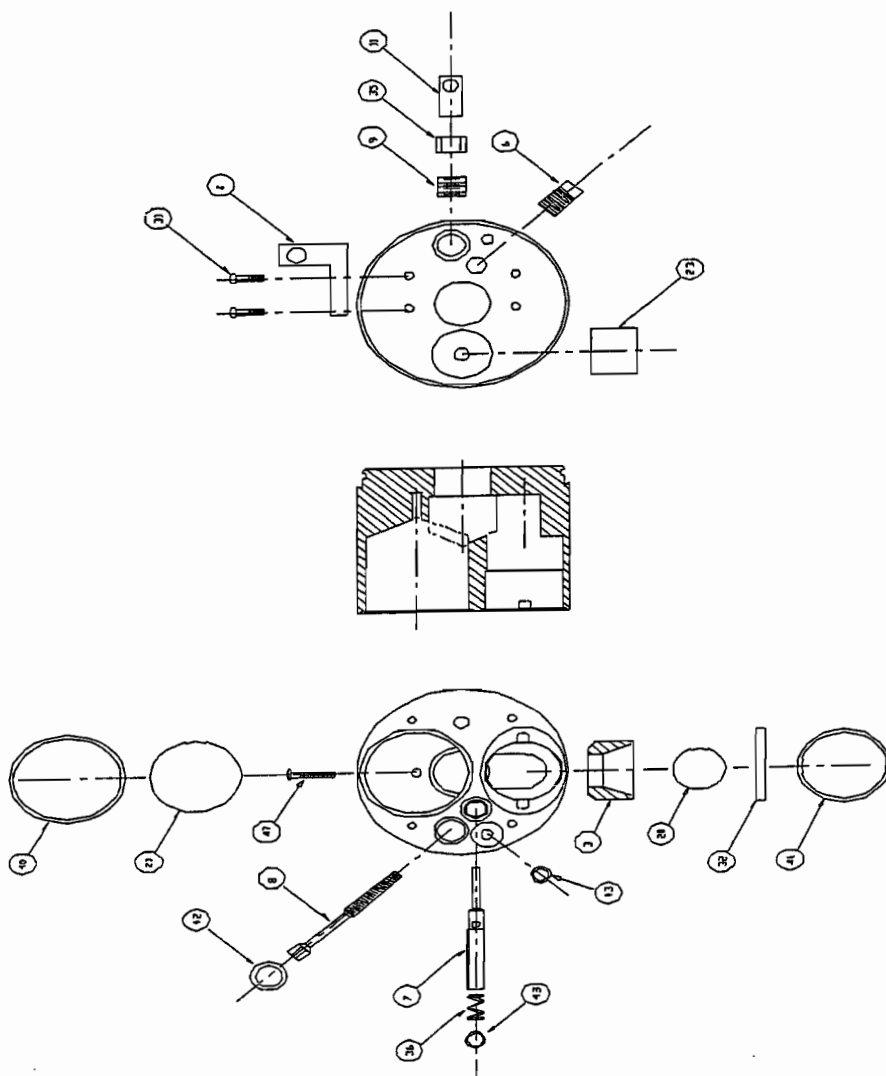


1	101740	BALL BEARING 1-1/2"
2	101236	ASSEMBLY ARCH BOTTOM
3	101254	WASHER FLAT 1/4" SS
4	101253	SPRING 600 OD 1.45 VITE
5	101233	VALVE CONVEYER
6	101264	U-BOLG 1.5X
7	100600	HOOD
8	101249	PIN SPRING 7/8 X 7/2 SS
9	101182	COLLAR CONTROL ROD
10	101458	FLOR
11	101197	LOCK ROD
12	101170	CONTROL ROD HINGE
13	101172	CONTROL ROD GUIDE
14	101172	CONTROL ROD GUIDE
15	101172	CONTROL ROD GUIDE
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28	101172	CONTROL ROD GUIDE

PROJECT: MVP IV PUMP ASSEMBLY  
 SHEET: 1 OF 1  
 DATE: 10/1/78  
 DRAWN BY: [Signature]  
 CHECKED BY: [Signature]  
 APPROVED BY: [Signature]  
 TITLE: MVP IV PUMP ASSEMBLY  
 PROJECT NUMBER: [Blank]  
 SHEET NUMBER: 1 OF 1  
 SCALE: [Blank]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		

FIG. NO. 100



Q1	301252	MUCKET CAP. SERV., 11-32 X 1.55
Q2	301263	O-RING, 0.12 WIDTH
Q3	301262	O-RING, 0.13 WIDTH
Q4	301261	O-RING, 0.15 WIDTH
Q5	301260	O-RING, 0.17 WIDTH
Q6	301248	SPRING, .360 OD, .026 WIRE
Q7	301247	BUT. 10-32 X 5/16", SS
Q8	301244	IN. TONIL 3/16" X 1.5" SS
Q9	301243	MUCKET CAP. SERV., BUTON HD
Q10	301259	MUCKET
Q11	301257	BALL, TOP INGAGE 1.5"
Q12	301256	BALL, EXCHANGE 1/8"
Q13	301255	VALVE, END
Q14	301254	VALVE, SEALED
Q15	301253	VALVE, SEALED
Q16	301252	VALVE, SEALED
Q17	301251	VALVE, SEALED
Q18	301250	VALVE, SEALED
Q19	301249	VALVE, SEALED
Q20	301248	VALVE, SEALED
Q21	301247	VALVE, SEALED
Q22	301246	VALVE, SEALED
Q23	301245	VALVE, SEALED

**POWELL ENGINEER**

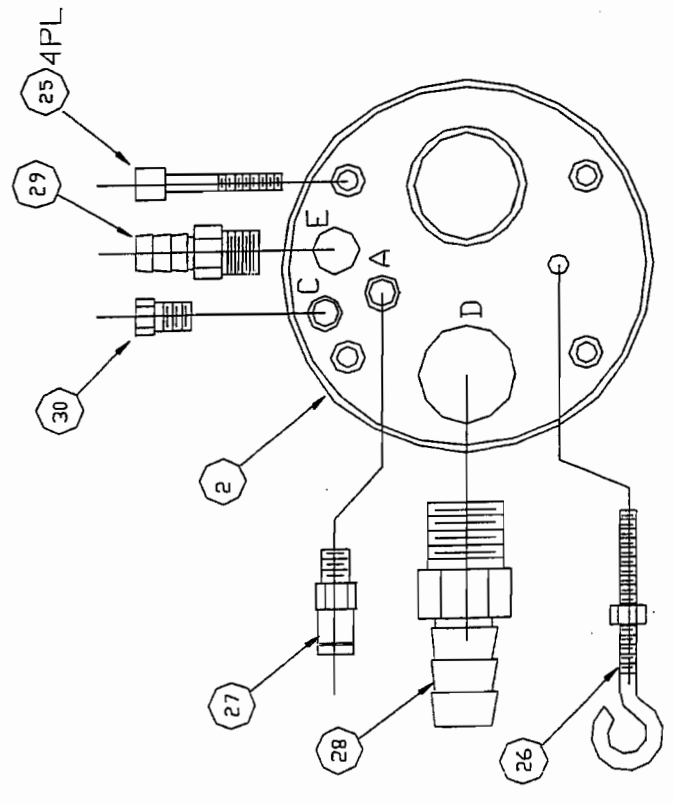
DESIGNED BY: \_\_\_\_\_  
 DRAWN BY: \_\_\_\_\_  
 CHECKED BY: \_\_\_\_\_  
 APPROVED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

FIGURE NUMBER: \_\_\_\_\_



PART NUMBER	REV.
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30	1	12151058	PLUG, 1/8" NPT SS	
29	1	301242	BARB, PUSH-LOK 3/8 X 1/4 NPT	
28	1	301241	BARB, PUSH-LOK 3/4NPT X 3/4HOSE	
27	1	301240	MALE CONNECTOR, 1/4TUBE X 1/8NPT	
26	1	9050110	EYE BOLT, 1/4 X 20	
25	4	301239	SOCKET CAP SCREW, 10-32 X 1 SS	
2	1	301174	TOP CAP	

TOLERANCES UNLESS NOTED OTHERWISE	 <b>BOART LONGYEAR</b> STONE INDUSTRIES, CO. 30086	SHEET OF	SCALE	DRAWN BY	SCARR
DECIMAL		4 OF 4	B	N/A	APPROVED BY
X 3 030					
XXX 3 004					
FRACTIONAL					
ANGLES					
RADIII					

DATE	3TH	ECOR	BY	REVISION	RECORD

**TITLE TOP CAP ASSEMBLY**

DRAWING NUMBER

**MVP IV/MVP**  
**CHECKING AND ADJUSTING THE FLOAT AND EXHAUST VALVE**

**Tools needed:**

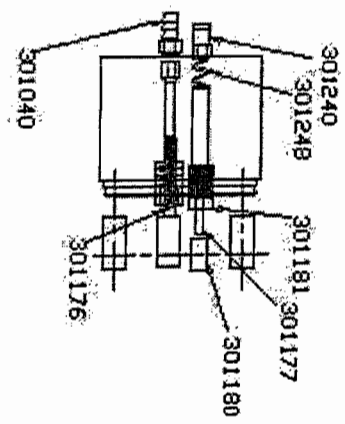
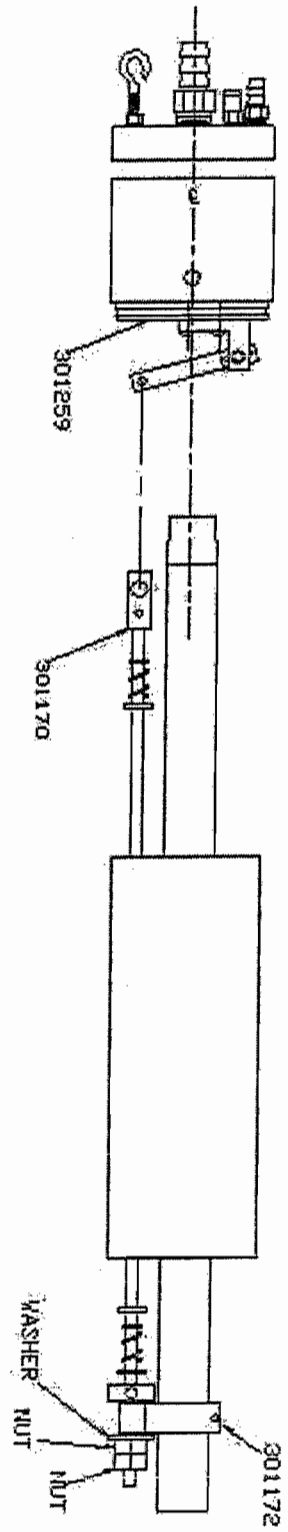
**5/16" open end wrench**

**5/32" hex wrench**

**flat head screwdriver ( A 7mm or 9/32" nut driver is required in older models)**

**Reference next page for drawing detail if needed**

1. Turn the air off and remove the pump from the well. Unthread the bottom end of the pump and remove the pump body from the head assembly.
2. Place the head assembly at 70° (ten o'clock) off vertical position and lift the float to the upper position to shift the pump to "on" position. Lower the float gently against the lower end of the control rod and the weight of the float should shift the pump to the "off" position. Should the weight of the float fail to shift the pump to the off position, follow the following steps to readjust the exhaust valve.
3. Loosen adjustment nuts on lower end of control rod. (#301170) (only applies to newer model)
4. Insert the screwdriver into the exhaust chamber and over the top of the exhaust valve.
5. Hold the screwdriver to prevent the exhaust valve from turning, while using the 5/16" wrench to loosen the jam nut on the lower side of the exhaust valve (turn nut counterclockwise).
6. Place the pump head assembly to 70°, (ten o'clock) position and lift the float to shift the pump to the "on" position. Lower the float gently against the lower end of the control rod and allow it to sit in this position.
7. Slowly turn the exhaust valve clockwise using the nut driver until the weight of the float shifts the pump to the "off" position.
8. Refer to step two and test again to verify that the setting is correct.
9. Once the exhaust valve has been properly adjusted, hold the exhaust valve with the screwdriver to prevent it from turning. Tighten the jam nut using the 5/16" wrench.
10. Refer to step two and test again to verify that the setting is correct.
11. With float up, turn first adjustment nut with hand until it hits the collar (301172). Tighten second nut against the first (newer models only)
12. Verify that air valve (301177) is only opening between .013 and .017 inches. This is critical to ensure the pump does not stall. Using a caliper, by coming in through the top of the air supply fitting (301248), measure the distance the roller (301180) lifts the valve (301177).
13. If more than .017 inches or less than .013 inches is measured, turn the seat using a 3/8" wrench (clockwise to decrease lift, counterclockwise to increase lift)
14. Verify valve adjustment.
15. Assemble pump and install.



## Limited Warranty

Durham Geo-Enterprises warrants that equipment shall be free from defects in material and workmanship for a period of **90 days** from the time equipment is put into service. In any event, the warranty period will not exceed **6 months** from the date of shipment.

Durham Geo-Enterprises's liability shall be limited to replacement of components or equipment (at the manufacturer's discretion) that have been determined by the manufacturer to be faulty. No claims in excess of component replacement value will be recognized. Durham Geo-Enterprises will not be held liable for damages or lost business relating to a warranty claim.

Specifically excluded from this warranty are claims deemed by the manufacturer to have resulted from normal wear and tear, improper use, or abuse of the equipment.

For a complete warranty disclosure, please call 1-800-837-0864 ☎ (outside Georgia, USA) or (770) 469-2720 ☎ (inside Georgia, USA) or refer to the printed statement on the back of any Durham Geo-Enterprises original invoice.



## Information Record

Model #: \_\_\_\_\_

Serial #: \_\_\_\_\_

Sold By: \_\_\_\_\_

Date Purchased: \_\_\_\_\_

The serial number for the pump is listed on the top of the pump head. You will need this number if you call Durham Geo-Enterprises for service or support.

We can be reached between 8:00 am and 5:00 PM Eastern Standard Time (EST) at:

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**Telephone:**

**1-800-837-0864 (outside Georgia, USA)**

**(770) 465-7557 (inside Georgia, USA)**

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**Fax:**

**(770) 469-2774**

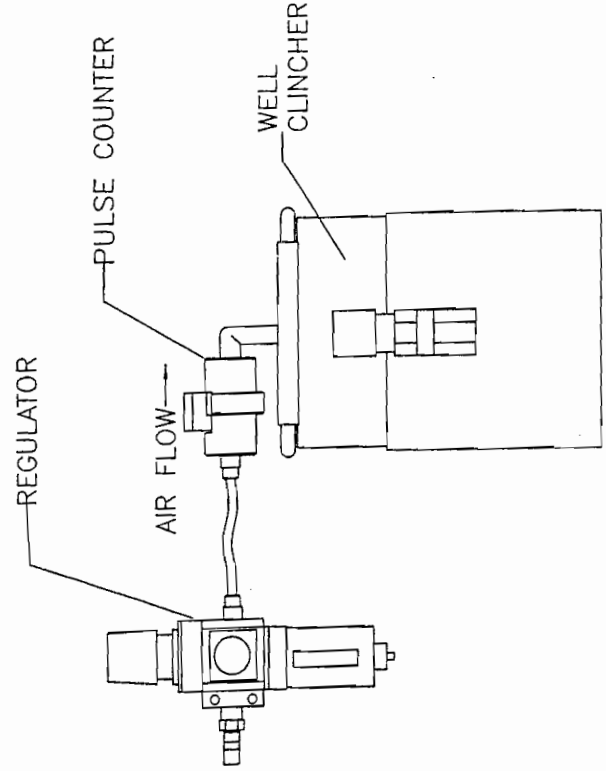
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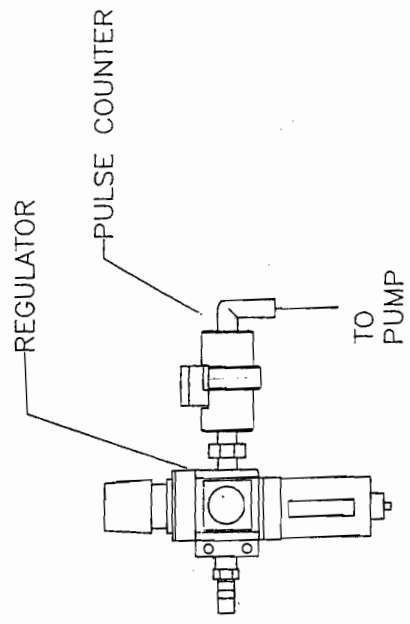


PART NUMBER

REV. A



PLUMBING OPTION "1"



PLUMBING OPTION "2"

TOLERANCES (EXCEPT AS NOTED) REV. 10/01/98		DATE: 02/19/2004		SHEET OF 1 1		SIZE B		SCALE: 1/1		DRAWN BY: AMP		APPROVED BY:			
DECIMAL .X ± .030 .XX ± .010 .XXX ± .004		FRACTIONAL ± 1/32		ANGULAR ± 1/2°		RADI ± 1/32		TITLE: PULSE COUNTER ASSEMBLY					DRAWING NUMBER		
Durham 2175 West Park Ct. Stone Mountain, Ga. 30087		Geo													
DATE	STA	ECO#	BY	DATE	STA	ECO#	BY	DATE	STA	ECO#	BY	DATE	STA	ECO#	BY
												12/11 2002	A		AMP
												RELEASED FOR PRODUCTION			



**MANUAL MOTOR CONTROLLERS  
and CIRCUIT-LOCK® ENCLOSURES  
30A, 40A & 60A, 600 VAC**

**Installation Instructions**

**English**

**GENERAL INFORMATION**  
1. NOTICE: For installation by a qualified electrician in accordance with national and local electrical codes and the following instructions.  
CAUTION: RISK OF ELECTRIC SHOCK. Disconnect power before installing. Never wire energized electrical components.  
CAUTION: USE COPPER CONDUCTORS ONLY.  
2. DO NOT TIN CONDUCTORS.  
3. Check that device's type and rating are suitable for the application.  
4. Separate overcurrent protection must be provided in accordance with National Electrical Code® Article 220 or Canadian Electrical Code Section B as appropriate.  
5. Suitable for use on a circuit capable of providing not more than 10,000 symmetrical Amperes, 600 VAC max., when protected by RK5 class fuses at rated current for each Cat. No.

**GENERAL WIRING INSTRUCTIONS**  
1. Select conductors having 90° C or higher rated insulation having sufficient ampacity in accordance with the 60° C column of National Electrical Code® Table 310-16 or Canadian Electrical Code Table 2.  
2. Strip conductors per Table on reverse side.  
3. Loosen terminal screws. Connect conductors to proper terminals. See diagram on switch body, Fig. 1 and Table (reverse side).  
4. Tighten screws per Table on reverse side.  
5. TAKE CAUTION THAT THERE ARE NO STRAY WIRE STRANDS.

**ENCLOSURE INFORMATION**

1. The enclosures include a lockout provision for a suitable padlock lockout device to isolate energy from the connected equipment as a method of compliance to OSHA Lockout/Tagout regulation 29 CFR Part 1910.147. Min. 3/16" dia. hasp to be used. This feature does NOT isolate the power supplied to the enclosure during internal servicing of the enclosure.  
2. Any unused conduit entrances must be sealed with Listed/Certified closure plugs.  
3. Type 1 enclosure may be mounted for top, bottom or back conduit entrances.  
4. Form condensate Drip Loops as shown in Fig. 2 when TOP conduit entrance is used.  
5. Type 3R enclosure may be mounted for bottom or back conduit entrances ONLY.

**ENCLOSURE INSTALLATION INSTRUCTIONS**

1. Remove cover and mount frame or enclosure using mounting holes on back of frame or enclosure.  
2. Remove knockouts at desired locations. Select appropriate conduit/cable entry fittings as required and assemble to frame or enclosure.  
3. Wire enclosure controller according to General Wiring Instructions.  
4. NOTICE: Green Grounding wire in conductible MUST be connected to GREEN grounding screw or grounding terminal marked GR.  
5. Mount controller with toggle in OFF position and positioned as follows:  
• Type 1 enclosure: toggle pointing DOWN  
• Type 3R enclosure: toggle pointing TO THE RIGHT.  
6. Secure controller with mounting screws provided.  
7. Install cover as follows:  
• Type 1 enclosure: secure with cover mounting screws  
• Type 3R enclosure: secure that controller toggle and RED lever are in the "OFF" position. See inside label from 3R enclosures.  
8. Secure cover with screws. Operate RED lever (SHOULD MOVE FREELY).

**COMMANDE DE MOTEUR, MANUEL et  
BOÎTIER CIRCUIT-LOCK®  
30 A, 40 A et 60 A, 600 V, CA**

**Notice de montage**

**Français**

**RENSEIGNEMENTS GÉNÉRAUX**  
1. AVIS - Doit être installé par un électricien qualifié conformément aux codes de l'électricité nationale et locale et selon les directives suivantes.  
2. ATTENTION - RISQUE DE CHOC ÉLECTRIQUE. Débrancher le circuit avant de procéder au montage. Ne jamais câbler des composants électriques dans un circuit sous tension.  
3. ATTENTION - EMPLOYER UNIQUEMENT DES CONDUCTEURS EN CUIVRE.  
4. ASSURER que le type et les caractéristiques nominales de ce dispositif conviennent à l'application.  
5. S'assurer que le type et les caractéristiques nominales de ce dispositif conviennent à la section B du Code canadien de l'électricité.  
6. AVIS - Un dispositif séparé de protection contre les surintensités doit être fourni conformément à la section B du Code canadien de l'électricité.  
7. Convient à l'emploi dans un circuit dont la capacité en court-circuit est inférieure à 10 000 ampères efficaces symétriques à un maximum de 600 V CA, lorsque protégé par un fusible de classe RK5 du calibre correspondant à la valeur de courant assignée au dispositif.

**DIRECTIVES GÉNÉRALES DE CÂBLAGE**

1. Choisir des conducteurs dont l'isolant a une résistance thermique de 90° C ou plus et de capacité de courant admissible suffisante selon la Table 2 du Code canadien de l'électricité.  
2. Dénuder les conducteurs selon les indications du Tableau au verso.  
3. Desserrer les vis de borne. Raccorder les conducteurs aux bornes appropriées. Consulter la Fig. 1 et le Tableau (verso).  
4. S'ASSURER QUE TOUTS LES BRINS SONT BIEN INSÉRÉS.  
5. Serrer les vis de borne selon les indications du Tableau au verso.

**RENSEIGNEMENTS SUR LES BOÎTIERS**

1. Ce boîtier offre une possibilité de blocage au moyen d'un dispositif à cadenas pour isoler les appareils qu'il y sont branchés, conformément aux exigences du règlement OSHA 29 CFR, section 1910.147 en matière de blocage et d'étiquetage. Utiliser un morillon d'un diam. min de 5 mm. Cependant, cette disposition N'ISOLE PAS le boîtier de sa source d'alimentation pour les fins de maintenance interne de celui-ci.  
2. Toute ouverture d'arrivée de conduit inutilisée doit être scellée au moyen d'un obturateur homologué.  
3. Le boîtier de type 1 peut être monté pour des arrivées de conduit par le haut, par le bas ou par l'arrière.  
4. Dans le cas d'une arrivée de conduit par le HAUT, former des boucles d'égoûttement tel qu'illustré à la Fig. 2.  
5. Le boîtier de type 3R peut être monté pour des arrivées de conduit par le bas ou par l'arrière SEULEMENT.

**MÉTHODE DE MONTAGE DES BOÎTIERS**

1. Retirer le couvercle et fixer le bâti ou le boîtier au moyen des trous dans l'arrière du bâti ou du boîtier.  
2. Retirer les débouchures aux endroits nécessaires. Choisir les raccords d'entrée de conduit ou de câble appropriés et les fixer au bâti ou au boîtier.  
3. Raccorder les conducteurs à la commande manuelle conformément aux Directives générales de câblage.  
4. AVIS - Il est OBLIGATOIRE de raccorder le fil de mise à la terre vert du conduit ou du câble à la vis VERTE de MALT ou à la borne de MALT identifiée par les lettres GR.  
5. Monter la commande manuelle en s'assurant que la bascule est en position «OFF» et orientée de la façon suivante:  
• Boîtier de type 1 : la bascule pointant vers le BAS.  
• Boîtier de type 3R : la bascule pointant vers la DROITE.  
6. Fixer la commande manuelle à l'aide des vis fournies.  
7. Fixer le couvercle comme suit:  
• Boîtier de type 1 : utiliser les vis de fixation du couvercle.  
• Boîtier de type 3R : s'assurer que la bascule de la commande manuelle et le levier ROUGE sont en position «OFF». Consulter l'étiquette à l'intérieur du boîtier 3R.  
8. Fixer le couvercle avec les vis. Actionner le levier ROUGE. (IL DEVRAIT SE DÉPLACER LIBREMENT.)

**DESCONECTOR MANUAL DE MOTOR y  
CAJA CIRCUIT-LOCK®  
30 A, 40 A y 60 A, V-600**

**Instrucciones de instalación**

**Español**

**INFORMACIÓN GENERAL**  
1. AVISO - Para ser instalado por un electricista calificado, de acuerdo con los códigos eléctricos nacionales y locales, y siguiendo estas instrucciones.  
2. CUIDADO - RIESGO DE CHOQUE ELÉCTRICO. Desconectar la corriente antes de la instalación. No conectar nunca componentes eléctricos en un circuito energizado.  
3. CUIDADO - UTILIZAR SOLAMENTE CONDUCTORES DE COBRE.  
4. NO ESTANAR LOS CONDUCTORES.  
5. Asegurarse de que el tipo y las características nominales del dispositivo sean apropiados para la aplicación.  
6. AVISO - Debe proporcionarse un dispositivo protector contra sobrecorriente por separado, conforme al artículo 220 de la Norma oficial mexicana NOM-001-SEMP.  
7. Puede utilizarse en un circuito capaz de suministrar hasta 10 000 amperes efectivos simétricos a 600 V CA como máximo, cuando protegido por fusibles de clase RK5 de calibre apropiado para el dispositivo.

**INSTRUCCIONES GENERALES DE CABLEADO**

1. Elegir calibres de conductores de la tabla 400-5 de la Norma oficial mexicana NOM-001-SEMP.  
2. Pelar los conductores como se muestra en la Tabla al dorso.  
3. Afijar los tornillos de los bornes. Conectar los conductores a los bornes apropiados. Ver la Figura 1 y la Tabla (dorso).  
4. ASEGURARSE DE QUE NO QUEDEN HILOS SUELTOS.  
5. Ajustar los tornillos de los bornes con el par indicado en la Tabla al dorso.

**INFORMACIÓN SOBRE LA CAJA**

1. Esta caja ofrece una posibilidad de bloqueo con un dispositivo apropiado de trabajo cuando para aislar los equipos conectados a la misma, a fin de dar cumplimiento a la norma OSHA 29 CFR, parte 1910.147 en materia de bloqueo y etiquetado. Utilizar un pasador con un diam. mín. de 5 mm. Sin embargo, esta característica NO AISLA la caja de su fuente de alimentación a los fines del mantenimiento interno de la misma.  
2. Toda entrada de conduit que no se utilice debe sellarse con obturadores homologados.  
3. La caja de tipo 1 puede montarse para entradas de conduit por arriba, por debajo o por detrás.  
4. Cuando se use la entrada de conduit por ARRIBA, formar lazos de goteo como se muestra en la Fig. 2.  
5. La caja de tipo 3R puede montarse SOLAMENTE para entradas de conduit por debajo o por detrás.

**INSTRUCCIONES DE INSTALACIÓN DE LA CAJA**

1. Quitar la tapa y montar el bastidor o la caja usando los orificios de fijación en el dorso del bastidor o de la caja.  
2. Quitar los discos removibles en los sitios que se desee. Elegir los accesorios apropiados para las entradas de conduit o de cable que sean necesarios y unirlos al bastidor o a la caja.  
3. Cablear el desconector de motor según las instrucciones generales de cableado.  
4. AVISO - El hilo verde de conexión a tierra en el conduit o el cable DEBE conectarse al tornillo VERDE de conexión a tierra o al borne de conexión a tierra marcado GR.  
5. Montar el desconector de motor con la palanca en posición «OFF» y colocada del modo siguiente:  
• Caja de tipo 1 : palanca apuntando hacia ABAJO.  
• Caja de tipo 3R : palanca apuntando hacia LA DERECHA.

6. Fijar el desconector de motor con los tornillos de fijación provistos.  
7. Instalar la tapa del modo siguiente:  
• Caja de tipo 1 : fijarla con los tornillos de fijación de la tapa.  
• Caja de tipo 3R : asegurarse de que la palanca del desconector de motor y la palanca ROJA estén en posición «OFF». Ver la etiqueta interior en las cajas 3R.  
8. Fijar la tapa con tornillos. Accionar la palanca ROJA (DEBERIA MOVERSE LIBREMENTE).



**Wiring Device-Kellems**  
Hubbell Incorporated (Delaware)  
185 Plains Road  
Milford, CT 06460-8897  
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PD1665 (Page 1)

Nos de RÉFÉRENCE					VALEURS ASSIGNÉES				CALIBRE DE FIL MAX AWG	LONGUEUR DE DENUDAGE mm		COUPLE VIS DE BORNE Nm	
BOÎTIER	CÂBLAGE LATÉRAL		CÂBLAGE ARRIÈRE		HP					CÂBLAGE LATÉRAL	CÂBLAGE ARRIÈRE		
	COMMANDE DE MOTEUR	BOÎTIERET COMMANDE	COMMANDE DE MOTEUR	BOÎTIERET COMMANDE	120 V CA	240 V CA	480 V CA	600 V CA					
HBL 1370	HBL7832		HBL7832BW	HBL1372BW	1 Ø	2	5	10	15	N° 10	32	16	2,4
	HBL7810UD		HBL7810BW	HBL1379BW	3 Ø	3	7,5	15	20				
	HBL7832		HBL7832BW	HBL1392BW	1 Ø	2	5	10	15				
	HBL7810UD		HBL7810BW	HBL1389BW	3 Ø	3	7,5	15	20				
HBL 1390	HBL7832		HBL7832BW	HBL1392BW	1 Ø	2	5	10	15	N° 4	16		2,8
	HBL7810UD		HBL7810BW	HBL1389BW	3 Ø	3	7,5	15	20				
HBL 13R90	HBL7832		HBL7832BW	HBL13R92BW	1 Ø	2	5	10	15	N° 8*	12		2,4
	HBL7810UD		HBL7810BW	HBL13R89BW	3 Ø	3	7,5	15	20				
HBL 16R90	HBL7832FVMD	HBL13R92MD			1 Ø	2	5	10	15	N° 4	16		2,8
	HBL7810FVMD	HBL13R89MD			3 Ø	3	7,5	15	20				
	HBL7842				1 Ø	2	5	10	15				
	HBL7843				3 Ø	3	7,5	15	20				
	HBL7862FW	HBL16R92			1 Ø	10	15	20					
	HBL7863FW	HBL16R93			3 Ø	10	25	30					
HBL 16R90	HBL7862				1 Ø	10	15	20		N° 4	16		2,8
	HBL7863				3 Ø	10	25	30					

\*Utiliser des cosses fermées homologuées

English

ENCLOSURE	SIDE WIRED MOTOR CONTROLLER	BACK WIRED MOTOR CONTROLLER	ENCLOSURE & MOTOR CONTROLLER	RATINGS	HP					TERMINAL MAX CAPACITY AWG	INSULATION STRIPPING INCH (mm)	TERMINAL TORQUE (lb-in)
					120V AC	240V AC	480V AC	600V AC	AWG			
HBL 1370	HBL7832	HBL7832BW	HBL1372BW	1 Ø	2	5	10	15	# 10	1 1/2 (32)	5/8 (16)	20 (2,4)
HBL 1390	HBL7832	HBL7832BW	HBL1392BW	3 Ø	2	5	10	15	# 10	1 1/2 (32)	5/8 (16)	20 (2,4)
HBL 13R90	HBL7832	HBL7832BW	HBL13R92BW	1 Ø	2	5	10	15	# 8*	1/2 (12)		20 (2,4)
HBL 16R90	HBL7862	HBL16R92		3 Ø	2	5	10	15	# 4	5/8 (16)		25 (2,8)

Español

BOÎTIER	DESCONECTOR DE MOTOR	CABLEADO LATÉRAL	DESCONECTOR DE MOTOR	CABLEADO POSTERIOR	CARACTERÍSTICAS NOMINALES	HP					CALIBRE MAX DE COND. AWG	PÉDANTOS CONDUCORES mm	ALISTAR TORNILOS DE BORNE COMPORTE Nm
						V-120	V-240	V-480	V-600	AWG			
HBL 1370	HBL7832	HBL7832BW	HBL1372BW	HBL1379BW	1 Ø	2	5	10	15	# 10	32	16	2,4
HBL 1390	HBL7832	HBL7832BW	HBL1392BW	HBL1389BW	3 Ø	2	5	10	15	# 10	32	16	2,4
HBL 13R90	HBL7832	HBL7832BW	HBL13R92BW	HBL13R89BW	1 Ø	2	5	10	15	# 8*	12		2,4
HBL 16R90	HBL7862	HBL16R92			3 Ø	2	5	10	15	# 4	16		2,8

\*Usar conectores de arto homologados

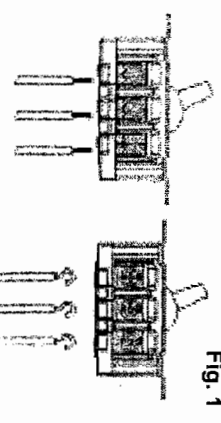


Fig. 1

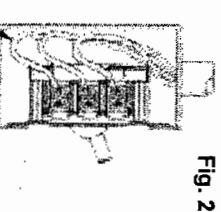


Fig. 2

Back Wired  
Cablage arrière  
Cableado posterior

Side Wired  
Cablage lateral  
Cableado lateral

Drip Loops  
Boudes d'époutement  
Lazos de goteo

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 México, D.F. 03100  
 Tlx: (5)575-2022  
 Fax: (5)559-8628



## AC Magnetic Contactors and Starters Contactores y arrancadores magnéticos de ca (~) Contacteurs et démarreurs magnétiques CA

Class Clase Classe	Type Tipo Type	Series Serie Série	Size Tamaño Taille	Poles (P) Polos (P) Pôles (P)
8502 & 8536	SB	A & B	0	2 & 3

### INTRODUCTION

This bulletin provides assembly, modification, and parts ordering instructions.

### INTRODUCCION

Este boletín incluye instrucciones de montaje, modificación y solicitud de piezas.

### INTRODUCTION

Ce bulletin contient les directives pour assembler, modifier et commander des pièces.

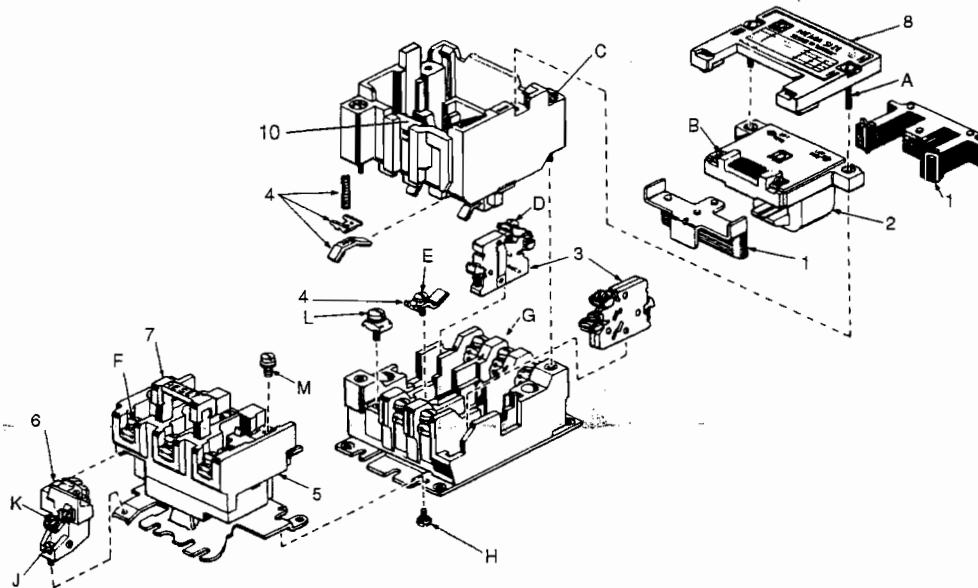


Figure / Figura / Figure 1 : Contactor and Starter Assembly / Montaje del contactor y arrancador  
Assemblage de contacteur et de démarreur

## ⚠ DANGER / PELIGRO / DANGER

### HAZARDOUS VOLTAGE

Disconnect all power before working on equipment.

**Electric shock will result in death or serious injury.**

### TENSION PELIGROSA

Desconecte toda la alimentación antes de efectuar cualquier trabajo en el equipo.

**Las descargas eléctricas podrán causar la muerte o lesiones serias.**

### TENSION DANGEREUSE

Coupez toute l'alimentation avant de travailler sur cet appareil.

**Une électrocution entraînera la mort ou des blessures graves.**

### SERIES

Series B applies only to the Type S, Form B starter (three ambient-compensated overloads). All parts of Form B, Series A and B starters are interchangeable; only the overload relay block differs. If replacing the overload relay block of a Form B, Series A starter with a Series B block, the overload relay

### SERIE

La serie B se aplica solamente a los arrancadores tipo S, forma B (tres sobrecargas compensadas por temperatura). Todas las piezas de los arrancadores forma B, series A y B son intercambiables; solamente el bloque del relevador de sobrecarga es diferente. Si reemplaza el bloque del relevador de

### SÉRIE

La série B n'est destinée qu'au démarreur de forme B, type S (trois surcharges stabilisées en température). Toutes les pièces des démarreurs de forme B sont interchangeables pour les séries A et B; seul le bloc-relais de surcharge est différent. Si on remplace le bloc-relais de surcharge d'un





thermal units must be selected from the Series B thermal unit selection tables for proper motor protection.

sobrecarga de un arrancador forma B, serie A con un bloque de la serie B, deberá seleccionar los elementos térmicos del relevador de sobrecarga de la tabla de selección de elementos térmicos de la serie B para proporcionar una protección adecuada al motor.

démarreur de forme B, série A par un bloc-relais de série B, les unités thermiques du relais de surcharge doivent être sélectionnées dans les tableaux de sélection des unités thermiques de série B pour assurer une protection adéquate du moteur.

### AUXILIARY CONTACTS

All contactors and starters feature a normally open (N.O.) holding circuit contact. N.O. or normally closed (N.C.) auxiliary contacts can be added in the field. Table 5 lists the Class and Type. Bulletin 30072-013-21 and the Square D Digest contain application information.

### CONTACTOS AUXILIARES

Todos los contactores y arrancadores contienen un contacto de circuito de sostén normalmente abierto (N.A.). Los contactos auxiliares normalmente cerrados (N.C.) o N.A. se pueden instalar en el local del cliente. La tabla 5 enumera su clase y tipo. El boletín 30072-013-21 y el Digest de Square D contienen información sobre sus aplicaciones.

### CONTACTS AUXILIAIRES

Tous les contacteurs et démarreurs sont dotés d'un contact de circuit de retenue normalement ouvert (N.O.). Des contacts auxiliaires N.O. ou des contacts normalement fermés (N.F.) peuvent être ajoutés sur place. Le tableau 5 dresse la liste des classes et des types autorisés. Le bulletin 30072-013-21 et le Digest de Square D contiennent des renseignements relatifs aux applications.

### COVER-MOUNTED CONTROL UNITS

NEMA Type 1 general purpose enclosures with slip-on or hinged covers contain knockouts for field addition of the kits listed in Table 1.

### UNIDADES DE CONTROL PARA MONTAJE EN LA CUBIERTA

Los gabinetes NEMA tipo 1 para uso general con cubiertas deslizantes o abisagradas contienen agujeros ciegos para la adición de los accesorios enumerados en la tabla 1 los cuales pueden ser instalados en el local del cliente.

### UNITÉS DE COMMANDE MONTÉES SUR COUVERCLE

Les coffrets à usage général NEMA type 1 avec des couvercles à glissières ou à charnières contiennent des débouchures permettant l'ajout sur place des kits figurant au tableau 1.

**Table / Tabla / Tableau 1 : Field Modification Kits, Class 9999**  
**Accesorios para la modificación en el local del cliente, clase 9999**  
**Kits de modification sur place, classe 9999**

Kit / Accesorio / Kit	Slip-On Cover Cubierta deslizante Couvercle à glissières	Hinged Cover Cubierta abisagrada Couvercle à charnières	Form (Factory Mod.) Forma (mod. de fábrica) Forme (mod. par l'usine)
Push button, Start-Stop Botón pulsador de arranque-parada Bouton-poussoir, Démarrage-Arrêt	SA2	SA3	A
Push button, On-Off Botón pulsador, encendido-apagado Bouton-poussoir, Marche-Arrêt	SA10	SA3	A3
Selector switch, Hand-Off-Auto Interruptor selector, manual-apagado-auto Interrupteur de sélection, Manuel-Arrêt-Auto	SC2	SC8	C
Selector switch, On-Off Interruptor selector, encendido-apagado Interrupteur de sélection, Marche-Arrêt	SC22	—	C6
Red pilot light Lámpara piloto roja Lampe témoin rouge	SP2R	SP28R <sup>[1]</sup>	P1

<sup>[1]</sup> For 120 V~ only. For other voltages, use Class 9001, Type KP units.  
 Para 120 V~ solamente. Para otras tensiones, use las unidades clase 9001, tipo KP.  
 Pour 120 V~ seulement. Pour d'autres tensions : utiliser les unités de classe 9001, type KP.

## OVERLOAD RELAYS

### Standard

*Melting alloy overload relay:* incorporates one or three thermal units. Its contact unit (item 6 in Figure 1) is available with a N.O. or N.C. isolated alarm contact, in addition to the standard N.C. contact. The contact unit with alarm circuit contacts is field-installable (see Table 5).

### Optional

*Non-temperature compensated bimetallic overload relay:* Form B1 incorporates two thermal units; Form B2 incorporates three thermal units.

*Ambient-temperature compensated bimetallic overload relay (Form B):* incorporates three thermal units.

*SPDT contact (all Type S bimetallic overload relays):* The N.O. contact can be used in an alarm circuit, and its wiring polarity must match that of the N.C. contact. Contacts are not replaceable. Use Table 5 to order replacement bimetallic overload relays.

Overload relays are not field-repairable. Do not disassemble them.

## TERMINALS

Use only **copper wire** on device power and control terminals. Pressure wire power terminals are suitable for wire sizes 14–8 AWG (2.5–6 mm<sup>2</sup>), solid or stranded. Pressure wire control terminals are suitable for wire sizes 16–12 AWG (1.5–4 mm<sup>2</sup>), solid or stranded.

## CONTACT INSPECTION AND REPLACEMENT

Discoloration and slight pitting do not harm contacts. **Do not file contacts**; this wastes contact material. Replace

## RELEVADORES DE SOBRECARGA

### Estándar

*Relevador de sobrecarga de aleación fusible:* incorpora uno o tres elementos térmicos. Su unidad de contacto (artículo 6 en la figura 1) se encuentra disponible con un contacto de alarma aislado N.A. o N.C., además del contacto estándar N.C. La unidad de contacto con los contactos de circuito de alarma se puede instalar en el local del cliente (vea la tabla 5).

### Opcional

*Relevador de sobrecarga bimetalico no compensado por temperatura:* La forma B1 incorpora dos elementos térmicos; la forma B2 incorpora tres elementos térmicos.

*Relevador de sobrecarga compensado por la temperatura ambiente (forma B):* incorpora tres elementos térmicos.

*Contacto 1P2T (todos los relevadores de sobrecarga bimetalicos tipo S):* El contacto N.A. puede ser usado en un circuito de alarma y su polaridad de cableado debe corresponder con la polaridad del contacto N.C. Los contactos no se pueden reemplazar. Utilice la tabla 5 para solicitar repuestos de los relevadores de sobrecarga bimetalicos.

Los relevadores de sobrecarga no se pueden reparar en el local del cliente. No los desmonte.

## TERMINALES

Use sólo conductores de **cobre** en las terminales de alimentación y control del equipo. Las terminales de alimentación de los conductores a presión son adecuadas para tamaños de cables calibre 14–8 (2,5–6 mm<sup>2</sup>), sencillo o múltiple. Las terminales de control de los conductores a presión son adecuadas para tamaños de cables calibre 16–12 (1,5–4 mm<sup>2</sup>), sencillo o múltiple.

## INSPECCION Y REEMPLAZO DE CONTACTOS

La decoloración y picadura liviana no dañan los contactos. **No lime los contactos**; esto desperdicia el material del contacto. Reemplace los contactos

## RELAIS DE SURCHARGE

### Standard

*Relais de surcharge à fusion d'alliage :* incorpore une ou trois unités thermiques. Son unité de contact (article 6, figure 1) est disponible avec un contact d'alarme isolé N.O. ou N.F. en plus du contact N.F. standard. L'unité de contact avec les contacts de circuit d'alarme peut être installée sur place (voir le tableau 5).

### En option

*Relais de surcharge bimetalique non stabilisé en température :* la forme B1 incorpore deux unités thermiques ; la forme B2 incorpore trois unités thermiques.

*Relais de surcharge bimetalique stabilisé en température (forme B) :* incorpore trois unités thermiques.

*Contact UPBD (tous les relais de surcharge bimetaliques de type S) :* le contact N.O. peut être utilisé dans un circuit d'alarme et la polarité de son câblage doit correspondre à celle du contact N.F. Les contacts ne peuvent pas être remplacés. Utiliser le tableau 5 pour commander des relais de surcharge bimetaliques de rechange.

Les relais de surcharge ne peuvent pas être réparés sur place. Ne pas les démonter.

## BORNES

Utiliser uniquement des fils en **cuivre** sur les bornes d'alimentation et de commande du dispositif. Les bornes d'alimentation des fils à pression conviennent pour des fils de calibre 14 à 8 AWG (2,5 à 6 mm<sup>2</sup>), à un ou plusieurs brins. Les bornes de commande des fils à pression conviennent pour des fils de calibre 16 à 12 AWG (1,5 à 4 mm<sup>2</sup>) à un ou plusieurs brins.

## INSPECTION ET REMPLACEMENT DES CONTACTS

La décoloration ou de légères piqûres de surface n'altèrent en rien les contacts. **Ne pas limer les contacts** ; ceci abîme le matériau de contact. Ne

contacts (item 4 in Table 5) only when worn thin.

To inspect or replace contacts, disconnect all power. Do not remove any wiring. Loosen the two captive screws (C) holding the contact actuator to the contact block. Lift the contact actuator to expose the contacts.

The Class 9998, Type SL22 kit contains replacement contacts and springs only for **power pole** kits. Each N.O. or N.C. contact requires one kit.

(artículo 4 en la tabla 5) sólo cuando estén desgastados.

Para inspeccionar o reemplazar los contactos, desconecte toda la alimentación. No retire el cableado. Desatornille los dos tornillos imperdibles (C) sosteniendo el actuador de contacto al bloque de contactos. Levante el actuador de contacto para exponer los contactos.

El accesorio clase 9998, tipo SL22 contiene contactos y resortes de repuesto solamente para los accesorios de los **polos de potencia**. Cada contacto N.A. o N.C. requiere un accesorio.

remplacer les contacts que lorsqu'ils sont usés (article 4, tableau 5).

Pour inspecter ou remplacer les contacts, mettre l'ensemble hors tension. Ne pas retirer le câblage. Desserrer les deux vis prisonnières (C) en maintenant l'actionneur du contact contre le bloc à contacts. Soulever l'actionneur des contacts pour faire apparaître ces derniers.

Le kit de classe 9998, type SL22 contient des contacts et des ressorts de rechange uniquement pour des kits des **pôles d'alimentation**. Chaque contact N.O. ou N.F. nécessite un kit.

**MANUAL OPERATION**

**FUNCIONAMIENTO MANUAL**

**FONCTIONNEMENT MANUEL**

**⚠ WARNING / ADVERTENCIA / AVERTISSEMENT**

**UNINTENDED EQUIPMENT OPERATION**

Disconnect all power before manually operating equipment to avoid contact arcing and unexpected load energization.

**Failure to observe this precaution can result in death, serious injury, or equipment damage.**

**OPERACION INVOLUNTARIA DEL EQUIPO**

Desconecte toda la alimentación antes de hacer funcionar manualmente el equipo, para evitar la formación de arcos en los contactos y la energización inesperada de carga.

**El incumplimiento de esta precaución puede causar la muerte, lesiones serias o daños al equipo.**

**FONCTIONNEMENT INVOLONTAIRE DE L'APPAREIL**

Coupez l'alimentation avant d'actionner manuellement cet appareil, pour éviter la formation d'arcs électriques sur les contacts ou une alimentation inattendue de la charge.

**Si cette précaution n'est pas respectée, cela peut entraîner la mort, des blessures graves ou des dommages matériels.**

Manually operate the contactor or starter with a screwdriver by pushing down the contact carrier. The coil cover has a slot for this use.

**COIL REPLACEMENT**

To remove the coil, loosen the two captive cover screws (A). Disconnect the wires from the coil terminals and remove the cover. Remove and disassemble the magnet, coil, and armature.

To replace the coil, assemble the magnet, replacement coil, and armature. Manually operate the contact carrier (described in "Manual Operation") and insert the complete unit. Before installing the cover, manually operate the device to ensure that all parts function properly. Use the

Haga funcionar manualmente el contactor o arrancador con un desarmador oprimiendo el portacontacto hacia abajo. La cubierta de la bobina tiene una ranura para este uso.

**REEMPLAZO DE LA BOBINA**

Para retirar la bobina, desatornille los dos tornillos imperdibles de la cubierta (A). Desconecte los cables de las terminales de la bobina y quite la cubierta. Retire y desmonte la bobina, el imán y la armadura.

Para reemplazar la bobina, ensamble el imán, la bobina de repuesto y la armadura. Haga funcionar manualmente el portacontacto (descrito en "Funcionamiento manual") y coloque la unidad completa. Antes de instalar la cubierta, haga funcionar manualmente el equipo y asegúrese de que todos sus componentes estén funcionando adecuadamente. Use los pares de apriete

Actionner manuellement le contacteur ou le démarreur en poussant le porte-contact vers le bas avec un tournevis. Le couvercle de la bobine possède une fente réservée à cet usage.

**REEMPLACEMENT DE LA BOBINE**

Pour retirer la bobine, desserrer les deux vis prisonnières du couvercle (A). Débrancher les fils des bornes de la bobine et ôter le couvercle. Retirer et démonter l'aimant, la bobine et l'armature.

Pour remplacer la bobine, assembler l'aimant, la bobine de rechange et l'armature. Actionner manuellement le porte-contact (comme décrit dans «Fonctionnement manuel») et insérer l'unité complète. Avant d'installer le couvercle, actionner manuellement le dispositif pour s'assurer que toutes les pièces fonctionnent correctement. Pour

tightening torques listed in Table 2 when reassembling device.

### ASSEMBLY

Figure 1 illustrates the contactor or starter assembly. Table 2 on page 6 and the device instructions provide factory recommended torques for mechanical, electrical, and pressure wire connections.

Use these torques to ensure proper device operation.

### SHORT-CIRCUIT PROTECTION

Provide branch-circuit overcurrent protection for starters, referring to the instructions supplied with the thermal unit selection table. Provide branch-circuit overcurrent protection for contactors (Class 8502 or 8702) in accordance with the National Electrical Code (NEC). Do not exceed the maximum protective device ratings listed in Table 3 on page 6.

Provide overcurrent protection for control circuits in accordance with the NEC and/or other applicable electrical codes. For applications requiring compliance with I.E.C. 947-5-1, use only Class CC fuses or better, 30 A maximum.

### DISTANT CONTROL

Depending upon the voltage, wire size, and number of control wires used, series impedance or shunt capacitance may limit the maximum distance of the wire run for remotely operated contactors and starters. If distances to start or stop stations exceed those listed in Table 4 on page 6, analyze the wire-run configuration and materials. For further information, request data bulletin M379 from D-FAX (document #1188), the Square D website ([www.squared.com](http://www.squared.com)), or your local Square D field office.

enumerados en la tabla 2 cuando vuelva a montar el equipo.

### ENSAMBLE

La figura 1 ilustra el ensamble del arrancador o del contactor. La tabla 2 en la página 6 y las instrucciones del equipo proporcionan los pares de apriete recomendados por el fabricante para las conexiones mecánicas, eléctricas y de los conductores a presión.

Use estos pares de apriete para asegurar el funcionamiento adecuado del equipo.

### PROTECCION CONTRA CORTOCIRCUITO

Proporcione protección contra sobrecorriente de circuito de derivación a los arrancadores, consultando las instrucciones incluidas con la tabla de selección del elemento térmico.

Proporcione protección contra sobrecorriente de circuito de derivación a los contactores (clase 8502 ó 8702) de acuerdo con el código nacional eléctrico de EUA (NEC). No exceda los valores nominales máx. del equipo protector que se enumeran en la tabla 3 en la página 6.

Proporcione protección contra sobrecorriente en los circuitos de control de acuerdo con el NEC y/u otros códigos eléctricos aplicables. Utilice solamente fusibles clase CC o mejores, de 30 A como máximo, en las aplicaciones que requieran el cumplimiento de la norma 947-5-1 de I.E.C.

### CONTROL A DISTANCIA

Dependiendo de la tensión, del calibre del conductor y de la cantidad de conductores de control que se usan, la impedancia en serie o la capacitancia en derivación puede limitar la distancia máxima del tendido de cables de contactores y arrancadores que se hacen funcionar remotamente. Si las distancias a las estaciones de arranque o parada exceden aquéllas enumeradas en la tabla 4 en la página 6, analice la configuración del tendido de cables y los materiales. Para obtener más información, solicite el boletín de datos del producto M379 de su oficina local de ventas de Square D.

remonter le dispositif, utiliser les couples de serrage figurant au tableau 2.

### ASSEMBLAGE

La figure 1 représente l'assemblage du contacteur ou démarreur. Le tableau 2 à la page 6 et les directives du dispositif donnent la liste des couples de serrage recommandés par l'usine pour des connexions mécaniques, électriques et de fils à pression.

Utiliser ces couples pour assurer un fonctionnement correct du dispositif.

### PROTECTION CONTRE LES COURTS-CIRCUITS

Fournir un dispositif de protection d'artère pour démarreurs, conformément aux directives figurant dans le tableau de sélection de l'unité thermique. Fournir un dispositif de protection d'artère pour contacteurs (classe 8502 ou 8702) conformément au Code national de l'électricité (CNÉ). Ne pas dépasser l'intensité nominale maximale du dispositif de protection figurant au tableau 3 à la page 6.

Fournir un dispositif de protection contre la surcharge aux circuits de commande selon le CNÉ et d'autres codes électriques applicables. Pour les applications devant être conformes à la norme 947-5-1 de I.E.C. (CEI : Commission électronique internationale) utiliser uniquement les fusibles Classe CC ou supérieurs, de 30 A au maximum.

### COMMANDE À DISTANCE

Selon la tension, le calibre du fil et le nombre de fils de commande utilisés, l'impédance de série ou la capacité shunt peut limiter la longueur maximale du câblage des contacteurs et des démarreurs commandés à distance. Si les distances aux postes de départ ou d'arrêt dépassent celles figurant dans le tableau 4 à la page 6, analyser la configuration et les matériaux du câblage des conducteurs. Pour de plus amples informations, consulter le bulletin M379 sur les données des produits, auprès du bureau local de vente de Square D.

**Table / Tabla / Tableau 2 : Factory Recommended Tightening Torques / Pares de apriete recomendados de fábrica  
 Couples de serrage recommandés par l'usine**

Item Art.	Description	Descripción	Description	Tightening Torque / Par de apriete / Couple de serrage	
				lb-in / lb-pulg lb-po	N•m
A	Cover screw (2 per cover)	Tornillo de la cubierta (2 por cubierta)	Vis de couvercle (2 par couvercle)	18-21	2,0-2,3
B	Coil terminal pressure wire connector (2 per coil)	Conector de los conductores a presión de la terminal de la bobina (2 por bobina)	Connecteur des fils à pression aux bornes de la bobine (2 par bobine)	9-12	1,0-1,3
C	Power plant screw (2 per device)	Tornillo de la planta de alimentación (2 por dispositivo)	Vis du groupe électrogène (2 par dispositif)	18-21	2,0-2,3
D	Internal auxiliary contact pressure wire connector (2 per contact)	Conector de los conductores a presión del contacto auxiliar interno (2 por contacto)	Connecteur des fils à pression du contact auxiliaire interne (2 par contact)	9-12	1,0-1,3
E	Stationary contact fastener (2 per pole)	Sujetador del contacto estacionario (2 por polo)	Attache de fixation du contact stationnaire (2 par pôle)	6-9	0,68-1,0
F	Lug screw (2 per pole)	Tornillo de la zapata (2 por polo)	Vis de cosse (2 par pôle)	[1]	[1]
G	Auxiliary wire binding screw	Tornillo de sujeción del conductor auxiliar	Vis de fixation du fil auxiliaire	18-21	2,0-2,3
H	Overload relay fastening screw (2 per overload block)	Tornillo sujetador del relevador de sobrecarga (2 por bloque de sobrecarga)	Vis de fixation du relais de surcharge (2 par bloc de surcharge)	18-21	2,0-2,3
J	Overload switch module fastening screw (1 per module)	Tornillo sujetador del módulo del interruptor de sobrecarga (1 por módulo)	Vis de fixation du module d'interrupteur de surcharge (1 par module)	9-12	1,0-1,3
K	Switch module pressure wire connector (2 per module standard; 4 per module with alarm circuit contact)	Conector de los conductores a presión del módulo del interruptor (2 por módulo estándar; 4 por módulo con contacto de circuito de alarma)	Connecteur des fils à pression du module d'interrupteur (2 par module en standard; 4 par module avec contact de circuit d'alarme)	9-12	1,0-1,3
L	Overload-to-contactor fastening screw (1 per pole)	Tornillo sujetador del relevador de sobrecarga al contactor (1 por polo)	Vis de fixation du relais de surcharge au contacteur (1 par pôle)	18-21 [2]	2,0-2,3[2]
M	Overload thermal unit fastening screw (2 per pole)	Tornillo sujetador del elemento térmico de sobrecarga (2 por polo)	Vis de fixation de l'unité thermique de surcharge (2 par pôle)	18-21	2,0-2,3

[1] See instructions supplied with the device. / Siga las instrucciones que vienen incluidas con el dispositivo. / Voir les directives accompagnant le dispositif.

[2] For contactor, see instructions supplied with the device. / Para el contactor, siga las instrucciones que vienen incluidas con el dispositivo. / Pour le contacteur, voir les directives accompagnant le dispositif.

**Table / Tabla / Tableau 3 : Maximum Ampere Rating / Valores nominales máx. en amperes  
 Valeurs nominales maximales de courant**

Maximum Voltage Tensión máxima Tension maximale	Class K5, RK5 or RK1 Fuse Fusible clase K5, RK5 o RK1 Fusible de classe K5, RK5 ou RK1	Class J or T Fuse Fusible clase J o T Fusible de classe J ou T	Inverse-Time Circuit Breaker Interruptor automático de retardo inverso Disjoncteur à retard inverse
600 V~	20 A	30 A	20 A
250 V~	25 A	30 A	35 A

**Table / Tabla / Tableau 4 : Maximum Control Distance for Copper Wire / Distancia máxima de control de conductores de cobre / Distance de commande maximale pour fils de cuivre**

Coil Voltage @ 60 Hz Tensión de la bobina @ 60 Hz Tension de bobine à 60 Hz	Maximum Control Distance / Distancia máxima de control / Distance maximale de commande			
	14 AWG (2,08 mm <sup>2</sup> )		12 AWG (3,3 mm <sup>2</sup> )	
	ft / pies / pieds	m	ft / pies / pieds	m
120 V~	845	258	1300	396
240 V~	595	181	495	151
480 V~	145	44	125	36

**PARTS ORDERING**

Specify the quantity, the part number or Class and Type, and the part description, giving complete nameplate data of the device (e.g., one armature and magnet kit 31041-605-50 for a Class 8536, Type SBO2, Series A starter).

**SOLICITUD DE PIEZAS**

Especifique la cantidad, el número de pieza o clase y tipo, y descripción de la pieza, proporcionando los datos completos de la placa de identificación del equipo (p.ej., un accesorio de imán y armadura 31041-605-50 para un arrancador clase 8536, tipo SBO2, serie A).

**COMMANDE DE PIÈCES**

Spécifier la quantité, le numéro de pièce ou la classe et le type, ainsi que la description de la pièce, en donnant tous les renseignements figurant sur la plaque signalétique du dispositif (par ex., accessoire d'armature et d'aimant 31041-605-50 pour un démarreur de classe 8536, type SBO2, série A).

**Table / Tabla / Tableau 5 : Parts List / Lista de piezas / Liste de pièces**

Item Art.	Description	Descripción	Description	Part Number Número de pieza N° de pièce	Quantity / Cantidad Quantité				
					1 P	2 P	3 P	4 P	5 P
1	Armature and magnet kit	Accesorio de imán y armadura	Kit d'armature et d'aimant	31041-605-50	1	1	1	1	1
2	Coil	Bobina	Bobine	See table 6 / Vea la tabla 6 Voir le tableau 6	1	1	1	1	1
3	Internal auxiliary contact N.O. N.C.	Contacto auxiliar interno N.A. N.C.	Contact auxiliaire interne N.O. N.F.	Class / Clase / Classe 9999 Type / tipo / type SX11 Type / tipo / type SX12	[3] —	[3] —	1 —	1 —	1 —
4	Contact kit	Accesorio de contacto	Kit de contact	Class / Clase / Classe 9998 Type / tipo / type SL2 Type / tipo / type SL12 Type / tipo SL12 & SL22	1 — —	1 — —	1 — —	— 1 —	— — 1
5	Melting alloy overload relay assembly 1 Element 2 or 3 Element	Ensamblaje del relevador de sobrecarga de aleación fusible 1 elemento 2 ó 3 elementos	Assemblage de relais de surcharge à fusion d'alliage 1 élément 2 ou 3 éléments	Class / Clase / Classe 9065 Type / tipo / type SDO4 Type / tipo / type SDO5	1 —	1 —	— 1	— 1	— 1
5 [1]	Bimetallic overload relay Non-compensated 2 element (Form B1) 3 element (Form B2) Compensated 3 element (Form B)	Relvador de sobrecarga bimetalico No compensado 2 elementos (forma B1) 3 elementos (forma B2) Compensado 3 elementos (forma B)	Relais de surcharge bimétallique Non compensé en température 2 éléments (forme B1) 3 éléments (forme B2) Compensé en température 3 éléments (forme B)	Class / Clase / Classe 9065 Type / tipo / type SDO5B1 Type / tipo / type SDO6B2 Class / Clase / Classe 9065 Type / tipo / type SDO6B	— — —	— — —	— — —	— — —	— — —
6	Melting alloy overload contact unit	Unidad de contacto de sobrecarga de aleación fusible	Unité de contact de surcharge à fusion d'alliage	Class / Clase / Classe 9998 Type / tipo / type SO1	1	1	1	1	1
6 [1]	Melting alloy overload contact unit with alarm circuit N.O. alarm contact N.C. alarm contact	Unidad de contacto de sobrecarga de aleación fusible con circuito de alarma Contacto de alarma N.A. Contacto de alarma N.C.	Unité de contact de surcharge à fusion d'alliage avec circuit d'alarme Contact d'alarme N.O. Contact d'alarme N.F.	Class / Clase / Classe 9999 Type / tipo / type SO4 Type / tipo / type SO5	— —	— —	— —	— —	— —
7	Reset bar	Barra de restablecimiento	Barre de réarmement	31034-042-01	1	1	1	1	1
8	Cover only (nameplate not included)	Cubierta solamente (placa de identificación no incluida)	Couvercle seulement (plaque signalétique non incluse)	31127-013-01	1	1	1	1	1
[1]	External auxiliary contact 1 N.O. 1 N.C. 1 N.O. and 1 N.C. 1 N.O., overlapping 1 N.C., overlapping	Contacto auxiliar externo 1 N.A. 1 N.C. 1 N.A. y 1 N.C. 1 N.A., con recubrimiento 1 N.C., con recubrimiento	Contact auxiliaire externe 1 N.O. 1 N.F. 1 N.O. et 1 N.F. 1 N.O., chevauchement 1 N.F., chevauchement	Class / Clase / Classe 9999 Type / tipo / type SX6 Type / tipo / type SX7 Type / tipo / type SX8 Type / tipo / type SX9 Type / tipo / type SX10	— — — — —	— — — — —	— — — — —	— — — — —	— — — — —
[1]	Power pole kit 1 N.O. 2 N.O.	Accesorio del polo de potencia 1 N.A. 2 N.A.	Kit de pôle d'alimentation 1 N.F. 2 N.F.	Class / Clase / Classe 9999 Type / tipo / type SB6 Type / tipo / type SB9	— —	— —	— —	1 —	— 1
10 [2]	Lever bearing	Cojinete de la palanca	Galet de levier	31041-032-01	1	1	1	1	1

[1] Not shown. / No se muestra. / Non montré.

[2] To ensure proper device operation: when installing the lever bearing onto the lever, the oval concavity on the inside surface of one leg of the bearing must mate with the corresponding oval convexity on the bottom of the lever.  
Para asegurarse de que el equipo está funcionando adecuadamente al instalar el cojinete de la palanca en la misma; la concavidad ovalada en la superficie interior en uno de los pies del cojinete debe corresponder con la convexidad ovalada correspondiente en la parte inferior de la palanca.  
Pour assurer un fonctionnement correct : lors de l'installation du galet du levier sur ce dernier, veiller à faire correspondre la cavité ovale située sur la surface interne d'un pied du galet avec la forme convexe située au bas du levier.

[3] Furnished on 2-pole starters; however 1- and 2-pole contactors are furnished with a holding circuit contact rated the same as a power pole.  
Incluida con los arrancadores de 2 polos; sin embargo, los contactores de 1 y 2 polos incluyen un contacto de circuito de sostén con el mismo valor nominal de un polo de potencia.  
Fourni sur les démarreurs à 2 pôles ; toutefois, les contacteurs à 1 et 2 pôles sont fournis avec un contact de circuit de retenue de la même valeur nominale que le pôle d'alimentation.

Table / Tabla / Tableau 5 : Parts List / Lista de piezas / Liste de pièces (cont. / cont. / suite)

Item Art.	Description	Descripción	Description	Part Number Número de pieza N° de pièce	Quantity / Cantidad Quantité				
					1 P	2 P	3 P	4 P	5 P
A	Cover screw	Tornillo de la cubierta	Vis de couvercle	21937-14341	2	2	2	2	2
B	Coil terminal pressure wire connector	Conector de los conductores a presión de las terminales de la bobina	Connecteur des fils à pression aux bornes de la bobine	31051-007-50	2	2	2	2	2
C	Power plant screw	Tornillo de la planta de alimentación	Vis du groupe électrogène	21916-14501	2	2	2	2	2
F	Wire clamp and screw (Size 0 contactor)	Pinza y tornillo del conductor (contactor tamaño 0)	Vis de fixation et serre-fil (contacteur de taille 0)	30018-018-50	—	—	—	2	4
G	Auxiliary wire binding screw	Tornillo de sujeción del conductor auxiliar	Vis de fixation de fil auxiliaire	21819-25081	2	2	2	2	2
L	Wire clamp and screw (Size 0 contactor)	Pinza y tornillo del conductor (contactor tamaño 0)	Vis de fixation et serre-fil (contacteur de taille 0)	30018-070-50	2	4	6	6	6
M	Overload thermal unit fastening screw	Tornillo sujetador del elemento térmico de sobrecarga	Vis de fixation de l'unité thermique de surcharge	21920-16160	—	4	6	6	6

The complete coil part number contains a prefix and a suffix (e.g., for 120 V~ 60 Hz coil, select 31041-400-42). When ordering replacement coils, give the part number, voltage, and frequency of the coil being replaced.

El número de pieza completo de la bobina contiene un prefijo y un sufijo (es decir, para una bobina de 120 V~ 60 Hz, el número de pieza es 31091-400-42). Cuando solicite las bobinas de repuesto, proporcione el número de pieza, la tensión y la frecuencia de la bobina que se está reemplazando.

Le numéro complet de la pièce de la bobine contient un préfixe et un suffixe (par ex., pour une bobine 120 V~ 60 Hz, sélectionner 31041-400-42). Pour commander des bobines de rechange, indiquer le numéro de pièce, la tension et la fréquence de la bobine à remplacer.

Table / Tabla / Tableau 6 : Magnet Coil Part Numbers / Números de piezas de la bobina magnética  
 Numéros de pièces des bobines d'aimant

Coil Prefix Prefijo de la bobina Préfixe de bobine	Hz	Coil Suffix / Sufijo de la bobina / Suffixe de bobine														VA~	
		24 V~	110 V~	120 V~	120/240 V~	208 V~	220 V~	240 V~	240/480 V~	277 V~	380 V~	440 V~	480 V~	550 V~	600 V~	Inrush Irrupción VA d'appel	Sealed Sellado Scellement
31041-400	60	20	Use Utilice Utiliser 120 V~	42	[1]	48	Use Utilice Utiliser 240 V~	51	[1]	52	56	Use Utilice Utiliser 480 V~	60	Use Utilice Utiliser 600 V~	62	245	27
	50	22	42	43	—	—	51	53	—	—	57	60	—	62	64	232	26

[1] Dual voltage coil. For 120/240 V~ 60 Hz, order 31041-402-02. For 240/480 V~ 60 Hz, order 31041-402-04.

[1] Bobina de tensión doble. Solicite 31041-402-02 para los modelos de 120/240 V~ 60 Hz y 31041-402-04 para los modelos de 240/480 V~ 60 Hz.

[1] Bobine à double tension. Commander 31041-402-02 pour les modèles à 120/240 V~ 60 Hz. Commander 31041-402-04 pour les modèles à 240/480 V~ 60 Hz.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

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 www.schneider-electric.com.mx

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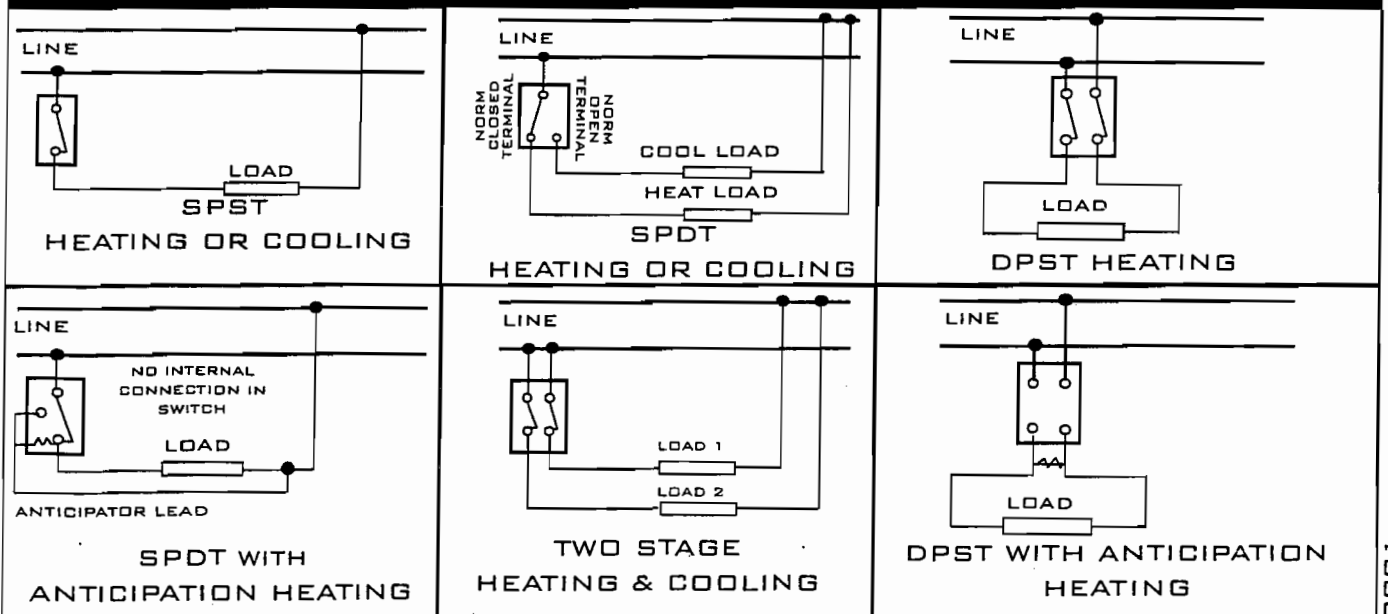
# COLUMBUS ELECTRIC

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DESCRIPTION	SPECIFICATIONS
<p>THE COLUMBUS ELECTRIC WALL LINE VOLTAGE THERMOSTAT IS SUITABLE FOR DIRECT CONNECTION WITH ANY RESISTANCE HEATING ELEMENTS AND UNIT HEATERS.</p>	<p><b>ELECTRICAL RATING</b>                      22 AMPS @ 125/277 VAC                      3/4 HP @ 125 VAC                      1 1/2 HP @ 250/277 VAC</p>
<p>THIS THERMOSTAT HAS A SNAP ACTION SWITCH OPERATED BY A BIMETAL ACTUATOR AND IS AVAILABLE IN SINGLE POLE, DOUBLE POLE WITH POSITIVE OFF, TWO STAGE HEAT, COOLING ONLY AND HEAT OR COOL MODELS. OTHER OPTIONS INCLUDE FACTORY OR FIELD INSTALLED LOCKING KITS FOR TOP AND FOR BOTTOM SETTING AND 6" WIRE LEADS.</p>	<p><b>DIFFERENTIAL</b>                      HEAT APPROXIMATELY.....2°F                      COOLING APPROXIMATELY....4°F                      HEAT ANTICIPATOR MODEL...1/2°F</p>
<p><b>WARNING</b></p> <p>IF THIS PRODUCT IS USED TO REPLACE A DEVICE CONTAINING MERCURY, THE PURCHASER OR CONSUMER MUST ENSURE THAT THE MERCURY IS PROPERLY MANAGED TO COMPLY WITH STATE OR FEDERAL REGULATIONS. THE MERCURY MUST NOT BECOME PART OF SOLID WASTE OR WASTE WATER. ADDITIONAL GUIDANCE MAY BE OBTAINED FROM THE MANUFACTURER OF THE PRODUCT BEING REMOVED, OR BY CALLING COLUMBUS ELECTRIC MANUFACTURING COMPANY MATERIALS MANAGER.</p>	<p><b>TEMPERATURE RANGE (STANDARD MODELS)</b>                      SETTING RANGE.....50°F TO 90°                      HEATING OR COOLING.50°F TO 90°                      ATTIC FAN CONTROL...90°F TO 135°</p>
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It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

**WARNING:** These products are not designed for use in, and should not be used for, patient connected applications.

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## SAFETY INSTRUCTIONS

The following instructions must be observed.

- This instrument was designed and is checked in accordance with regulations in force EN 60950 ("Safety of information technology equipment, including electrical business equipment").  
A hazardous situation may occur if this instrument is not used for its intended purpose or is used incorrectly. Please note operating instructions provided in this manual.
- The instrument must be installed, operated and maintained by personnel who have been properly trained. Personnel must read and understand this manual prior to installation and operation of the instrument.
- The use of an external line fuse is recommended. Add or replace the external fuse with the following specified type and rating only:

<u>Input Power</u>	<u>Recommended Fuse</u>
115 VAC	100 mA slow blow fuse
230 VAC	50 mA slow blow fuse
12-24 VDC	250 mA slow blow fuse

**Disconnect power supply before adding or replacing fuse!**

- The manufacturer assumes no liability for damage caused by incorrect use of the instrument or for modifications or changes made to the instrument.

## Symbols Used On Unit

<u>Number</u>	<u>Symbol</u>	<u>Publication</u>	<u>Description</u>
1	— — —	IEC 417, No. 5031	Direct current
2		IEC 417, No. 5172	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION (equivalent to Class II of IEC 536—see annex H)
3		ISO 3864, No. B.3.1	Caution (refer to accompanying documents)

## Technical Improvements

- The manufacturer reserves the right to modify technical data without prior notice.

# DESCRIPTION & SPECIFICATIONS

**Description:**

Featuring 6 digits of bright, 7-segment LED displays, this unit is an integrating totalizer/ratemeter which accepts analog signal inputs. The unit can be field programmed to accept 0-20mA, 4-20mA, 0-5V, 0-10V or 1-5V signals. An optional Square Law input is available for inputs that require square root extraction. A 4-20mA output option is available to control strip recorders or other peripherals. Two assignable set points are standard for two stage shut off. The high and low scaling settings are programmable from the front panel. By pressing the "view" button, the unit will display: integrated total, rate, peak or valley. RS-422 or RS-232 serial communications are available options for data communication with a host computer.

**Specifications:**

**Display:** 6 digit, .55" high, LED.

**Input Power:** 110, 220 VAC ± 15% or 12 to 24VDC.  
Current: maximum 300 mA DC or 10.0 VA at rated AC voltage.

**Output Power:** (AC powered units only) + 24VDC.  
@ 50 mA regulated ±5%

**Temperature:**

Operating: +41°F (5°C) to +130°F (+54°C).  
Storage: -40°F (-40°C) to +200°F (93°C).

**Memory:** EEPROM stores data for ten years if power is lost.

**Reset:**

Front Panel: resets displayed values and control outputs.

Remote: 4-30 VDC positive edge, resets totalizer and control outputs.

**Control Outputs:**

Standard: Open collector sinks 250 mA from 30VDC when active.

Optional: 2 each Form C SPDT 10Amp @ 120/240 VAC or 28 VDC. (Open collector outputs are also supplied with 10VDC provided at transistor outputs through relay coil. If greater than 2mA is used, relay will remain energized. Applying greater than 10 VDC may destroy unit. Transistor will sink 100mA in "ON" state.)

**Input:**

Standard: Linear 0-20mA, 4-20mA, 0-5V, 0-10V or 1-5V selectable from the front panel.

Optional: Square Law 0-20mA, 4-20mA, 0-5V, 0-10V, or 1-5V, is available for inputs that require square root extraction.

**Input Impedance:** Current: 100Ω; Voltage: 115KΩ

**Calibration:** The unit does all of the calibrations internally. There are no potentiometers to adjust and the unit never needs to be removed from the case.

**Set Points:** The two control set points can be set at any number from 0 to 59999. The set point outputs can be assigned to rate or total. The unit comes standard with two open collector control outputs. Two 5 Amp, Form C relays are optional. The outputs are programmable from .01 to 599.99 sec or latched until reset when assigned to the total and a hysteresis (alarm range) when assigned to the rate.

**Rate Display:** Updates 5 times per second, Accurate to 4.5 digits. Set "low" greater than "high" for inverted display (LINEAR ONLY).

**Totalizer:** Integrates from the rate reading and accumulates up to 6 digits of total count. The time base (hours, minutes or seconds) is field programmable from the front panel.

**Analog Out:** The unit can be ordered with an optional 4-20mA output which is proportional to the rate display. The high and low settings are programmable from the front panel. Set "low" greater than "high" for inverted output. A sinking driver generates a corresponding linear current through the external devices. The output updates with each update of the rate. Accuracy is 50uA worst case. For rated accuracy, load must be connected to the analog output before unit is powered. Compliance voltage must be 3 to 30 VDC non inductive. (The unit can provide the DC source as long as the drop across the devices being driven does not exceed 21V).

**Programming:** Decimal points, Scaling from 0 to 59999 units per selected time base, set points, input type, security lock code, and assigning outputs are all programmable from the front panel.

**Housing:** Standard 1/8 DIN, high impact 94VO plastic case.

**Shipping Weight:** 2 lbs.

**Overvoltage Protection:**  
50 V

**Overcurrent Protection:**  
50 mA

**Resolution:** 14.5 Bits

**Accuracy:**

<u>RANGE</u>	<u>% FS ERROR</u> (worst case)	<u>% FS ERROR</u> (typical)
4-20 mA	0.1%	.05%
0-10 VDC	0.2%	0.1%
0-5 VDC	.25%	.15%
1-5 VDC	.25%	.15%

Square Law: (above 5% of bottom range) 0.1%  
(5V inputs .4%) Worst case over complete range: 2%

**Temperature Stability:** Will not drift more than 20 parts per million per °C from 5°C to 54°C



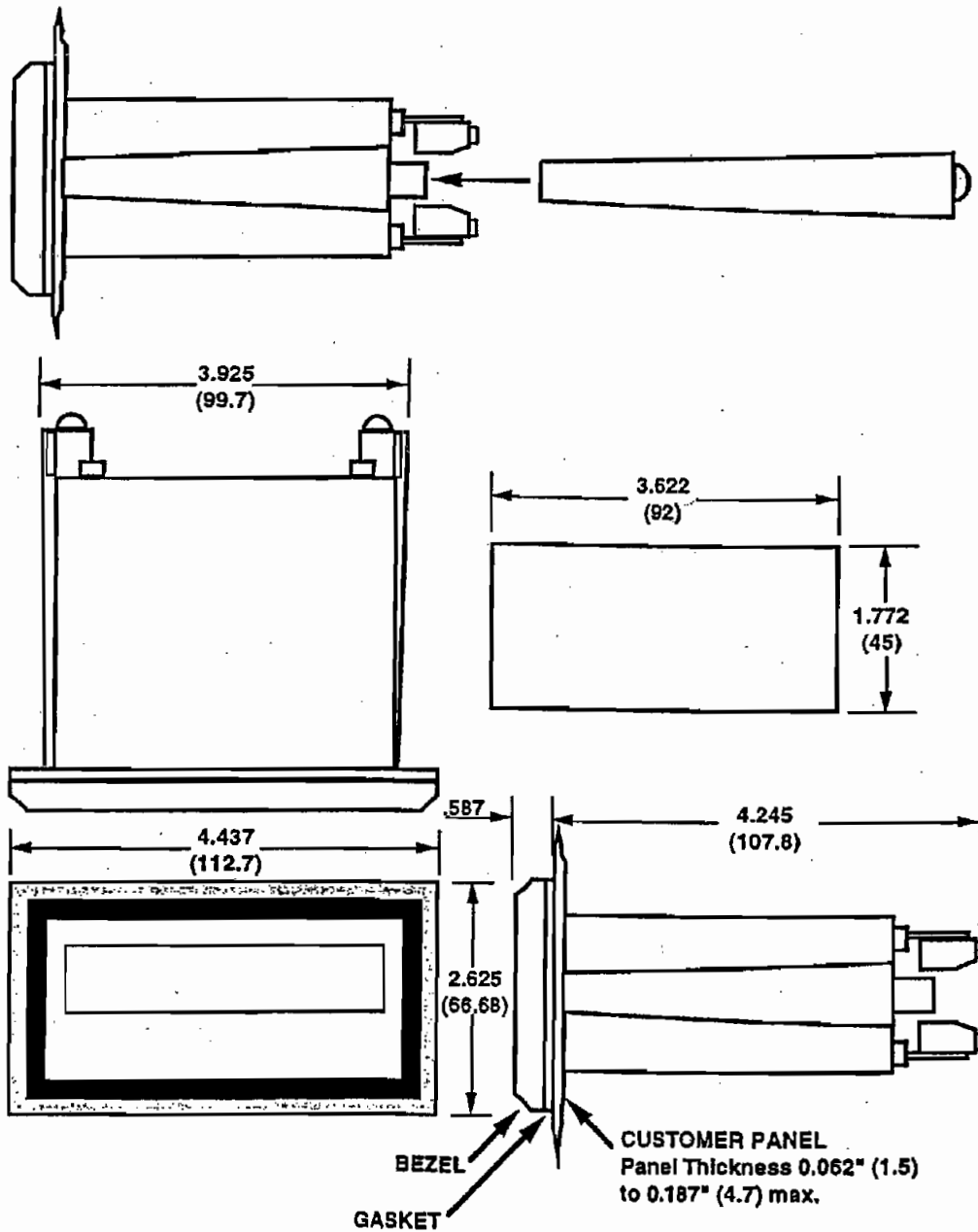
# MOUNTING

## HOW TO MOUNT:

Slide the body of the unit through the rubber gasket. Insert the unit into the panel. Slide the brackets up the groove to press against the back of the panel, as shown in "FIG. A". Insert the screws into the rear of the brackets.

Tighten the screws evenly and alternately. A panel less than .1" may distort if the clamps are screwed too tightly. Do not over tighten! A normal level of torque is required. Maximum torque should be 3" pounds.

FIG. A



# WIRING

## AC / DC CONNECTIONS:

**NOTE:** Connect power only after other connections are finished. Do not touch the live AC power terminals. The unit has been designed with an isolated AC input, therefore polarity is not a concern for the AC power. The chassis is plastic, therefore earth ground is not used. For DC operation, connect +DC to terminal 10 and -DC to terminal 3.

Although the unit is designed to be immune from line or RF interference, the unit is controlled by a microprocessor and an electrically "noisy" environment could cause operating problems. The input power lines should not be common to power lines for motors, pumps, contactors, etc.

Four sources of noise can occur:

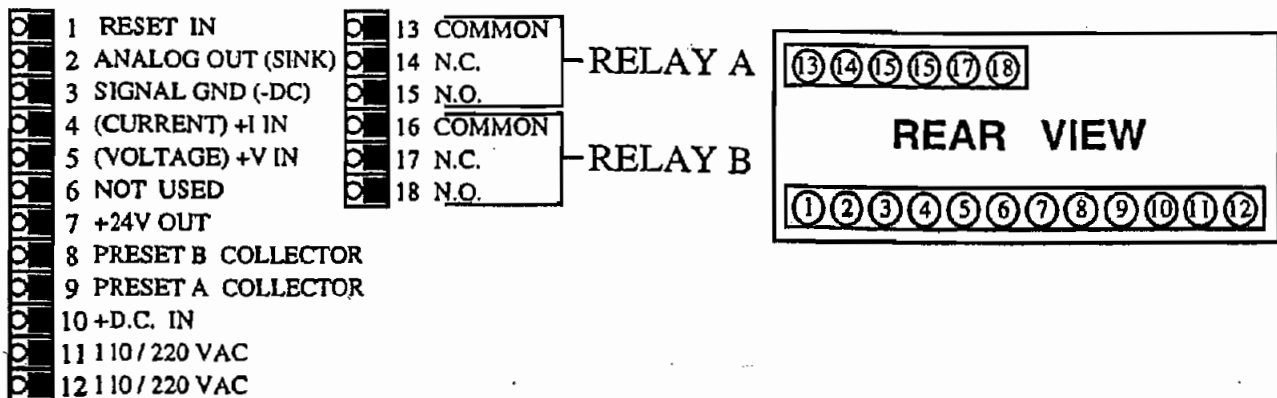
1) AC power line noise- If the unit cannot be connected to an electrically clean power source, an inductive load suppressing device (MOV as GE#V130LA1 or Resistor Capacitor as Paktron# .2uf/220 ohm @ 400V) can be installed. Although locating the suppressor across the AC supply at the unit should help, best results are obtained by connecting the suppressor across the leads of the "load" at the device causing the spikes.

2) Input line noise- The noise is carried on the input and DC ground lines. Make sure the input wires are not run into the unit in a bundle with power input lines. We recommend using shielded cable. Connect the shield to DC ground of the unit and "earth" at one point in the circuit preferably at the DC ground terminal of the unit.

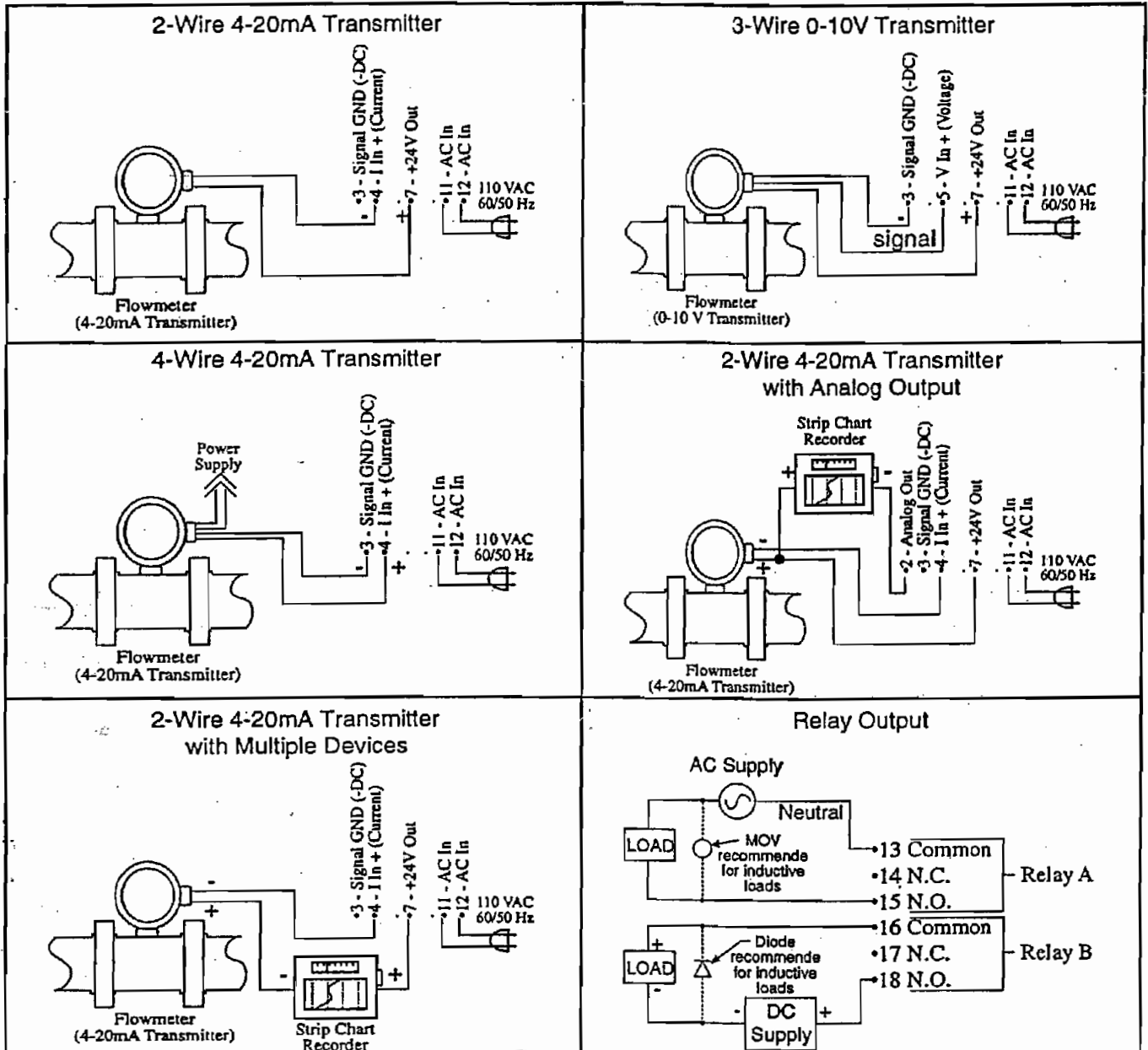
3) Output lines- The unit has Two open collector outputs and two optional relay outputs. When these outputs are used to run external relays or solenoids, spikes can be generated upon activation. This noise can spread through the instrument causing operating problems. If the source is a D.C. operated device, a general purpose diode (IN4004) placed across the solenoid prevents electrical noise spikes. Connect the cathode (banded side) to the more positive side of the coil. If the source is an A.C. operated device, use a Resistor Capacitor or MOV across the coil.

4) 24 VDC output supply- Noise can be generated on the 24 VDC output supply if it is used to drive inductive loads or if the current draw exceeds 50mA. Insure that all inductive loads have a diode (such as IN4004) across the coil and that the current does not exceed 50mA.

## WIRING CONNECTIONS



# TYPICAL WIRING HOOKUPS



## OPEN COLLECTOR & RELAY OPERATION

The open collector and relay outputs trigger when the total or rate (assignable; see programming step 2) equals the corresponding Preset (A or B). When the outputs are assigned to the "total", the operator can assign a duration of time (.01 to 599.99 sec.) that the output will remain energized. If 0.00 is assigned, the output will latch until reset. If output A is set at a duration (other than 0.00), the totalizer will autorecycle when Preset A is reached. At this time, output B will de-energize (if it was energized). Preset A is the final preset and should be set higher than Preset B, when both outputs are assigned to the total. If output A is set at a duration other than 0.00 and Preset A is set less

than Preset B, Preset B will be ignored (provided that they are both assigned to total). The totalizer will never autorecycle at Preset B.


When the outputs are assigned to the "rate", the outputs can be assigned a hysteresis (alarm range). The hysteresis is the number of units below the preset that the output will remain energized. EXAMPLE: Preset set @ 100; Hysteresis set @ 10. The output will energize when the rate equals 100 and de-energize when the rate falls below 90 (10 below Preset).


**NOTE:** If the input scaling is inverted, the control output functions are inverted (LINEAR ONLY).


# V41 & V\_41 PROGRAMMING FLOWCHART

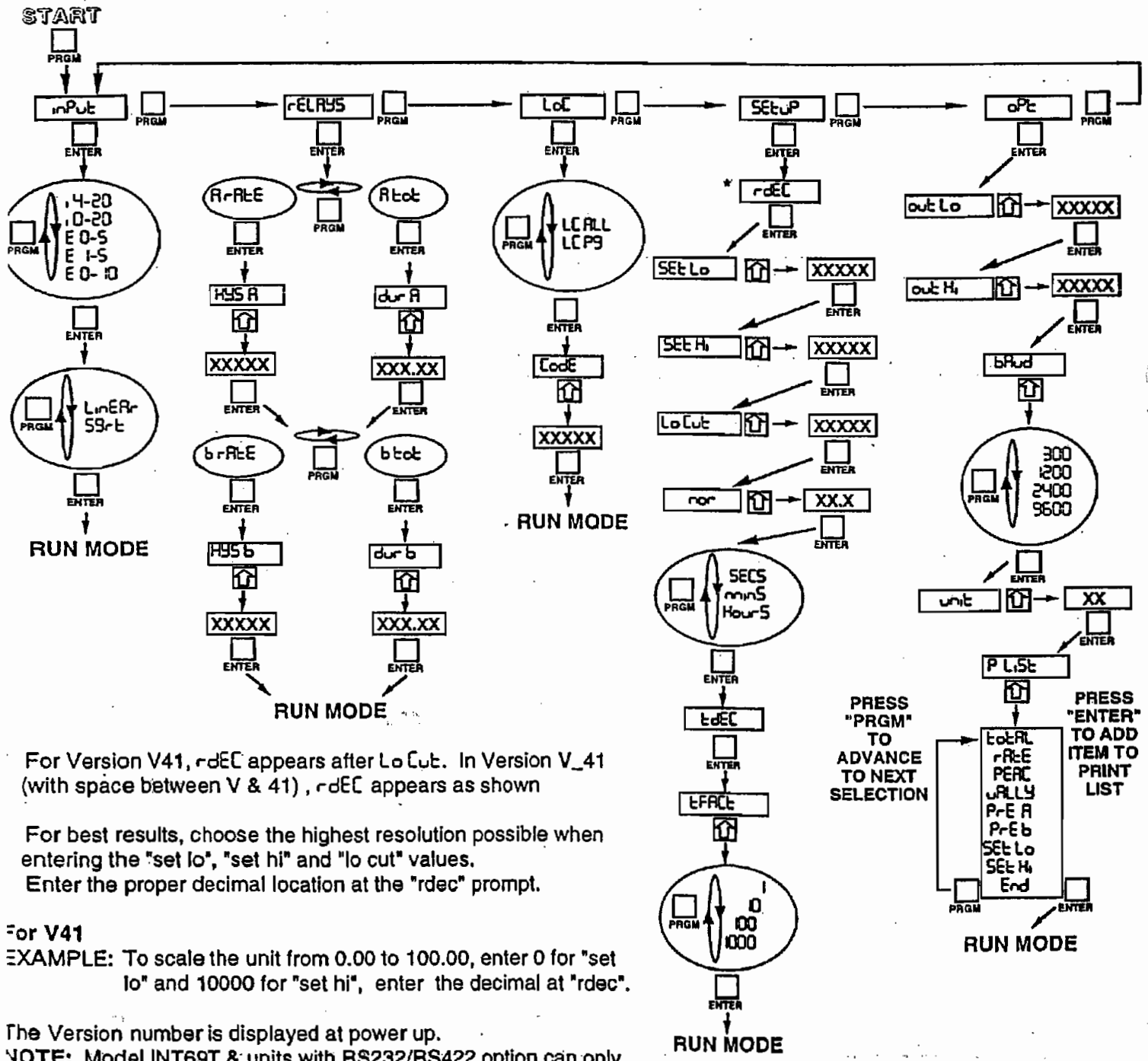
**NOTE:**

SEVERAL PROGRAMMING SELECTIONS  
**WILL NOT APPEAR WITH "RATE ONLY"  
 & "TOTAL ONLY" UNITS**  
 OPTIONS NOT ORDERED WILL NOT APPEAR  
 IN PROGRAM SELECTIONS

 This symbol indicates any key.

 Press this key to step through Menu choices

 Press this key to enter displayed value.



For Version V41, rDEC appears after Lo Cut. In Version V\_41 (with space between V & 41), rDEC appears as shown

For best results, choose the highest resolution possible when entering the "set lo", "set hi" and "lo cut" values. Enter the proper decimal location at the "rdec" prompt.

For V41  
**EXAMPLE:** To scale the unit from 0.00 to 100.00, enter 0 for "set lo" and 10000 for "set hi", enter the decimal at "rdec".

The Version number is displayed at power up.  
**NOTE:** Model INT69T & units with RS232/RS422 option can only be used with V\_41.

# DEFINITIONS

INPUT - INPUT; This section of the program menu assigns the type of input the unit will be using (0-20 mA, 4-20 mA, 0-5 V, 0-10 V, 1-5 V, Linear or square root extraction).

I4-20 - I 4-20; This sets the unit for a current input of 4 to 20 mA.

I0-20 - I 0-20; This sets the unit for a current input of 0 to 20 mA.

E 1-5 - E 1-5; This sets the unit for a voltage input of 1 to 5 volts.

E 0-5 - E 0-5; This sets the unit for a voltage input of 0 to 5 volts.

E 0-10 - E 0-10; This sets the unit for a voltage input of 0 to 10 volts.

LINEAR - LINEAR; This sets the unit for linear input.

SQRt - SQUARE ROOT; This sets the unit for square root extraction.

RELAYS - RELAYS; This section of the program menu sets the control output variables (relays & open collector).

RAFE - OUTPUT A FOR RATE; This assigns the A output to the rate.

HYS A - HYSTERESIS FOR OUTPUT A; This value is the number of units below Preset A that the output will remain "ON". EXAMPLE: Preset A set at 100, Hys set at 10. Output A will activate (turn on) when the rate equals 100; Output A will deactivate (turn off) when the rate falls below 90 (10 below Preset A)

Rtot - OUTPUT A FOR TOTAL; This assigns the A output to the totalizer.

dur A - OUTPUT A DURATION; This is the duration of time (.01 to 599.99 sec) that Output A will remain energized. If 0.00 is entered the output will latch until reset. If a value other than 0.00 is entered the unit will autorecycle at Preset A.

brAFE - OUTPUT B FOR RATE; This assigns the B output to the rate.

HYS b - HYSTERESIS FOR OUTPUT B; Same as HYS A.

b tot - OUTPUT B FOR TOTAL; This assigns the B output to the totalizer.

dur b - OUTPUT B DURATION; This is the duration of time (.01 to 599.99 sec) that Output B will remain energized. If 0.00 is entered the output will latch until reset.

LoC - LOCK; This section of the program menu sets up the lockout type and code.

LoALL - LOCK ALL; When this is selected the lockout will lock the program as well as the Presets and reset button. The presets can be viewed but not changed.

LC P9 - LOCK PROGRAM; When this is selected the lockout will lock only the program. The Reset can be activated and the presets can be viewed and changed.

Code - CODE; This is a 5-digit code which will be used to lock and unlock the front panel.

SEtUP - SETUP; This section of the program menu sets up the operating variables.

rDEC - RATE DECIMAL LOCATION; This allows the user to program a decimal point for the rate display.

SEt Lo - SET LOW; This is the rate value for the lowest input (0 or 1 Volts; 4 mA). (i.e. 4 mA = 10 lbs/hr.)

SEt Hi - SET HIGH; This is the rate value for the highest input (5 or 10 Volts; 20 mA). (i.e. 20 mA = 500 lbs/hr.)

Lo Cut - LOW CUT-OFF; This is the lowest rate value to be recognized. All rate readings below this value will assume the "set lo" value.

NOR - NORMALIZING FACTOR; This is an averaging factor (00.0 to 99.9). Higher settings provide more normalizing (averaging) for a more stable display. Derived from the equation:

$$\frac{(\text{OLD DATA} \times \text{"NOR"} + \text{NEW DATA})}{(\text{"NOR"} + 1)}$$

SECS - SECONDS; This tells the unit that the High and Low input values are entered in units per second.

minS - MINUTES; This tells the unit that the High and Low input values are entered in units per minute.

HourS - HOURS; This tells the unit that the High and Low input values are entered in units per hours.

tDEC - TOTALIZER DECIMAL LOCATION; This allows the user to enter a decimal for the totalizer display. This decimal is not a dummy decimal and will scale the totalizer display accordingly. (i.e. if the tdec is set in the tenths position (#####.#), 100 will be displayed as 100.0)

tFRct - TOTALIZER FACTOR; This factor divides the totalizer display by 1, 10, 100 or 1000.

opt - OPTIONS; This section of the program menu is for setting up optional features (analog out, RS232/422 serial communications).

out Lo - OUT LOW; The displayed rate value at which the unit will output 4 mA (2 lbs./hr = 4 mA out).

out Hi - OUT HIGH; The displayed rate value at which the unit will output 20 mA (2000 lbs./hr = 20 mA out).

bRud - BAUD RATE; The baud rate at which the RS232 or RS422 communications will operate.

9600 - 9600 BAUD; This sets the communications at 9600 Baud.

2400 - 2400 BAUD; This sets the communications at 2400 Baud.

1200 - 1200 BAUD; This sets the communications at 1200 Baud.

300 - 300 BAUD; This sets the communications at 300 Baud.

UNIT - UNIT NUMBER; This assigns the unit an ID number from 1 to 99. This number is to be addressed when the unit is to be on line. A unit with 0 assigned will never come on line.

PLIST - PRINT LIST; This sets a list of data that will be transmitted whenever the strobe is activated.

TOTAL - TOTAL COUNT; When this is added to the print list, the unit will transmit the total when the strobe is activated.

RATE - RATE; When this is added to the print list, the unit will transmit the present rate value when the strobe is activated.

PEAK - PEAK; When this is added to the print list, the unit will transmit the present peak value when the strobe is activated.

VALLEY - VALLEY; When this is added to the print list, the unit will transmit the present valley value when the strobe is activated.

PREA - PRESET A; When this is added to the print list, the unit will transmit the Preset A value when the strobe is activated.

PREB - PRESET B; When this is added to the print list, the unit will transmit the Preset B value when the strobe is activated.

SET L - SET LOW; When this is added to the print list, the unit will transmit the Set Low value when the strobe is activated.

SET H - SET HIGH; When this is added to the print list, the unit will transmit the Set High value when the strobe is activated.

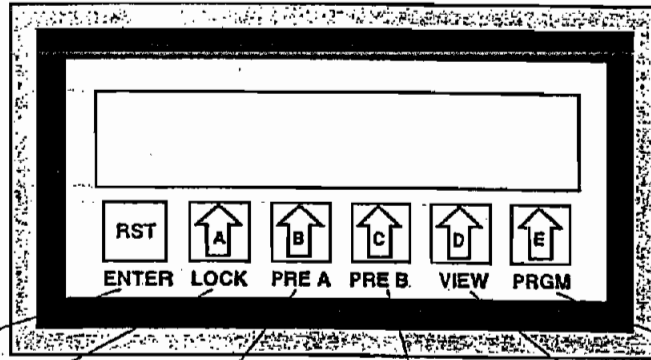
END - END; This is the only exit from the P List. If END is not entered the unit will start at the beginning of the P List again.

PXXXXX - P; This will appear in the 6th (furthest to the left) digit when viewing the Peak. The peak value is the highest rate reading that the unit had displayed since the peak had been reset. The peak is not retained in memory when power is lost.

UXXXXX - U; This will appear in the 6th (furthest to the left) digit when viewing the Valley. The valley value is the lowest rate reading that the unit had displayed since the valley had been reset. The valley is not retained in memory when power is lost.

RXXXXX - R; This will appear in the 6th (furthest to the left) digit when viewing the Rate.

# FRONT PANEL OPERATIONS



Press to RESET in operating mode; Press to "ENTER" in programming mode.

Press once to freeze display. Press any key to update display normally. Press rapidly (3 times within 5 seconds) to "enter" LOCK code for panel lock.

Press to view or change Preset A

Press to view or change Preset B

Press to alternately view Rate, Total, Peak & Valley.

Press to cycle through PROGRAM choices; Press to step through set up choices in program mode.

## PROGRAMMING

STEP  
1  
SETTING  
INPUT

<u>PRESS</u>	<u>DISPLAY</u>	<u>REMARKS</u>
<input type="checkbox"/> PRGM	inPut	This section of the menu is used to set up the type of signal the unit will be receiving.
<input type="checkbox"/> ENTER	4-20, 0-20 E 1-5, E 0-5 or E 0-10	Press the PRGM key to step through choices. Press the RST/ENTER key to enter the displayed choice.
<input type="checkbox"/> ENTER	LinEAr or SqrT	This section will only appear on units with the square root extraction option. Press the PRGM key to toggle between the choices and press the RST/ENTER key to enter the desired choice.



**STEP**  
**2**  
**SETTING**  
**RELAYS**

**NOTE:** If relay outputs are not used, set dur A & dur B at "0.0" to prevent the counters from resetting at the presets.

<u>PRESS</u>	<u>DISPLAY</u>	<u>REMARKS</u>
<input type="checkbox"/> PRGM	inPut	This section of the menu sets up the open collector outputs and/or relays.
<input type="checkbox"/> PRGM	rELAYS	
<input type="checkbox"/> ENTER	RrAtE or RtOt	Output A assigned to the rate or total. Press the PRGM key to toggle between choices, press the RST/ENTER key to enter the displayed choice.
<input type="checkbox"/> ENTER	(IF TOT SELECTED)  dur A (hit any key to view or change existing dur A value XX.X)	dur A = the duration of time (.01 to 599.99 sec) that output A will remain on or energized. When dur A is displayed, hit any key to view or change dur A. Press the RST/ENTER key to enter displayed value. When dur A is set at 0.00, output A will latch until reset; when dur A is set other than 0.00 the counter will autorecycle at Preset A.
<input type="checkbox"/> ENTER	(IF RATE SELECTED)  HYS A (hit any key to view or change existing HyS A value XXXXX)	Hys (hysteresis)= The number of units below the preset that the output will remain "ON". EXAMPLE: Preset set @ 100; HyS set @ 10. Output will activate (turn on) when rate = 100 and turn off when rate falls below 90 (10 below preset).
<input type="checkbox"/> ENTER	b rAtE or b tOt	Follow instructions for A RATE & A TOT.
<input type="checkbox"/> ENTER	(IF TOT SELECTED) dur b	Follow instructions for dur A
<input type="checkbox"/> ENTER	(IF RATE SELECTED) HYS b	Follow instructions for hys A

**STEP  
3  
SETTING  
LOCK**

**PRESS**

PRGM  
  
PRGM  
  
PRGM

**DISPLAY**

inPut  
rELAYS  
LoC

**REMARKS**

This section of the menu is used to set up the lockout type and code.

ENTER

LC PG or LC ALL

LC PG = Locks program but presets are accessible.

LC ALL= Locks program & presets. Press the PRGM button to toggle between choices; Press RST/ENTER to enter displayed choice.

ENTER

CoDE  
Press any key to view or change the lock code

When CODE is displayed, press any key to view existing lock code. To change the code press the key under each digit to be changed. Press RST/ENTER to enter displayed value.

**STEP  
4  
SETTING  
SETUP**

PRGM  
  
PRGM  
  
PRGM  
  
PRGM

inPut  
rELAYS  
LoC  
SEtUP

This section of the menu is used to set up important operating variables.

ENTER

rDEC

RDEC= rate decimal location; Press the key under the digit with the desired location. Press the "E" key if a decimal is not desired. Press RST/ENTER to enter the displayed location.

ENTER

SEt Lo  
Press any key to view or change existing value

SET LO= Rate value for the lowest input (0 or 1V; 4mA).(i.e. 4mA = 10 lbs/hr.) Key in the desired low value and press RST/ENTER to enter displayed value.

ENTER

SEt Hi  
Press any key to view or change existing value

SET HI= Rate value for the highest input (5 or 10V; 20mA).(i.e. 20mA = 500 lbs/hr.). Key in the desired high value and press RST/ENTER to enter displayed value.

CONTINUED ON NEXT PAGE

STEP  
4  
CONT...

---

SETTING  
SETUP

PRESS	DISPLAY	REMARKS
<input type="checkbox"/> ENTER	LO CUT Press any key to view or change existing value	LO CUT= Low cut-off; Lowest rate value to be recognized. All rate read- ings below the "cutoff" will assume the "set lo" value. Key in the desired value and press RST/ENTER to enter dis- played value.
<input type="checkbox"/> ENTER	NOR Press any key to view or change existing value	NOR= Normalizing (averaging) factor (00.0 to 99.9); Key in the desired value and press RST/ENTER to enter dis- played value. Higher settings provide more normalizing (averaging) for a more stable display.
<input type="checkbox"/> PRGM <input type="checkbox"/> ENTER	MIN, HourS or SECS	This section tells the unit that the high & low setting are entered in units per Minutes, Hours or Seconds. Press the PRGM key to step through choices. Press RST/ENTER to enter displayed choice.
<input type="checkbox"/> ENTER	TDEC	TDEC= Totalizer Decimal; Press the arrow keys to enter in the desired totalizer decimal. Press RST/ENTER to enter displayed choice. Entering a decimal will add resolution to the total. (i.e. tdec=####.#; 100 will be dis- played as 100.0)
<input type="checkbox"/> ENTER	TFACT Press any key to view or change existing value	TFACT= Totalizer Factor; This factor allows you to divide the totalizer by 1, 10, 100, 1000
<input type="checkbox"/> PRGM <input type="checkbox"/> ENTER	1, 10, 100 or 1000	Press the PRGM key to step to the desired factor. Press RST/ENTER to enter displayed choice.

**STEP  
5  
SETTING  
OPTIONS**

**PRESS**

**DISPLAY**

**REMARKS**

PRGM  
  
PRGM  
  
PRGM  
  
PRGM  
  
PRGM

inPut

rELAYS

LoC

SEtUP

oPt

This section of the menu is for setting up the variables for any options which were ordered (Analog out or Serial communications).

ENTER

out Lo  
Press any key to view  
or change existing  
value

OUT LO= The rate value represented by the 4 mA end of the 4-20 mA output  
Key in the desired value and press RST/ENTER to enter displayed value.

ENTER

out Hi  
Press any key to view  
or change existing  
value

OUT HI= The rate value represented by the 20 mA end of the 4-20 mA output. Key in the desired value and press RST/ENTER to enter displayed value.

ENTER

bAud  
Press any key to view  
or change existing  
value  
9600, 1200,  
2400 or 300

BAUD = Baud rate for RS 232 or RS 422 communications option. Press any key to view existing value.

Press the PRGM key to view available baud rates; Press RST/ENTER to enter displayed value.

ENTER

unit  
Press any key to view  
or change existing  
value

UNIT = Unit ID number. Key in the desired unit number (1-99) and press RST/ENTER to enter displayed value.

OR   
ENTER PRGM



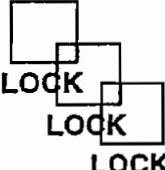

P LISt  
Press any key to enter  
print list  
toTAL  
rAtE  
PEAK  
VALLY  
PrE A  
PrE b  
SEt Lo  
SEt Hi  
End

P LIST = Print list.  
Press RST/ENTER to add items to list;  
Press PRGM to remove items from list.

TOTAL = Total  
RATE = Rate  
PEAK = Peak  
VALLY = Valley  
PRE A = Preset A  
PRE B = Preset B  
SET LO = Low Input Value  
SET HI = High Input Value  
END = Press RST/ENTER to exit (end) print list;  
Press PRGM to recycle through list choices.

**THE PROGRAM SETUP IS COMPLETE! YOU ARE NOW READY TO SET THE PRESETS.**

# SETTING THE PRESETS & PANEL LOCK

	<u>PRESS</u>	<u>DISPLAY</u>	<u>REMARKS</u>
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center; width: fit-content; margin: 0 auto;"> <b>SETTING THE PRESETS</b> </div>	 <b>PRE A</b>	<p style="text-align: center;"><b>PrEr</b></p> <p>Press any key to view or change existing value</p>	<p>PRE A = Preset A (Final Preset); The set point at which output A will trigger. If the displayed value is not the desired preset, press the key(s) under the digit to be changed.</p>
<p><b>NOTE:</b> Presets can be set at any value from 0 to 59999.</p>	 <b>PRE B</b>	<p style="text-align: center;"><b>PrEb</b></p> <p>Press any key to view or change existing value</p>	<p>PRE B = Preset B (Prewarn); The set point at which output B will trigger. If the displayed value is not the desired preset, press the key(s) under the digit to be changed.</p>
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center; width: fit-content; margin: 0 auto;"> <b>SETTING THE LOCK STATUS</b> </div>	 <b>LOCK</b>	<p style="text-align: center;"><b>LoE</b></p> <p>Press any key to enter the 5-digit lock code.</p>	<p>Key in the lock code (see programming step 3) by pressing the keys under the digits to be changed. Each time a key is pressed the digit will increment one. Press the RST/ENTER key to enter the displayed code.</p>
<p>Press LOCK 3 times within 5 seconds (If LOCK is pressed once, unit freezes display)</p>	 <b>ENTER</b>	<p style="text-align: center;"><b>LoE</b> or <b>unLoE</b></p>	<p>After the code is entered the unit will display LOC (unit is locked) or UNLOC (unit is un-locked). This message will be displayed for approximately 3 seconds before the unit returns to the run mode. If an invalid code is entered, no message is displayed; try again.</p>

# RS 232/422 OPERATIONS

This section applies to units which have the serial communications interface option. Up to 99 units can be linked together. Unit status can be accessed and many menu items can be entered through the serial port. Data is transmitted at selected baud rates using standard eight bit ASCII characters and one "stop" bit. The unit does not check or transmit a parity bit.

## UNIT I.D. (DEVICE #)

Each unit in the hookup must be assigned a unit number from 1 to 99. This can be entered through the front panel (see step 5 of the programming section). If "00" is assigned, the unit can not be brought on line through the serial port. The units will remain in an "off" high impedance state until addressed by the assigned unit number. Once a unit is addressed, do not address another unit until the data has been sent and any data requested has been transmitted back.

## BAUD RATE

The baud rate is the speed at which data is transmitted, expressed in bits per second. Baud rates of 300, 1200, 2400 or 9600 are available. Select the desired baud rate from the menu. (see step 5 of the programming section).

## PRINT LIST

The serial interface card is equipped with a strobe line. When the strobe line is activated a user selectable set of data (print list) is transmitted. This transmission can be sent to a computer or printer. The print list consists of eight selectable items: COUNT, RATE, PEAK, VALLEY, PRE A, PRE B, LOW SET, HIGH SET. The list can be entered through the front panel (see step 5 of the programming section) or through the serial port (read on).

## HELP

A help command has been installed for easy access of the command and data variables. When help is needed, type a "?" and press return (enter) whenever a unit is on line. The following list will be transmitted:

D#XX:

S Set

E Exam

R Reset

G Lock

L\*List

C\*Count

R\*Rate

P\*Peak

V\*Valley

A\*PreA

B\*PreB

L\*Lo Set

H\*Hi Set

J Lo Out

K Hi Out

N Norm

D Unit

E Input

G Hy/DrA

I Hy/DrB

M Time

T Baud

W Lock

X Meter

Y A Typ

Z B Typ

O Code

F RDec

Q TDec

U TFact

The unit transmits the unit ID (D#XX) as well as the variables for the corresponding commands and data. A "\*" indicates that the data is available for the print list.

## COMMANDS:

Each command consists of an instruction and an address. Each instruction and address is represented by a letter. The prefix of each command must be an instruction followed by an address (and address variable if applicable).

### INSTRUCTIONS (1st letter of command):

[S] Set - Used to set the value or operating parameter of an address. (i.e. "SC 5000" will set the count at 5000)

[E] Examine - Used to examine the value or status of an address. (i.e. "ER" will examine the present rate reading)

[R] Reset - Used to reset the count & control output, peak or valley. (i.e. "RP" will reset the peak value)

[G] Lock - used to lock and unlock the unit. Type "G" followed by the "lock code" to lock and unlock the unit.

[L]\*List - Used to set the print list. (i.e. "LCRVA" will set the list for count, rate, valley and preset A. These values will be transmitted whenever the strobe is activated.)

## ADDRESSES (2nd letter of command):

[C]\*Count  
[R]\*Rate  
[P]\*Peak  
[V]\*Valley  
[A]\*PreA  
[B]\*PreB  
[L]\*Lo Set  
[H]\*Hi Set  
[J] Lo Out  
[K] Hi Out  
[N] Norm  
[D] Unit  
[E] Input  
[G] Dur A  
[I] Dur B  
[M] Time  
[T] Baud  
[W] Lock  
[X] Meter  
[Y] A Type  
[Z] B Type  
[O] Code  
[F] RDec  
[Q] TDec  
[U] TFact

## POSSIBLE COMMANDS:

Each command must be followed by a carriage return for execution.

**DX:** (device "unit ID" #)- Unit XX will come "on line" and stay "on line" until another device is addressed.

**SD XX:** (set device "unit ID" #)- sets unit ID # at requested value

**ED:** (examine device)- Unit will transmit the present device (unit ID) number (i.e. d=000000XX).

**SC XXXXX:** (set count)- Sets count at requested value.

**EC:** (examine count)- Unit will transmit the present count value ( i.e. c=00XXXXXX).

**RC:** (reset count)- Resets the counter and control output .

**ER:** (examine rate)- Unit will transmit the present rate value (i.e. r= 000XXXXX).

**RR:** (reset rate)- Resets the normalization

**EP:** (examine peak)- Unit will transmit the present peak value (i.e. p= 000XXXXX).

**RP:** (reset peak)- Unit will reset the peak.

**EV:** (examine valley)- Unit will transmit the present valley value (i.e. v=000XXXXX).

**RV:** (reset valley)- Resets the valley.

**SA XXXXX:** (set preset A)- Sets preset A at requested value.

**EA:** (examine preset A)- Unit will transmit present preset A value (i.e. a=000XXXXX).

**SB XXXXX:** (set preset B)- Sets preset B at requested value.

**EB:** (examine B)- Unit will transmit present preset B value (i.e. b = 000XXXXX).

**SL XXXXX:** (set "Low")- Sets "set low" at requested value.

**EL:** (examine "Low")- Unit will transmit present "set low" value (i.e. l = 000XXXXX).

**SH XXXXX:** (set "High")- Sets "set high" at requested value.

**EH:** (examine "High")- Unit will transmit present "set high" value. (i.e. h = 000XXXXX)

**SJ XXXXX:** (set "low out")- Sets "out low" at requested value. Only available with ANALOG OUT option.

**EJ:** (examine "low out")- Unit will transmit present "out low" value. (i.e. j = 000XXXXX)

**SK XXXXX:** (set "high out")- Sets "out high" at requested value. Only available with ANALOG OUT option

**EK:** (examine "high out")- Unit will transmit present "out high" value. (i.e. k = 000XXXXX)

**SN XX.X:** (set norm)- Sets "norm" at requested value. Must be a 3-digit number with decimal.

**EN:** (examine norm)- Unit will transmit present "norm" value (i.e. n = 000XX.X).

**SE I 4-20, I 0-20, e 0-5, e 1-5 or e 0-10:** (set input)- sets input to one of the 4 available types. Enter type exactly as it appears on the display.

**EE:** (examine input)- Unit will transmit input type (i.e. e 0-10).

**SG XXXXX:** (set dur A or hys A)- Sets dur A or hys A at requested value. (dur A when A is assigned to total; hys A when A assigned to rate).

**EG:** (examine dur A or hys A)- Unit will transmit present dur A or hys A value (i.e.g = 000XXXXX)

**SI XXXXX:** (set dur B or hys B)- Sets dur B or hys B at requested value. (dur B when B is assigned to total; hys B when B assigned to rate).

**EI:** (examine dur B or hys B)- Unit will transmit present dur B or hys B value (i.e. I = 000XXXXX)

**SM secs, mins or hours:** (set time base)- Sets time base to desired setting.

**EM:** (examine time base)- Unit will transmit present time base (i.e. secs).

**ST XXXX:** (set baud)- Sets baud at desired rate (9600, 2400, 1200 or 300).

**ET:** (examine baud)- Unit will transmit present baud rate (i.e. 9600).

**EW:** (examine lock type)- unit will transmit present lock type (i.e. lc pg).

**SX linear or sqrt:** (set meter type)- Sets meter input for linear or square root extraction. Only available with square law option.

**EX:** (examine meter type)- Unit will transmit present meter type (i.e. linear).

**SY A tot or A rate:** ( set A type)- Assigns control output A to rate or total.

**EY:** (examine A type)- Unit will transmit present A type (i.e. a tot).

**SZ B tot or B rate:** ( set B type)- Assigns control output B to rate or total.

**EZ:** (examine B type)- Unit will transmit present B type (i.e. b tot).



- SO XXXXX:** (set lock code)- Sets lock code at requested value.
- EO:** (examine code)- Unit will transmit present code (i.e. o=000XXXXX).
- SFX:** (set rate decimal location)- Sets rate decimal at requested location (0 to 4).
- EF:** (examine rate decimal location)- Unit will transmit the present rate decimal location (i.e. f = 0000000X).
- G:XXXXXX:** (lock unit)- Locks and unlocks unit. (XXXXXX = code)
- SQ X:** (set totalizer decimal location)- Sets totalizer decimal at requested location (0 to 4)
- EQ:** (examine totalizer decimal location)- Unit will transmit present total decimal location (i.e. Q = 0000000X).
- SUXXXX:** (set totalizer scale factor)- Sets totalizer scale factor at requested value. This factor divides the totalizer by 1, 10, 100 or 1000. (i.e. SUXXX100 sets the divider at 100 where "X" represents the required space characters.
- EU:** (examine totalizer scale factor )- Unit will transmit present total scale factor (i.e. U = XXX100 where "X" represents the space characters).
- L CRPVABLH:** (list)- The list can consist of any combination of the eight available options. Any address with a "" next to it can be listed.

### SERIAL INTERFACE OPERATION:

Data is received and transmitted over standard EIA RS232 or RS422 levels. Each ten bit character is made up of a start bit, eight bit ASCII code and a stop bit.

The input impedance of RS232 is 3K $\Omega$  to 7K $\Omega$  worst case. The terminal addressing the unit must be capable of driving all loads in the loop. The input impedance of RS422 is much higher and there should be no problem driving as many as 99 units. The transmit line remains in a high impedance "off" state until addressed. Only one unit is to be on line at a time!!! More than one unit on line could damage the unit or destroy the transmitted data.

When the unit is active (on line) it will operate in an echo back mode so that data sent from the terminal will be transmitted back for verification. When the unit is "on line", use the proper serial transmit commands to request data or set a new value. Be sure to send only one command at a time followed by a carriage return to insure proper operation. If an error is made, a correction can be made by back spacing and retyping correct data before the return (enter) is sent. Once a return (enter) is sent, the unit begins processing the data and will transmit the requested data on a non-priority basis over the data transmit line. The unit will not transmit data if the Printer Busy line is activated (high). When the Printer Busy line is activated all transmissions are halted until the line goes low or open. There should be a pause after data is requested to insure that all data has been transmitted before making another request or addressing another unit. If transmission has not started within two seconds after data is requested, it can be assumed that there is a problem. The unit transmits a carriage return and line feed after each data value. The unit will stay "on line" until another unit is addressed.

### RS232/RS422 - PC INTERFACE:

The following BASIC program is for setting up RS232/RS422 on serial port (#1) at 300 baud. Run this program after connecting the serial interface connections.

```

10 SCREEN 0,0:WIDTH 80
20 CLS:CLOSE
30 OPEN "COM1:300,n,8,1,CS,DS,CD" AS #1
40 ON ERROR GOTO 110
50 B$=INKEY$
60 IF B$< >" THEN PRINT #1,B$;
70 IF EOF (1) THEN 50
80 A$=INPUT$ (LOC(1),#1)
90 PRINT A$;
100 GOTO 50
110 RESUME

```

# RS232 / RS422 WIRING

## COMPUTER HOOKUP:

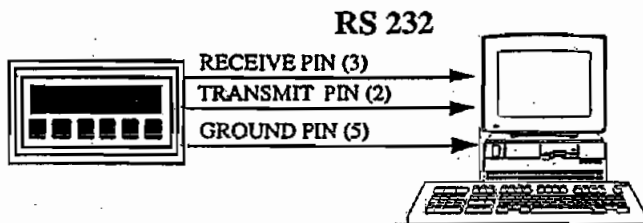
**RS 232:** When connecting the unit to a computer with RS 232 communication, only three connections are needed. These connections are: Receive data, Transmit data and Ground. The connections should be made as follows:

### DB-9 CONNECTOR

Transmit data (pin 2)  
Receive data (pin 3)  
Ground (pin 5)

### COMPUTER

Receive data  
Transmit data  
Ground



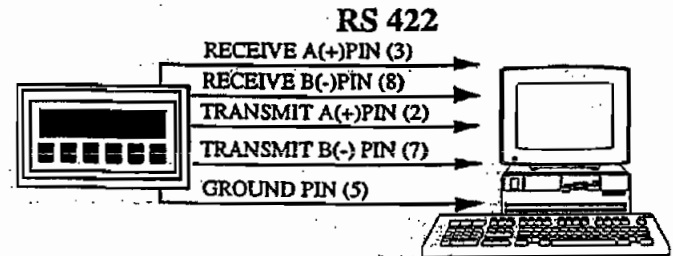
**RS 422:** When connecting the unit to a computer with RS 422, five connections are needed. These connections are: Receive data A (+), Receive data B (-), Transmit data A (+), Transmit data B (-) and Ground. The connections should be made as follows:

### DB-9 CONNECTOR

Trans. data A(+) (pin 2)  
Trans. data B(-) (pin 7)  
Rec. data A(+) (pin 3)  
Rec. data B(-) (pin 8)  
Ground (pin 5)

### COMPUTER

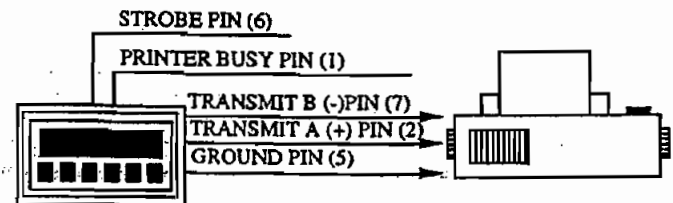
Rec. data A(+)  
Rec. data B(-)  
Trans. data A(+)  
Trans. data B(-)  
Ground



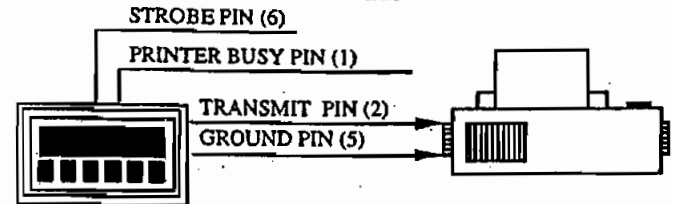
## PRINTER HOOKUP:

When connecting the unit to a printer, you must first program the desired baud rate, parity and strobe list with a computer. After the unit is programmed it can be connected to the printer. Connect the transmit line(s) of the unit to the receive line(s) of the printer and be sure that both devices have common grounds. When the strobe line is triggered the unit will transmit the selected strobe list which you had previously programmed.

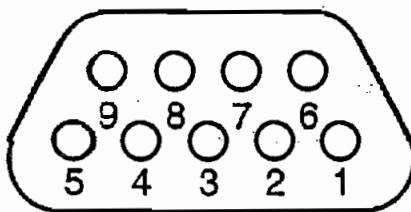
### RS 422



### RS 232



### DB - 9 CONNECTOR

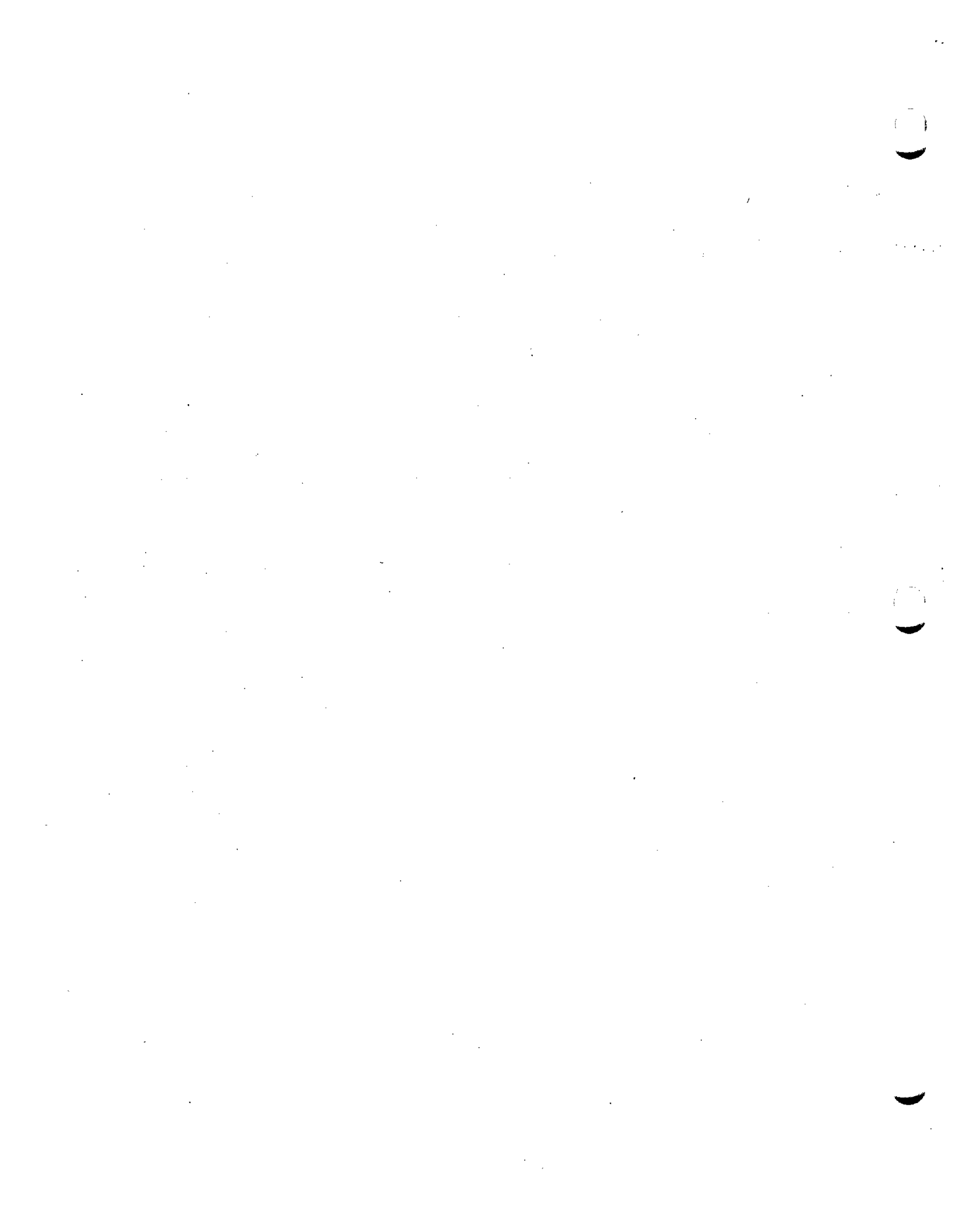


- 1- Printer busy: 3 to 30 VDC, Level activated.
- 2- Transmit A(+) (RS422); Transmit (RS232)
- 3- Receive A(+) (RS422); Receive (RS232)
- 4- Not Used
- 5- Ground
- 6- Strobe: 3 to 30 VDC Positive Edge
- 7- Transmit B(-) (RS422 Only)
- 8- Receive B(-) (RS422 Only)
- 9- Not Used

# TROUBLESHOOTING GUIDE

<b>PROBLEM</b>	<b>POSSIBLE CAUSES</b>	<b>SOLUTIONS</b>
Power is applied to unit but the display does not light.	1. AC or DC power wiring is incorrect.	1. Recheck power wiring.
Unit works but occasionally the display freezes or skips counts.	1. Line noise is effecting the processor due to a current spike or surge.	1. Use a different power supply or install a surge suppressor.
Input signal is connected but the unit does not totalize or rate.	1. Input wiring is incorrect 2. High and low scaling settings are incorrect. 3. Transmitting device is defective. 4. Unit is defective.	1. Recheck input wiring. 2. Recheck high and low scaling settings. 3. Replace transmitting device. 4. To confirm set meter for 0-10V input, low @ 0; high @ 10. Apply a 0-10V signal to the voltage input (pin 5). When viewing the rate the meter should display the voltage value that is applied. If not call factory for an RMA#.
Display reading is inaccurate.	1. Input wiring is incorrect.	1. Be sure that voltage signals are connected to voltage input (pin 5) and current signals are connected to current input (pin 4).
Ratemeter works properly but totalizer is incorrect.	1. Time base is incorrect.	1. Recheck time base setting in setup section of the program menu.

**IF YOU HAVE ANY OTHER PROBLEMS, PLEASE CALL THE FACTORY.**





## WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion, or current, heat, moisture or vibration, improper specification, misapplication, misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

We are glad to offer suggestions on the use of our various products. Nevertheless, OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.

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## RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. Call toll free in the USA and Canada: 1-800-622-2378, FAX: 203-359-7811; International: 203-359-1660, FAX: 203-359-7807.

BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, YOU MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems you are having with the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION**, consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. Your P.O. number to cover the COST of the of the repair/calibration,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems you are having with the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. That way our customers get the latest in technology and engineering.

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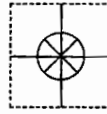
- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters



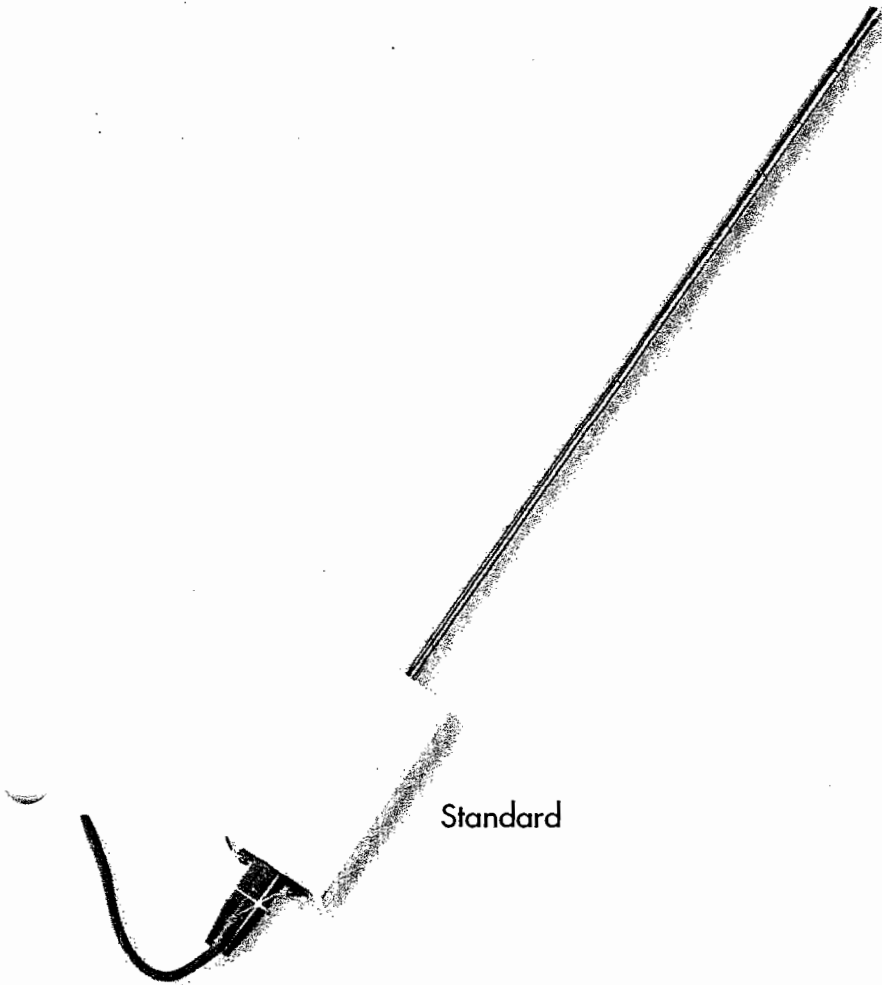
**1 YEAR**  
WARRANTY

MADE IN  
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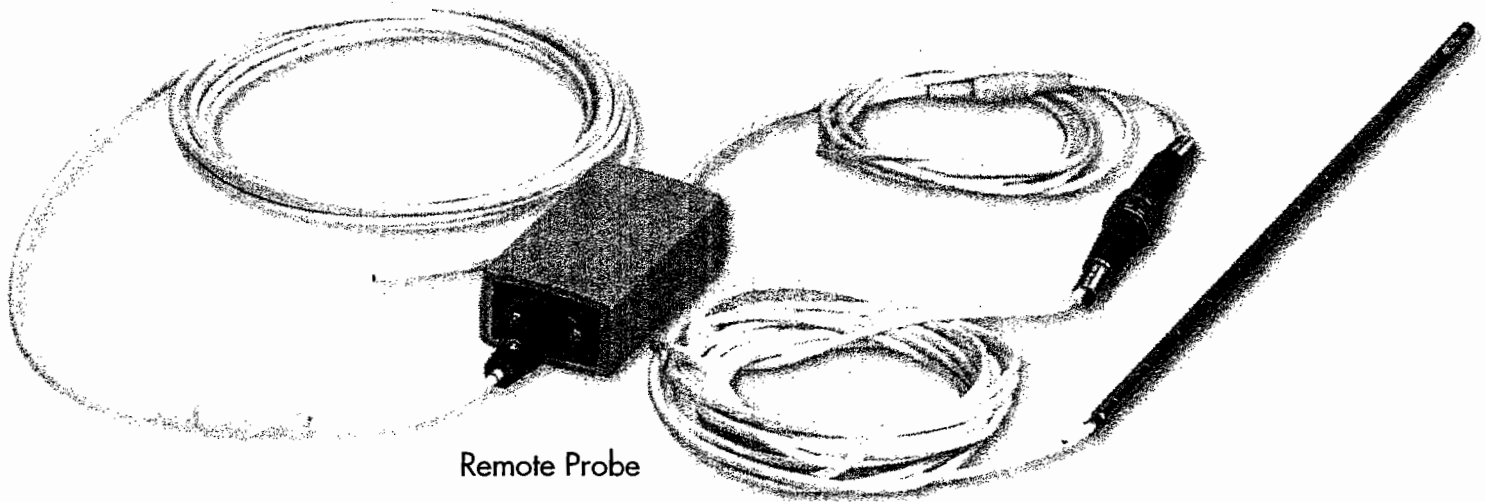
CE



# User's Guide



Standard



Remote Probe

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# FMA-900 SERIES Air Velocity Transducers





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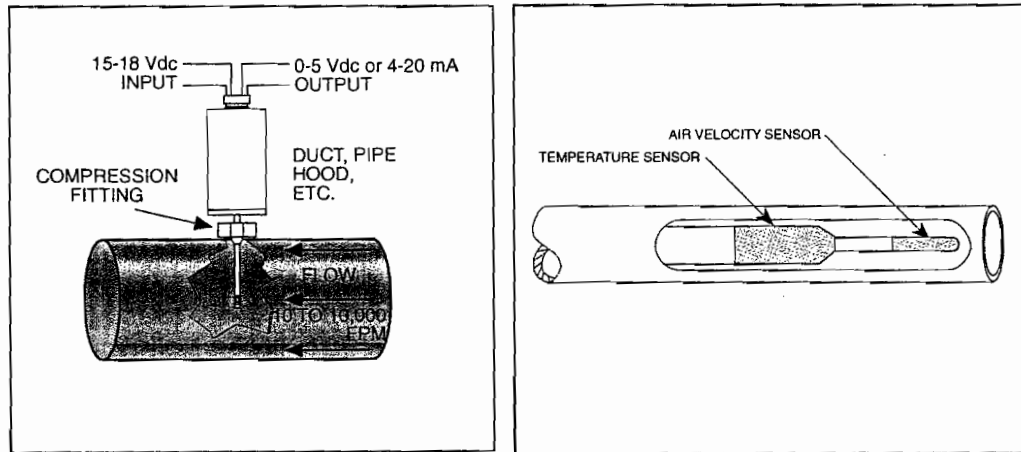
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The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.  
**WARNING:** These products are not designed for use in, and should not be used for, patient-connected applications.



## General Description

The OMEGA® FMA-900 air velocity mass flow transducer is ideal for economical monitoring of clean air flows in ducts and pipes, while producing very little permanent pressure drop in the flowstream. The FMA-900 employs two rugged glass-coated RTD elements, protected by a 1/4" diameter 304SS tube with a "window" cut out. One RTD is the velocity sensor, while the other RTD provides ambient air temperature compensation. The velocity sensor is heated to maintain a constant (approximately 30° C) temperature differential above the ambient air temperature, as measured by the second RTD element. The cooling effect of the air flow experienced by the velocity sensor is measured and converted to an electrical output signal proportional to air velocity. The FMA-900 is provided with a 13" long probe as standard. The 304SS tubing is provided with inch marks for ease of insertion depth.



## Unpacking

Remove the Packing List and verify that you have received all equipment. If you have any questions about the shipment, please call the OMEGA Customer Service Department.

Upon receipt of shipment, inspect the container and equipment for any sign of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

### NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material in the event reshipment is necessary.

The following items are supplied with the FMA-900:

- FMA-900 Series Air Velocity Transducer
- Mating connector
- Removable plastic protective cover (supplied on the sensor tip)
- Operator's manual

## Important Considerations Before Installation

### CAUTION

The FMA-900 air velocity transducer is not explosion-proof, nor is it intrinsically safe. Do not use for flammable or hazardous gases, or in hazardous areas.



The FMA-900 air velocity transducer is intended for use with clean air or nitrogen ONLY. Do not use with other gases, as other gases will produce an uncalibrated, non-linear output signal. In addition, air carrying dust or oil (such as found in blower/compressor systems that utilize oil) can lead to coating of the sensor and thus, inaccurate readings. Refer to the Maintenance section for more information on cleaning the sensor.

The FMA-900 is a bi-directional device; flow in the forward or reverse direction provides the same output.

## Installing the Flowmeter

The FMA-900 air velocity transducer can be mounted vertically or horizontally without shift in calibration.

1. Remove the plastic protective cap from the sensor tip.
2. Run a length of straight pipe before and after the flowmeter. The amount of upstream straight pipe run required depends upon the type of obstruction which is immediately upstream of the flow sensor. See Table 2-1 for specific requirements. Downstream of the flow sensor, in all situations, run 5 diameters of straight pipe, regardless of the downstream obstruction.
3. Align the FMA-900 with the air flow. Make sure the width of the electronics box (2 inches) is parallel with the flow stream.

The score line on the tubing is another way of aligning the air flow sensor with the flow stream. The score line starts from the center of the transducer window and as a result it can be aligned properly.

One means of installing the probe into a flow stream is to utilize a compression fitting, such as OMEGA's SSLK-14-14 stainless steel compression fitting with Teflon ferrules, which permits adjustment of the insertion depth of the probe.

On Remote Probe Models (-R), connect the remote probe cable to the Electronic Housing.

Table 2-1 Piping Requirements

	Typical Piping	Recommended Straight Pipe Length "A"		Remarks
		Without Vanes	With Vanes	
All Fittings in Same Plane		15D	15D	Closed Branch
		20D	15D	Elbow, Tee, Branch Pipe
		25D	15D	Elbow, 2 planes
		25D	15D	Long-radius bends
Fittings in Two Planes		30D 25D	15D 15D	Elbow Long-radius bends
		40D 35D	15D 15D	Elbow Long-radius bends
Varied Section		20D	15D	Contracting Pipe
		40D	20D	Expanding Pipe
Valves		Recommend Meter Be Installed Upstream		Regulating, reducing valves Ball, check valves Shut-off valves

Note: Straight pipe length on the downstream side to be 5 pipe diameters minimum.  
 \* D - Pipe internal diameter.

## Wiring the Flowmeter

1. Connect pins as follows:

<u>PLUG PIN NO.</u>	<u>DESCRIPTION</u>
1	0-5 VDC or 4-20 mA Output (-)
2	0-5 VDC or 4-20 mA Output (+)
3	Power Supply (+)
4	No Connection
5	No Connection
6	Power Supply (-)

2. Blow clean air through the FMA-900.
3. Install the sensor into the pipe or duct.

## Measuring Air Flow

The FMA-900 measures standard velocity, which is the mass velocity of the air referenced to 25° C and 760 mm Hg. No temperature or pressure corrections are required. Where SCFM (standard cubic feet per minute) measurements are desired:

1. Locate the point of average velocity in the pipe or duct.
2. In round pipes, under turbulent flow conditions (where the Reynolds number is greater than 5,000), mount the velocity sensor approximately 1/8 of a pipe diameter in from the pipe wall. For example, in an 8" diameter pipe, mount the probe 1" in from the pipe wall.
3. For pipes or ducts where the flow is not turbulent, or the flow profile is not symmetrical (due to inadequate straight pipe runs, etc.), perform a traverse of the duct, in accordance with standard duct traversal methods as recommended by ASHRAE or the National Air Balance Council.
4. To obtain SCFM, once the probe is mounted in the location of average velocity, multiply the average velocity readings (in SFPM, standard feet per minute) by the cross-sectional area of the pipe or duct, in square feet. For standard pipe, these values can be found in the technical section of the OMEGA Complete Flow and Level Measurement Handbook and Encyclopedia®.

## Maintenance

Except for intermittent removal of the sensor from the line for cleaning, there is no routine maintenance for the FMA-900. If the probe becomes coated with dust, blow the dust away with clean air. If the probe is coated with sticky material, clean it with a solvent which is compatible with epoxy, glass, and 304SS, and which will not leave a residue on the sensor. You may clean the sensor with water or alcohol (Ethanol) and an artist's brush.

## Calibration

Each FMA-900 is individually calibrated in a NIST-traceable wind tunnel. For calibration certification or calibrating to a new range, the unit must be returned to OMEGA. To obtain an Authorized Return (AR) number, call the OMEGA Customer Service Department with a Purchase Order number to cover the recalibration charges.



## Specifications

### Ranges:

<u>Model No.</u> <u>0-5 V Output</u>	<u>Model No.</u> <u>4-20 mA Output</u>	<u>Range</u>
FMA-900-V	FMA-900-I	0-100 SFPM
FMA-901-V	FMA-901-I	0-200 SFPM
FMA-902-V	FMA-902-I	0-500 SFPM
FMA-903-V	FMA-903-I	0-1000 SFPM
FMA-904-V	FMA-904-I	0-2000 SFPM
FMA-905-V	FMA-905-I	0-5000 SFPM
FMA-906-V	FMA-906-I	0-10,000 SFPM

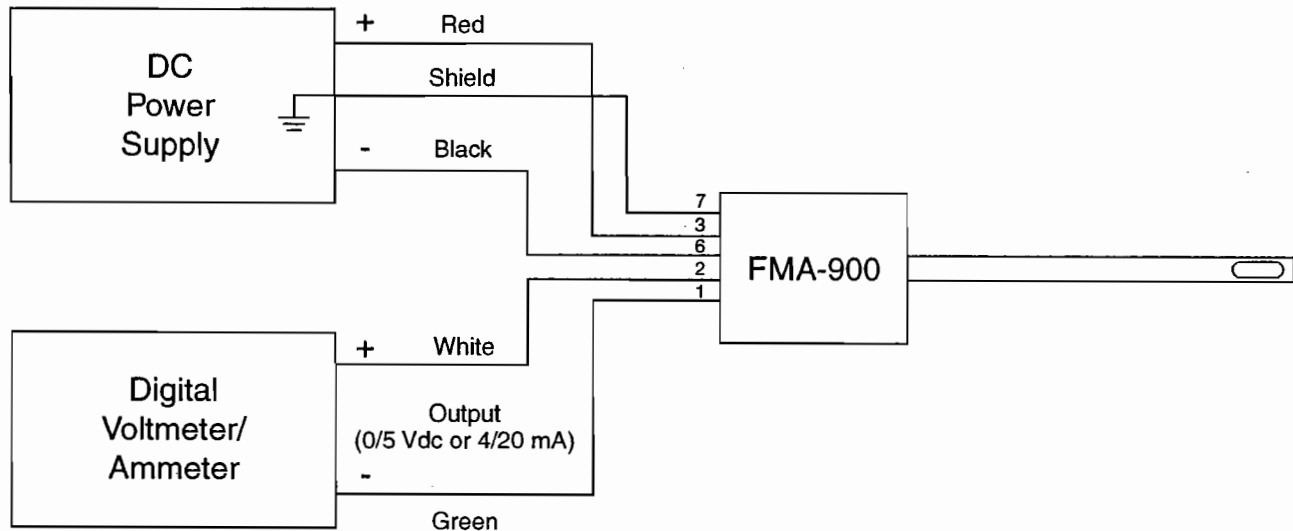
<b>Accuracy:</b>	$\pm 1.5\%$ of Full Scale at room temperature. Add $\pm 0.5\%$ of reading from 32 to 122°. Add 1% Full Scale below 1,000 SFPM.
<b>Repeatability:</b>	$\pm 0.2\%$ of Full Scale
<b>Response Time:</b>	400 milliseconds to within 63% of final value at room temperature
<b>Probe:</b>	Aluminum oxide ceramic glass coating and epoxy; probe body 304SS
<b>Probe Temperature/Pressure:</b>	-40 to 250°F (-40 to 121°C); 150 PSIG maximum
<b>Remote Probe (-R):</b>	Available with 15' (4.6m) shielded cable between the Probe and the Electronic Housing
<b>Electronics Temperature Range:</b>	Operating: 32 to 122°F (0 to 50°C) Storage: 32 to 158°F (0 to 70°C)
<b>Ambient Temperature Compensation:</b>	About 5 minutes for 20°F ambient temperature change
<b>Power:</b>	15 to 18 Vdc at 300 mA (15 to 24 Vdc at 300 mA for 0-100 SFPM and 0-200 SFPM ranges)
<b>Output Load Resistance:</b>	Voltage: 250 ohms minimum Current: 0-400 ohms maximum; 4-wire
<b>Accessories:</b>	Mating connector prewired to 15 feet shielded cable with built-in ferrite core included
<b>Dimensions:</b>	Case: 3.5"H x 2"W x 1.25"D (89mm H x 51mm W x 31.8 mm D) Probe: 1/4" (6.35mm) O.D., 13" long standard (330 mm), 3.75" long optional ("S")
<b>Weight:</b>	0.35 lbs. (0.16 kg)

OTHER IMPORTANT CONSIDERATIONS BEFORE INSTALLATION

CAUTION

- ⚠ Follow All Safety Precautions and Operating Instructions Outlined in this Manual.
- ⚠ The Unit May be Powered from a DC Power Supply. The Power Supply Should Have Integral Impedance Protection.
- ⚠ Recommended Wiring Cable: Shielded 4-Conductor Cable, 22 or 24 AWG Stranded.
- ⚠ Recommended Power Supply Rating: 0-24 Vdc @ 300 mA, 7.2 VA
- ⚠ There are No User Replaceable Fuse in this Product.
- ⚠ Avoid Contact with Hazardous Live Parts.
- ⚠ Do Not Operate in Flammable or Explosive Environments.
- ⚠ This Product is for Use Only with Equipment which has no Accessible Live Parts.

TYPICAL INSTALLATION SCHEMATIC





## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

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## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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# ***Certificate of Compliance***

FMA-905-I

Serial No.: 050222

OMEGA Engineering, Inc. certifies that the instrument referenced above has been fully inspected, tested and calibrated prior to shipment in accordance with the instruction manual supplied. OMEGA further certifies that this instrument meets or exceeds all of the published electrical, mechanical and operational performance characteristics.

All tests and calibrations were performed with instruments, equipment and standards which are traceable to the U.S. National Institute of Standards and Technology.

This instrument has been performance tested at the following test points:

	<u>Standard Test Points</u>	<u>Unit Test Results</u>
1>	0 F.P.M.	4.004 mA
2>	1000	7.112
3>	3000	13.580
4>	5000	20.039

Accepted By: Tom Hamilton

Date: 2/17/2005

OMEGA Engineering, Inc., One Omega Drive, Box 4047, Stamford, CT 06907-0047

Tel: (203) 359-1660 • Fax: (203) 359-7811

[www.omega.com](http://www.omega.com) e-mail: [info@omega.com](mailto:info@omega.com)

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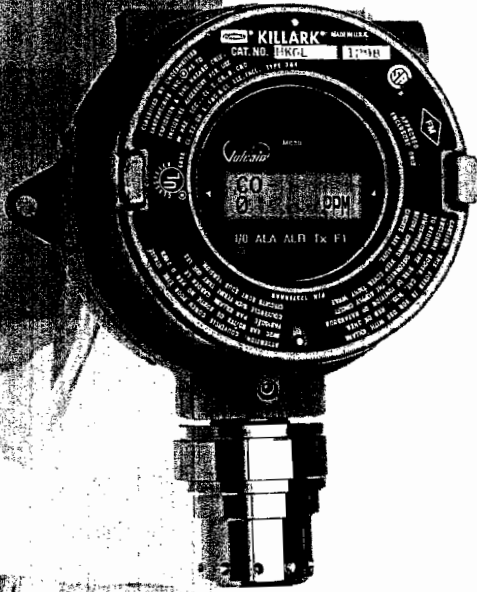
2



Gas Transmitter

**VA 301 D<sub>2</sub>**

**User Manual**



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## WARRANTY AND LIMITS OF LIABILITY

Vulcain Inc. warrants to the original purchaser that its product, and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase. Vulcain will, without any charge and at its option, repair or replace defective products or components upon their delivery to its Repair and Service Department. This warranty does not apply in the event of misuse or abuse of the product, or as a result of unauthorized alterations or repairs. Vulcain shall not be liable for any consequential damages, including, without limitation, damages resulting from loss of use.

Every precaution for accuracy has been taken in the preparation of this manual. However, Vulcain neither assumes responsibility for any omissions or errors that may appear, nor liability for any damages that may result from the use of the products in accordance with the information contained in this manual.

To obtain warranty service, return the product, along with a complete description of the defect, transportation prepaid. Vulcain assumes no risk for damage in transit. Following warranty repair, the product will be returned to the buyer, transportation prepaid.

### Technical Support Line:

**1-800-563-2967**

*Before returning a product for warranty service,  
please contact Vulcain's Technical Support  
Department.*



### Warranty Registration



*To validate the warranty, this registration form must be completed in full and sent to Vulcain within 90 days of the date of purchase. Fax it to Vulcain at 1 888 967 9938.*

Customer's name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

State/Province: \_\_\_\_\_

Location of the installation: \_\_\_\_\_

Serial No.: \_\_\_\_\_

**BEFORE RETURNING ANY INSTRUMENTS, PLEASE CONTACT US TO OBTAIN A RETURN OF MATERIAL AUTHORIZATION NUMBER.**

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## UNPACKING

After opening the package and removed the equipment and components. Make sure that you have all the items described on the order form or packing slip.

## DESCRIPTION









Characterized by their reliability, long life and superior performance in the most adverse environmental conditions, Vulcan's industrial line of products has earned an extensive and excellent reputation in a broad range of applications. The VA301D<sub>2</sub> Series can monitor a large variety of toxic and hundreds of different flammable gases.

### WARNING



Some materials such as, but not limited to, tetraethyl lead, silicosis, some sulfur, phosphorus, and chlorinated compounds may have a poisoning effect resulting in a loss of sensibility.

## IMPORTANT NOTICE

-  Make sure to locate the monitor and sensing assemblies in an area easily accessible to a technician.
-  Avoid any location where the monitor could be subject to vibrations.
-  Avoid any location close to noisy equipment.
-  Avoid any location where temperature changes occur rapidly.
-  Verify all the requirements and existing regulations which may affect the choice of location.
-  Select a location at the perimeter of the chiller, boiler, cooler or any other equipment that may leak. Airflow patterns must also be considered.
-  Always mount the sensor pointing downwards.
-  Conduit installation must conform to local fire, building and electrical codes.

## SURFACE-MOUNT INSTALLATION

Installation of the monitor (stand-alone) or transmitter (network) simply requires the physical mounting of the enclosure and connection of the power and output lines.

**TABLE 1**  
Recommended height

Detected gas	Relative Density (air = 1)	Recommended Height
CO Carbon Monoxide	0.968	3-5 feet (1 - 1.5 m) from floor
* NO <sub>2</sub> Nitrogen Dioxide	1.58 (cold)	1-3 foot (30 cm-1 m) from ceiling
H <sub>2</sub> Hydrogen	0.07	1 foot (30 cm) from ceiling
Cl <sub>2</sub> Chlorine	2.50	1 foot (30 cm) from floor
NH <sub>3</sub> Ammonia	0.59	1 foot (30 cm) from ceiling
H <sub>2</sub> S Hydrogen Sulfide	1.19	1 foot (30 cm) from floor
HCl Hydrogen Chloride	1.30	1 foot (30 cm) from floor
HCN Hydrogen Cyanide	0.932	1 foot (30 cm) from floor
ETO Ethylene Oxide	1.50	1 foot (30 cm) from floor
O <sub>2</sub> Oxygen	1.43	3-5 feet (1 - 1.5 m) from floor
SO <sub>2</sub> Sulfur Dioxide	2.25	1 foot (30 cm) from floor
COMB		Most combustibles are heavier than air, with the exception of methane, hydrogen, ethylene and acetylene. For gases that are heavier than air, sensors should be installed approximately 1 foot (30 cm) from the floor. For combustibles that are lighter than air, sensors should be installed 1 foot (30 cm) from the ceiling, close to the potential leak source.

\* Can be different for specific use. Hot NO<sub>2</sub> from exhaust systems is lighter than 1.58.

## DETERMINATION OF THE NUMBER OF TRANSMITTERS

The number of transmitters is determined by a unit's radius of surveillance. Using Table 2 below, the number of units can be easily evaluated.

**TABLE 2**  
Radius of surveillance

Gas Detected	Radius of Surveillance	Area Covered
CO Carbon Monoxide	50 feet (15 metres)	7,854 square feet (707 m <sup>2</sup> )
NO <sub>2</sub> Nitrogen Dioxide	23 feet (7 metres)	1,662 square feet (154 m <sup>2</sup> )
Others		

**TABLE 3**  
Interfering gases sensor

Gas	Factor	Gas	Factor
Acetic Acid	3.413	Methyl Alcohol	1.460
Acetone	2.208	Methyl Ethyl ketone	2.631
Acetylene	1.665	N-Butane	2.040
Bihane	1.392	N-Decane	3.413
Ethyl Alcohol	1.691	N-Pentane	2.210
Ethylene	1.537	N-Propyl Alcohol	1.967
Hydrogen	1.233	O-Xylene	2.998
Iso-Butane	1.832	Propane	1.883
Iso-Pentane	2.300	Propene	1.837
Methane	1.000	Toluene	2.470



## DUCT-MOUNT INSTALLATION

This system is used to sample air flowing through ventilation ducts. The unit is suitable where the air velocity is between 500 and 4000 ft/minute (2.5 to 20.3 m/sec.), and it is generally installed in the main return ventilation duct before the recirculation fans. Make sure to verify all the requirements and existing regulations which may affect the choice of its location. We recommend installation on a straight duct at 3 feet (1 m) away from any curve.

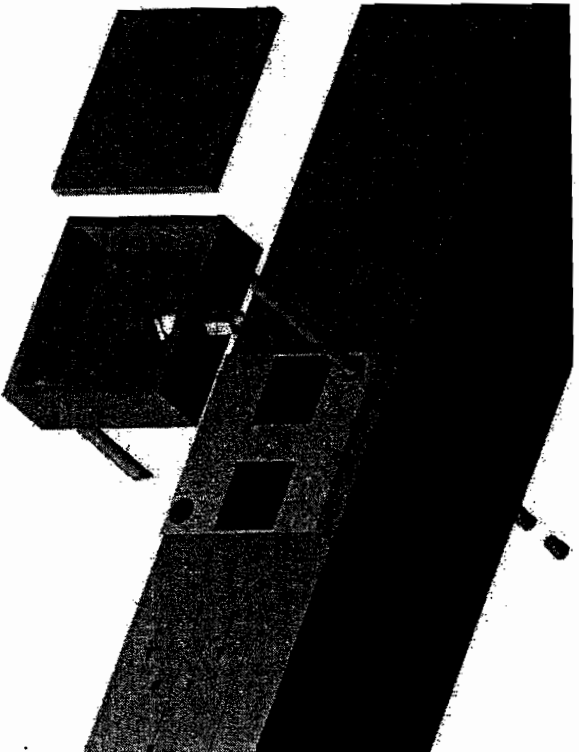
1. Post the drilling guide to the ventilation duct.
2. Drill the openings for the sampling tubes.
3. Insert the sampling tube with lateral air holes in the appropriate connector orienting air holes facing airflow. Tighten with the (8-32 5/16) screw on the connector.
4. Insert the exhaust tube into the appropriate connector orienting the slant away from airflow. Tighten with the (8-32 5/16") screw on the connector.
5. For a ventilation duct longer than 20 inches, extra tubing is necessary. It is preferable to drill a hole at the opposite side facing the detection unit to support the far end of the tube. Seal the end of the tube with the cork supplied. If necessary, seal the openings on the duct around the tubings.
6. Connect the power and the outputs as shown in the *electrical wiring* section.
7. Before mounting the cover of the sampling unit box, start the ventilation feeding fan and check if there is any leakage. If necessary, seal with air plugs.
8. The cover should be mounted using metallic screws (6/32 1/2").

To convert from CFM to velocity (ft./minutes), divide the flow by the area.

Example: In a 2ft X 4ft duct, where the area is 8ft<sup>2</sup> and a CFM of 40,000, the air velocity will be  $40,000\text{ft}^3/\text{minutes} / (8\text{ft}^2) = 5,000\text{ ft./minutes}$



## DUCT MOUNT INSTALLATION DETAILS



# ELECTRICAL WIRING

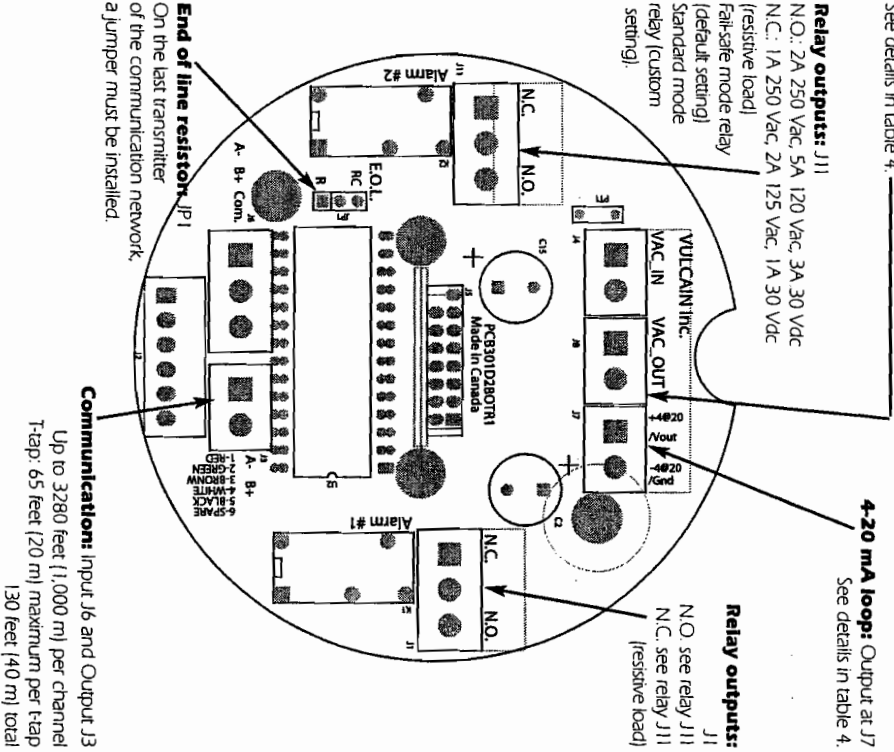
## BACK

**Power:** Input J4 and Output J8  
 15 to 27 Vac, 18 to 38 Vdc, 380 mA @ 24 Vdc.  
 Frequency 60-Hz  
 See details in table 4.

**Relay outputs: J11**  
 N.O.: 2A 250 Vac, 5A 120 Vac, 3A 30 Vdc  
 N.C.: 1A 250 Vac, 2A 125 Vac, 1A 30 Vdc  
 (resistive load)  
 Fail-safe mode relay  
 (default setting)  
 Standard mode relay (custom setting)

**4-20 mA loop:** Output at J7  
 See details in table 4.

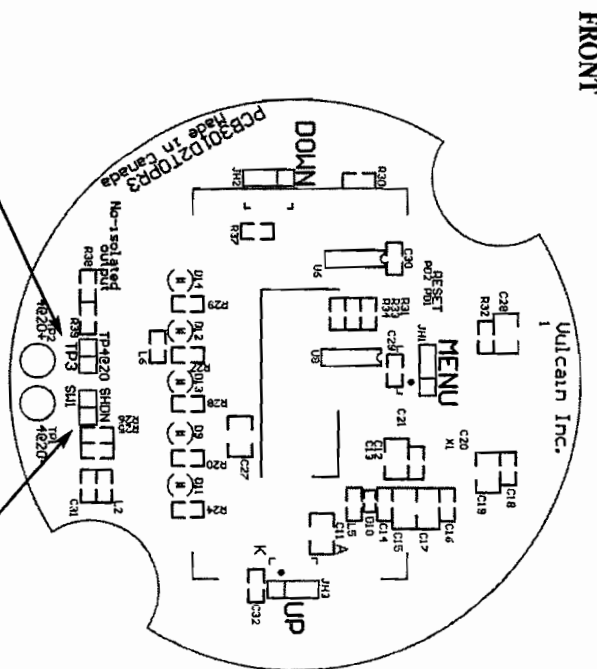
**Relay outputs:**  
 J1  
 N.O. see relay J11  
 N.C. see relay J11  
 (resistive load)



**End of line resistor: JP1**  
 On the last transmitter of the communication network, a jumper must be installed.

**Communications:** input J6 and Output J3  
 Up to 3280 feet (1,000 m) per channel  
 T-tap: 65 feet (20 m) maximum per T-tap  
 130 feet (40 m) total

## FRONT



**4@20 loop jumper: TP3**  
 Remove the jumper to obtain a measure of current on TP2 and TP1.

**Power Jumper: SW1**  
 Place the jumper correctly in order to power the transmitter.

## INITIAL START-UP

Once powered up, the unit will begin displaying gas concentrations. The initial stabilization period for the combustible detectors is within 5 minutes. For the other configurations, the period is less than 24 hours.

# WIRING REQUIREMENTS

TABLE 4  
Power wire gauge

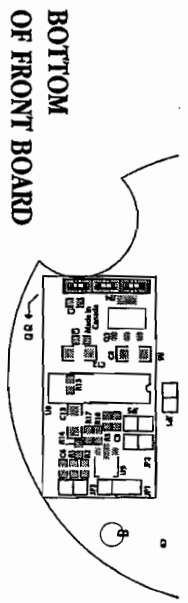
Cable length	Number of transmitters						
	4	8	12	16	32	64	128
500 feet (150 m)	18 AWG	18 AWG	16 AWG	14 AWG	14 AWG	12 AWG	12 AWG
1000 feet (300 m)	18 AWG	16 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG
1500 feet (450 m)	16 AWG	16 AWG	14 AWG	12 AWG	12 AWG	***	***
2000 feet (600 m)	14 AWG	14 AWG	12 AWG	12 AWG	***	***	***
4000 feet (1200 m)	12 AWG	12 AWG	12 AWG	***	***	***	***

The communication cable must be one pair twisted (6 twist per foot) and shielded 24 AWG Belden 9841 or equivalent up to 4,000 feet (1,200 m).

## 4-20 mA LOOP CONFIGURATION

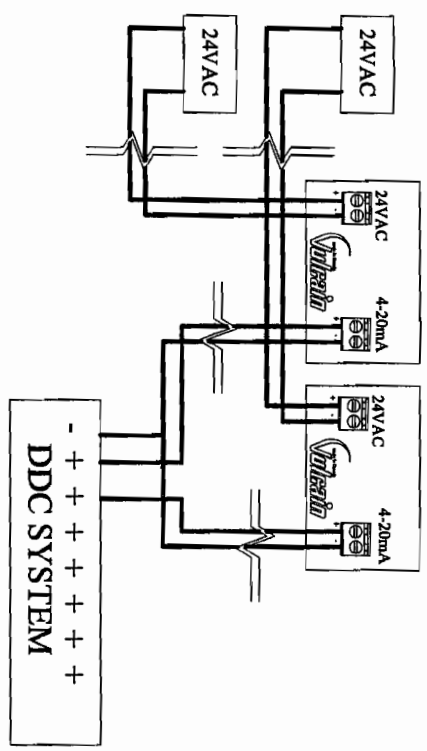
### CURRENT SOURCING OUTPUT CONFIGURATION

The transmitter supplies the loop current. The maximum impedance supported by the loop is 400 ohms. Set jumpers on S1 at 1-2, 3-4 and 5-6.



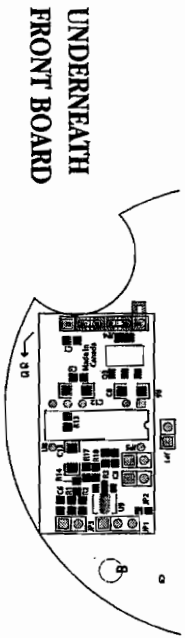
**WARNING**  
A dedicated power supply must be used with each unit. Considerable damage may occur if this condition is not strictly followed.

### Current sourcing output



**LOOP POWERED CONFIGURATION** (factory setting)

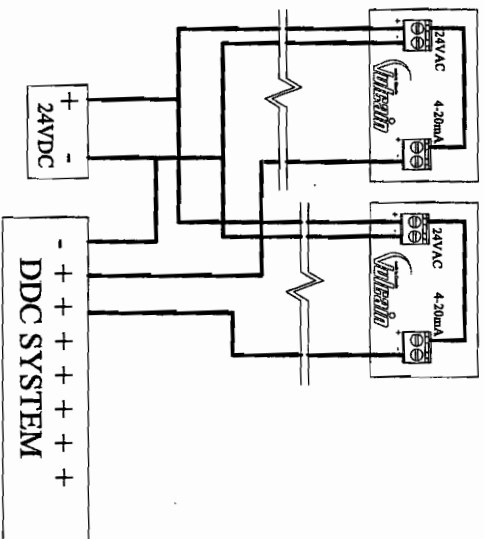
The 4-20 mA output is factory set for loop powered configuration and requires a power source of 12 Vdc to 30 Vdc. The overall impedance depends on the voltage supplied to the 4-20 mA loop.



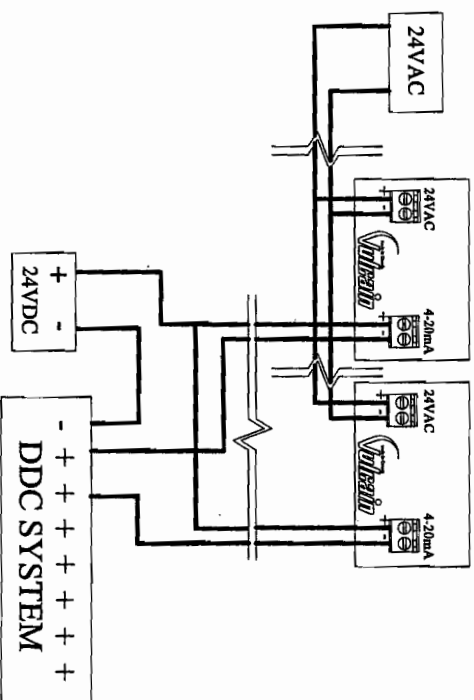
**TABLE 5**  
Permitted impedance in the 4-20 mA loop

Voltage Source applied	total impedance
12 Vdc	400 Ohms
16 Vdc	600 Ohms
20 Vdc	800 Ohms
24 Vdc	1000 Ohms
30 Vdc	1300 Ohms

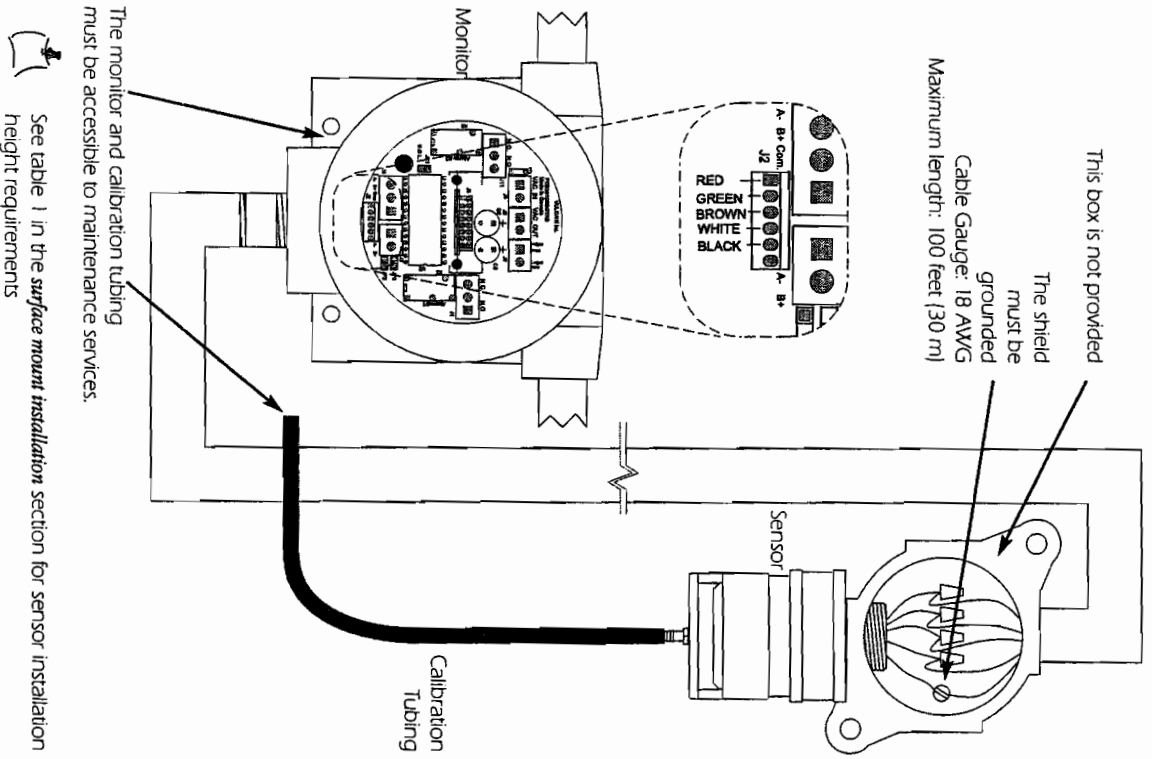
**3-wires configuration**



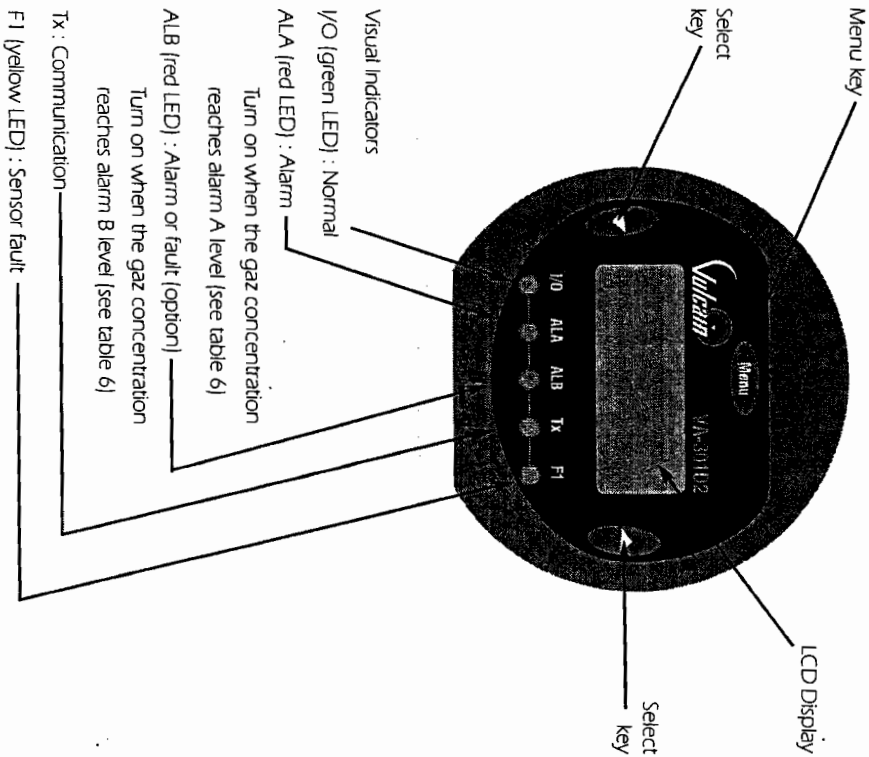
**4-wires configuration**



## OPTIONAL REMOTE SENSOR CONFIGURATION



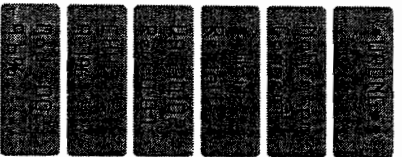
## USER INTERFACE



## USER'S MENU

Menu Set Zero	Set Zero	Saved zero calibration of the sensor.
Menu Set Zero	Set Zero Cancel	Cancellation of zero calibration of the sensor.
Menu Set Zero	Set Zero	Calibration of the gas reading.
Menu Set Gas	Set Gas 20.00%	Adjustment of the calibration gas value.
Menu Set Span	Set Span Bo Calibr	Confirmation of the calibration of the gas reading.
Menu Set Span	Set Span Bo Calibr	Cancellation of the calibration.
Menu Set Span	Set Span Cancel	Displays after confirmation of the calibration of the gas reading.
Menu Set Span	Set Span Save	Validation of the calibration of the gas reading.
Menu Set Span	Set Span Bo Calibr	Cancellation of the calibration.
Menu Exit	Exit	Exit menu.
Menu Loop 4@20	Loop 4@20 option only 4@20 loop adjustment	Loop 4@20 option only 4@20 loop adjustment.
Menu Set Min	Set Min	4mA Adjustment.
Menu Set Min	Set Min	Adjustment confirmation
Menu Set Min	Set Min	Displays after adjustment confirmation.
Menu Set Max	Set Max	20mA adjustment.
Menu Set Max	Set Max	Adjustment confirmation.
Menu Set Max	Set Max	Displays after adjustment confirmation.
Menu Set Zero	Set Zero	Configuration of zero calibration of the sensor.
Menu Set Zero	Set Zero Cancel	Cancellation of zero calibration of the sensor.
Menu Set Zero	Set Zero	Displays after confirmation of zero calibration of the sensor.
Menu Set Zero	Set Zero	Zero calibration of the sensor.
Menu Set Zero	Set Zero	Alarm B maximum level adjustment.
Menu Set Min	Set Min	Alarm B maximum level configuration.
Menu Set Min	Set Min	Alarm B minimum level adjustment.
Menu Set Min	Set Min	Alarm B minimum level configuration.
Menu Set Max	Set Max	Alarm A maximum level adjustment.
Menu Set Max	Set Max	Alarm A maximum level configuration.
Menu Set Min	Set Min	Alarm A minimum level adjustment.
Menu Set Min	Set Min	Alarm A minimum level configuration.
Menu Set Min	Set Min	Alarm level adjustment menu.
Menu Set Min	Set Min	Transmitter address configuration.
Menu Set Min	Set Min	Address configuration menu
Menu Set Min	Set Min	Password for user's programming menu.
Menu Set Min	Set Min	Name of the unit, displayed upon initialization.

Menu Set Zero	Set Zero	Saved zero calibration of the sensor.
Menu Set Zero	Set Zero Cancel	Cancellation of zero calibration of the sensor.
Menu Set Zero	Set Zero	Calibration of the gas reading.
Menu Set Gas	Set Gas 20.00%	Adjustment of the calibration gas value.
Menu Set Span	Set Span Bo Calibr	Confirmation of the calibration of the gas reading.
Menu Set Span	Set Span Bo Calibr	Cancellation of the calibration.
Menu Set Span	Set Span Cancel	Displays after confirmation of the calibration of the gas reading.
Menu Set Span	Set Span Save	Validation of the calibration of the gas reading.
Menu Set Span	Set Span Bo Calibr	Cancellation of the calibration.
Menu Exit	Exit	Exit menu.
Menu Loop 4@20	Loop 4@20 option only 4@20 loop adjustment	Loop 4@20 option only 4@20 loop adjustment.
Menu Set Min	Set Min	4mA Adjustment.
Menu Set Min	Set Min	Adjustment confirmation
Menu Set Min	Set Min	Displays after adjustment confirmation.
Menu Set Max	Set Max	20mA adjustment.
Menu Set Max	Set Max	Adjustment confirmation.
Menu Set Max	Set Max	Displays after adjustment confirmation.
Menu Set Zero	Set Zero	Configuration of zero calibration of the sensor.
Menu Set Zero	Set Zero Cancel	Cancellation of zero calibration of the sensor.
Menu Set Zero	Set Zero	Displays after confirmation of zero calibration of the sensor.
Menu Set Zero	Set Zero	Zero calibration of the sensor.
Menu Set Zero	Set Zero	Alarm B maximum level adjustment.
Menu Set Min	Set Min	Alarm B maximum level configuration.
Menu Set Min	Set Min	Alarm B minimum level adjustment.
Menu Set Min	Set Min	Alarm B minimum level configuration.
Menu Set Max	Set Max	Alarm A maximum level adjustment.
Menu Set Max	Set Max	Alarm A maximum level configuration.
Menu Set Min	Set Min	Alarm A minimum level adjustment.
Menu Set Min	Set Min	Alarm A minimum level configuration.
Menu Set Min	Set Min	Alarm level adjustment menu.
Menu Set Min	Set Min	Transmitter address configuration.
Menu Set Min	Set Min	Address configuration menu
Menu Set Min	Set Min	Password for user's programming menu.
Menu Set Min	Set Min	Name of the unit, displayed upon initialization.



- Entry of an invalid password.
- Indicates no sensor is connected.
- Automatic re-initialization before returning to detection mode.
- Product name and program version.
- Sensor type and percent (%) concentration.
- Indicates that the unit is in Modbus communication mode.
- Indicates the assigned address. Indicates the concentration read.

**SPECIFICATIONS**

- Power Requirements: 15 - 27 Vac, 18 - 38 Vdc, 380 mA @ 24 Vdc
- Operating Temperature Range: -40°F to 100°F (-40°C to 40°C) Toxic gases  
-40°F to 112°F (-40°C to 50°C) Combustible gases
- Operating Humidity Range: 0% to 95% RH Non-condensed  
NH<sub>3</sub>: 15% to 90% RH, Non-Condensed
- Sensing Technologies: Q1: electrochemical (toxic)  
catalytic combustion (combustibles)  
diffusion fuel cell (oxygen)
- Display: Alpha numeric LCD display with back light
- Visual Indicators: Green LED: Normal operation  
Red LED: Alarms A  
Red LED: Alarms B  
Green LED: Communication  
Yellow LED: Fault
- Outputs: 4-20 mA, 2 optional SPDT fail safe relays  
Up to 2000 feet (600 m) per channel  
T-tap: 65 feet (20 m) maximum per t-tap  
130 feet (40 m) total
- Minimum size Conductors: See *wiring requirements* section
- Relay Output Rating: Normally open: 2A 250 Vac, 5A 125 Vac, 3A 30 Vdc  
Normally close: 1A 250 Vac, 2A 125 Vac, 1A 30 Vdc
- Relay Mode: Fail-safe mode relay (default setting)
- Storage Temperature: Standard mode relay (custom setting)  
-40°F to 112°F (-40°C to 50°C)
- Pressure Limits: 800 to 1200 millibars
- Communication: RS-485 two wires  
Autodetect Vulcanus or Modbus
- Communication Protocol: 9.6 kbauds (also available: 0.3, 2.4, 19.2)
- Transmission Speed: 1 start bit, 7 bits of data, 2 stop bits, no parity
- Eight-bit Frame: 8 status bits available
- Enclosure: Class 1, Division 1, Groups B, C, D
- Dimensions: 7.5 in. (H) X 6.25 in. (W) X 4.5 in. (D)  
(19 cm x 16 cm x 11.5 cm)
- Weight: 4.6 lbs. (2.1 Kg)
- Frequency: 60 Hz

## RANGE AND ALARM LEVELS

Table 6  
Range and Alarm Levels

Gas Detected	Range	Alarm A	Alarm B
CO	0 - 250 PPM	25 PPM	200 PPM
Carbon Monoxide			
NO <sub>2</sub>	0 - 10 PPM	0.72 PPM	2 PPM
Nitrogen Dioxide			
Cl <sub>2</sub>	0 - 15 PPM	0.5 PPM	1 PPM
Chlorine			
NH <sub>3</sub>	0 - 100 PPM	25 PPM	35 PPM
Ammonia			
H <sub>2</sub> S	0 - 50 PPM	10 PPM	15 PPM
Hydrogen Sulfide			
HCL	0 - 25 PPM	3 PPM	4 PPM
Hydrogen Chloride			
HCN	0 - 50 PPM	10 PPM	20 PPM
Hydrogen Cyanide			
ETO	0 - 20 PPM	1 PPM	5 PPM
Ethylene Oxide			
O <sub>2</sub>	0 - 25% Vol	19.5% Vol	22% Vol
Oxygen			
SO <sub>2</sub>	0 - 10 PPM	2 PPM	5 PPM
Sulfur Dioxide			
O <sub>3</sub>	0 - 2.5 PPM	1 PPM	2 PPM
Ozone			
HF	0 - 10 PPM	2 PPM	3 PPM
Hydrogen fluoride			
F <sub>2</sub>	0 - 1 PPM	0.1 PPM	0.3 PPM
Fluor			
AsH <sub>3</sub>	0 - 2.5 PPM	0.05 PPM	0.1 PPM
Arsine			
COMB	0 - 100% LEL	25% LEL	50% LEL
Combustibles			



Specific setting of the alarm levels may have already been performed to meet the specific customer application.

## PERIODIC INSPECTIONS AND CALIBRATION

This unit requires calibration. The calibration frequency will be a function of the operating conditions, including operating under extreme temperatures, exposure to contaminants or gas. If the exposure to the gas is greater than the unit's full scale, the unit must be recalibrated. A calibration inspection must be included as part of a routine maintenance to ensure proper operation of the gas detection unit.



If the units span or zero cannot be adjusted, the sensor may be approaching its end-of-life and have been contaminated with high concentration of gas, and it must be replaced.

## CALIBRATION PROCEDURE

### 1- Warm-up period

Turn the unit on for a minimum of (15) minutes

### 2- Connecting the hardware

Plug the calibration adaptor onto the gas sensor inlet

Screw the regulator to the calibration span gas cylinder or air cylinder for the zero adjustment

Connect the regulator outlet to the calibration adaptor with the 1/8" I.D. polymer tubing

### 3- Adjusting the zero (if required)

When the unit indicates 0% COMB in an area with no presence of combustible gas, proceed to step 4, adjusting the span.

To adjust the zero, inject air at a flow rate of 500ml/min.

Place the magnet on top of Menu. Then place it above Up or Down Arrow until the password VA is reached.

Place the magnet on top of Menu to acknowledge.

Place the magnet on top of Up or Down Arrow until the Set Zero field is reached.

Place the magnet on top of Menu to acknowledge.

Place the magnet on top of Menu to activate GoCalib.

Wait message appears, the transmitter will go into zero calibration.

When the Menu Set Zero message appears, the zero calibration is complete.

Place the magnet on top of Up or Down Arrow until the Quit field is reached.

Place the magnet on top of Menu to confirm.

### 4- Adjusting the span

Turn on the regulator. The calibration span gas is now flowing into the unit. Let the gas flow for a minimum of 1 minute. After one minute, the reading should be stabilized.

Place the magnet on top of Menu. Then place it above Up or Down Arrow until the password VA is reached.

Place the magnet on top of Menu to acknowledge.

Place the magnet on top of Menu to acknowledge.

Place the magnet on top of Up or Down Arrow until the Set Span field is reached.

Place the magnet on top of Menu to acknowledge.

Place the magnet on top of Up or Down Arrow to select the proper gas value.



The proper span gas value equals the 20% LEL CH4 multiplied by the sensitivity factor related to the target gas. See appendix for related factor. (Verify calibration gas concentration label).  
 Example: Propane's sensitivity factor is 1.883. The span gas value is 20% \* 1.883 = 37.7%

Once the span gas value is selected, place the magnet on top of Menu to acknowledge.

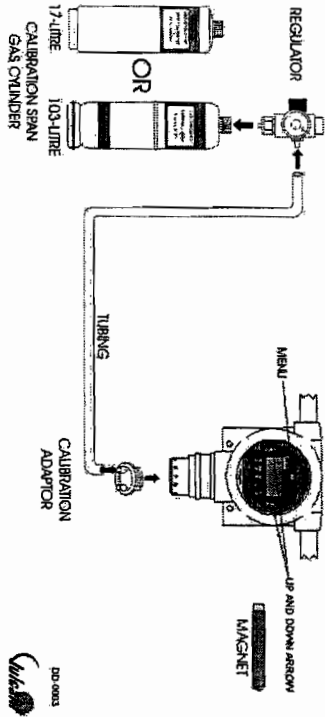
Place the magnet on top of Menu to activate GoCalib.

Once this field is selected, place the magnet on top of Menu to acknowledge.

Wait message appears, the transmitter will go into auto calibration mode and will indicate a gas concentration.

When the Menu Set Span message appears, the calibration is complete.

Place the magnet on top of Up or Down Arrow until the Quit field is reached. Place the magnet on top of Menu to confirm.



## TROUBLESHOOTING

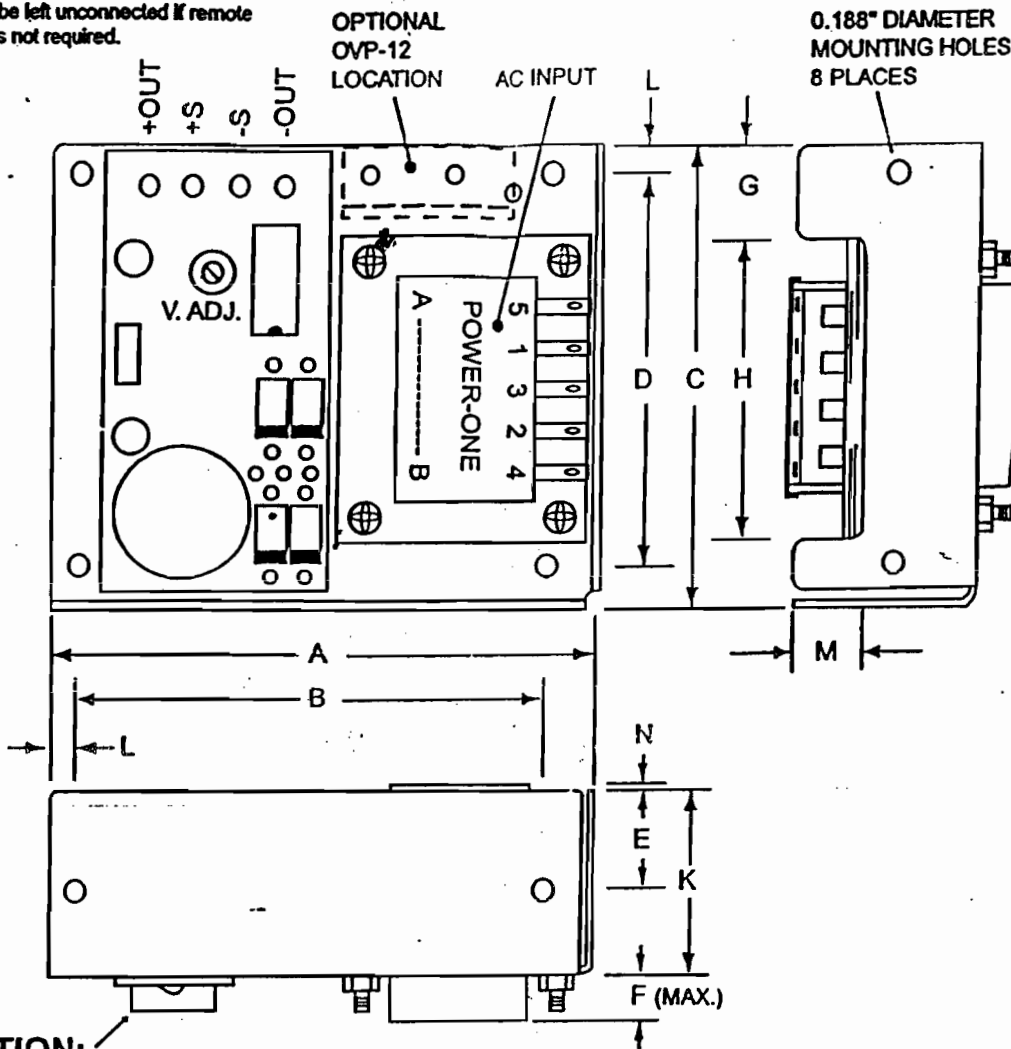
Fault Displayed	Possible Cause	Solution
<b>No SENSOR CONNECT</b>	-The sensor connector (J2) has been disconnected -The remote sensor hasn't been connected -Any other cause	-Insert the connector (J2) on the unit's bottom card -Make the junction inside the junction box -Reset the unit or replace the sensor housing
<b>SENSOR??</b>	-The sensor board has been removed -Any other cause	-Replace the sensor board and reset the unit -Reset the unit or replace the sensor board
<b>FAILSENS</b>	-The sensor board has been removed -Calibration has been performed without gas or with a wrong span gas value -Any other cause	-Replace the sensor board and reset the unit -Reset the unit, then it takes the previous setting before calibration -Reset the unit or replace the sensor board
<b>NOTCALIB</b>	-Unit hasn't been calibrated	-Calibrate the zero then the span

### HA & HB Power Supply Series - Single Output Linears

#### CAUTION:

DO NOT CONNECT LOAD LEADS TO SENSE TERMINALS. Sense leads should be left unconnected if remote sense is not required.

NOTE: Unit may be mounted on any axis. Also, Printed Circuit Board layout and location of Voltage Adjust Potentiometer varies by model.



#### CAUTION:

The metal case of the TO-3 transistor is an unprotected live circuit connection. Take care to ensure that this device is not shorted to the system chassis upon installation.

OVERALL SIZE: 4.87" x 4.00" x 2.10"

WEIGHT: 2.2 lb

TOLERANCES: .XX = 0.03" (0.8mm)

.XXX = 0.010" (0.3mm)

INPUT CONNECTIONS: Solder terminals on transformer.

OUTPUT CONNECTIONS: Dual gauge solder turrets on PCB.

CHASSIS: 0.090" aluminum alloy, with clear anodized finish.

Callout	Inches	Millimeters
A	4.87	123.7
B	4.125	104.8
C	4.00	101.6
D	3.375	85.7
E	0.87	22.1
F	0.45	11.4
G	0.79	20.2
H	2.60	66.0
K	1.62	41.2
L	0.250	6.4
M	0.57	14.5
N	0.06	1.5

Additional application information is available from the Power-One web site at [www.power-one.com](http://www.power-one.com).

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P.O. BOX ACKERSTRASSE 56 • CH-8610, USTER, SWITZERLAND • PHONE: (41) 1 944 8383

### HA & HB Power Supply Series - Single Output Linears

AC INPUT: 100/120/220/230/240 VAC, 47-63 Hz.

Derate output current 10% for 50 Hz operation.



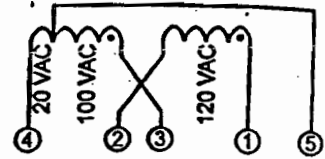
TUV approved to EN60950

UL recognized to UL1950/  
UL60950



CSA approved to  
CSA # 22.2, No. 950 A

### AC INPUT CONNECTION INFORMATION



CONNECTION TABLE			EXT
INPUT	JUMPER	APPLY	
100V	1-3, 2-4	1-5	A*
120V	1-3, 2-4	1-4	
220V	2-3	1-5	
230V	2-3	1-4	B*
240V	2-3	1-4	



\* Required fusing is marked on chassis.

Model	External Fusing (Required):		Output Ratings:		Airflow Required for Continuous Full Load Operation at 50°C
	*A (Amps)	*B (Amps)	Nom. V <sub>o</sub> (VDC)	Max. I <sub>o</sub> (Amps)	
HA5-1.5/OVP-A	0.25	0.125	5	1.5	N/A
HB5-3/OVP-A	0.5	0.25	5	3.0	N/A
HA15-0.9-A	0.25	0.125	12 or 15	0.9	N/A
HB12-1.7-A	0.5	0.25	12	1.7	N/A
HB15-1.5-A	0.5	0.25	15	1.5	N/A
HA24-0.5-A	0.5	0.25	24 or 28	0.5	N/A
HB24-1.2-A	0.75	0.375	24	1.2	100 LFM
HB28-1-A	0.75	0.375	28	1.0	50 LFM
HB48-0.5-A	0.75	0.375	48	0.5	N/A
HB120-0.2-A	0.75	0.375	120	0.2	75 LFM
HB200-0.12-A	0.75	0.375	200	0.12	N/A
HB250-0.1-A	0.75	0.375	250	0.1	N/A

## - CAUTIONS & NOTES -

**CAUTION:** These component level power supplies are intended exclusively for installation within other equipment by an industrial assembly operation or by professional installers. These are Class I power supplies; the chassis must be properly connected to earth ground in end use. The DC Output is isolated from chassis/earth ground, and may be used as either a positive or negative output relative to the application's DC common. Component power supplies are to be installed in end-use equipment according to the requirements of the safety standard used for that equipment. These power supplies are not designed to be operated outside of an enclosure which provides a means of mechanical, electrical, and fire protection.

**CAUTION:** DO NOT CONNECT PIN 5 OF THE TRANSFORMER TO EARTH GROUND. Leave Pin 5 disconnected unless it is used for a desired input range as described in the connection table above.

**CAUTION:** Always connect the load to the power supply's load terminals before connecting the sense leads. Always remove the sense leads before disconnecting the power supply load. Units feature open sense lead protection. Connecting sense lead(s) to load without associated load lead connection(s) will force current through the sense connection. This load current will cause failure of the remote sense function.

Overvoltage protection is provided on HA5-1.5/OVP-A & HB5-3/OVP-A only. For other models with less than 48V output, an optional OVP module (OVP-12) is available. Mounting holes are provided in the chassis for this option.

Outputs are SELV, except units with output voltage equal to or greater than 48V.

Some models may require forced air cooling in restrictive environments (see chart above).

Derate output current 2.5% per degree centigrade for ambient temperatures above 50°C (70°C Max. ambient).

Covers are not available from Power-One.

Additional application information is available from the Power-One web site at [www.power-one.com](http://www.power-one.com).

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## INSTALLATION INSTRUCTIONS

### HA & HB Power Supply Series - Single Output Linears

**AC INPUT:** 100/120/220/230/240 VAC, 47-63 Hz.

Derate output current 10% for 50 Hz operation.



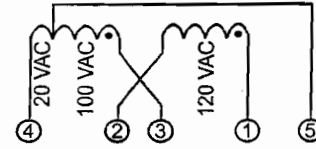
® TUV approved to EN60950

UL recognized to UL1950/  
UL60950



® CSA approved to  
CSA # 22.2, No. 950 A

#### AC INPUT CONNECTION INFORMATION



CONNECTION TABLE			EXT
INPUT	JUMPER	APPLY	
100V	1-3, 2-4	1-5	A*
120V	1-3, 2-4	1-4	
220V	2-3	1-5	
230V	2-3	1-4	B*
240V	2-3	1-4	



\* Required fusing is marked on chassis.

Model	External Fusing (Required):		Output Ratings:		Airflow Required for Continuous Full Load Operation at 50° C
	*A (Amps)	*B (Amps)	Nom. V <sub>o</sub> (VDC)	Max. I <sub>o</sub> (Amps)	
HA5-1.5/OVP-A	0.25	0.125	5	1.5	N/A
HB5-3/OVP-A	0.5	0.25	5	3.0	N/A
HA15-0.9-A	0.25	0.125	12 or 15	0.9	N/A
HB12-1.7-A	0.5	0.25	12	1.7	N/A
HB15-1.5-A	0.5	0.25	15	1.5	N/A
HA24-0.5-A	0.5	0.25	24 or 28	0.5	N/A
HB24-1.2-A	0.75	0.375	24	1.2	100 LFM
HB28-1-A	0.75	0.375	28	1.0	50 LFM
HB48-0.5-A	0.75	0.375	48	0.5	N/A
HB120-0.2-A	0.75	0.375	120	0.2	75 LFM
HB200-0.12-A	0.75	0.375	200	0.12	N/A
HB250-0.1-A	0.75	0.375	250	0.1	N/A

## - CAUTIONS & NOTES -

**CAUTION:** These component level power supplies are intended exclusively for installation within other equipment by an industrial assembly operation or by professional installers. These are Class I power supplies; the chassis must be properly connected to earth ground in end use. The DC Output is isolated from chassis/earth ground, and may be used as either a positive or negative output relative to the application's DC common. Component power supplies are to be installed in end-use equipment according to the requirements of the safety standard used for that equipment. These power supplies are not designed to be operated outside of an enclosure which provides a means of mechanical, electrical, and fire protection.

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Overvoltage protection is provided on HA5-1.5/OVP-A & HB5-3/OVP-A only. For other models with less than 48V output, an optional OVP module (OVP-12) is available. Mounting holes are provided in the chassis for this option.

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Derate output current 2.5% per degree centigrade for ambient temperatures above 50°C (70°C Max. ambient).

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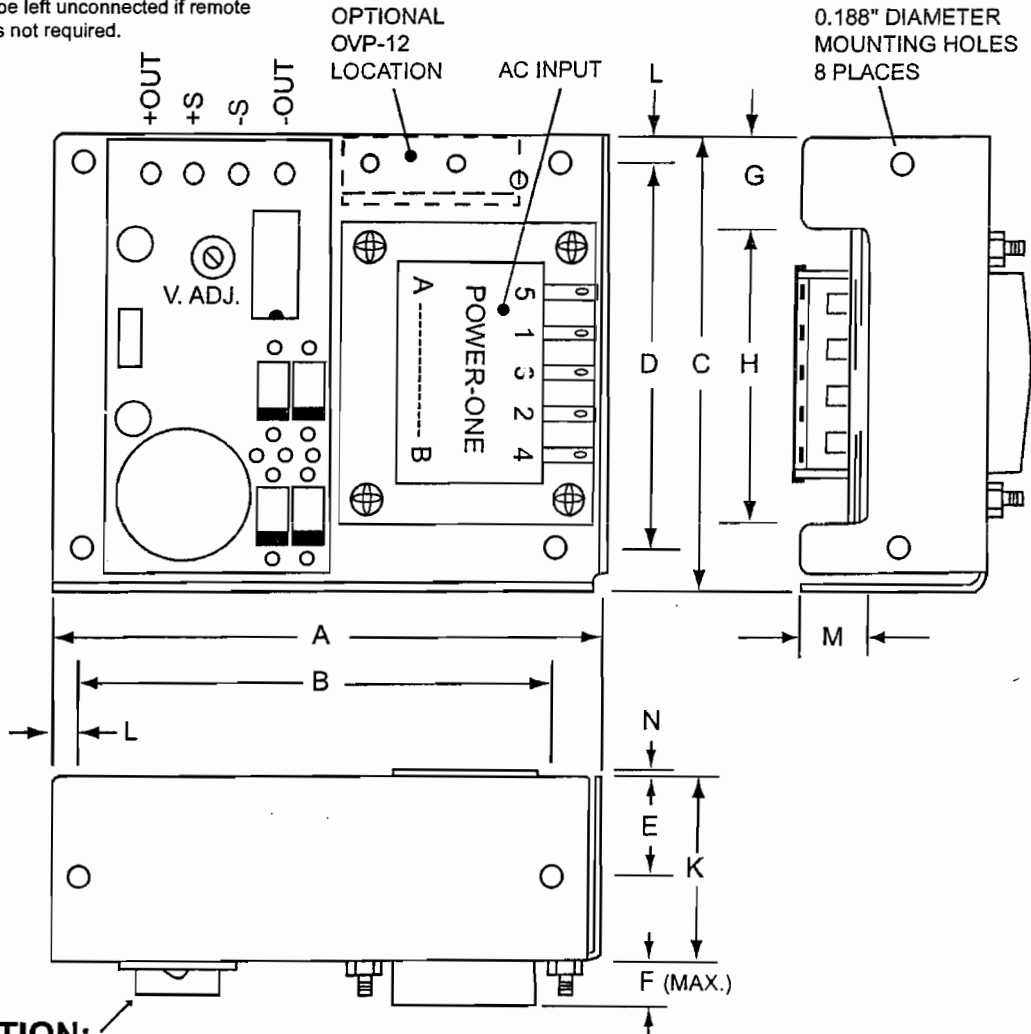
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### HA & HB Power Supply Series - Single Output Linear

#### CAUTION:

DO NOT CONNECT LOAD LEADS TO SENSE TERMINALS. Sense leads should be left unconnected if remote sense is not required.

NOTE: Unit may be mounted on any axis. Also, Printed Circuit Board layout and location of Voltage Adjust Potentiometer varies by model.



#### CAUTION:

The metal case of the TO-3 transistor is an unprotected live circuit connection. Take care to ensure that this device is not shorted to the system chassis upon installation.

OVERALL SIZE: 4.87" x 4.00" x 2.10"

WEIGHT: 2.2 lb

TOLERANCES: .XX = 0.03" (0.8mm)

.XXX = 0.010" (0.3mm)

INPUT CONNECTIONS: Solder terminals on transformer.

OUTPUT CONNECTIONS: Dual gauge solder turrets on PCB.

CHASSIS: 0.090" aluminum alloy, with clear anodized finish.

Callout	Inches	Millimeters
A	4.87	123.7
B	4.125	104.8
C	4.00	101.6
D	3.375	85.7
E	0.87	22.1
F	0.45	11.4
G	0.79	20.2
H	2.60	66.0
K	1.62	41.2
L	0.250	6.4
M	0.57	14.5
N	0.06	1.5

Additional application information is available from the Power-One web site at [www.power-one.com](http://www.power-one.com).

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op		1	2	3	4	5	6	7	8
VAC	0.0	v: +12.003							
AAC		a: 0.0							

VOLTAGE	v: +12.003
RANGE ADJUST	v: +15.038
CURRENT LIMIT	a: Passed
LOAD REG	v: +0.002
INPUT DROPOUT	r: +0.000
LINE REG	v: +0.001
NOISE & RIP	r: +0.000
SHORT CIRCUIT	a: Passed

==== Power-One Inc. ===== 4.30 =====  
 Passed ; HA15-0.9-A                    sn# y15380       wo#                    ; 67.77; 08-14-2003







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- ▾ Electronic Signals
- ▾ Hazardous Location

### 872 / 873 Series

AdaptaHorn Single Projector Vibrating HornIndoor Applications

- Operating range: -20% to +10% of nominal voltage
- Heavy duty die-cast housing

### 872 AC Series

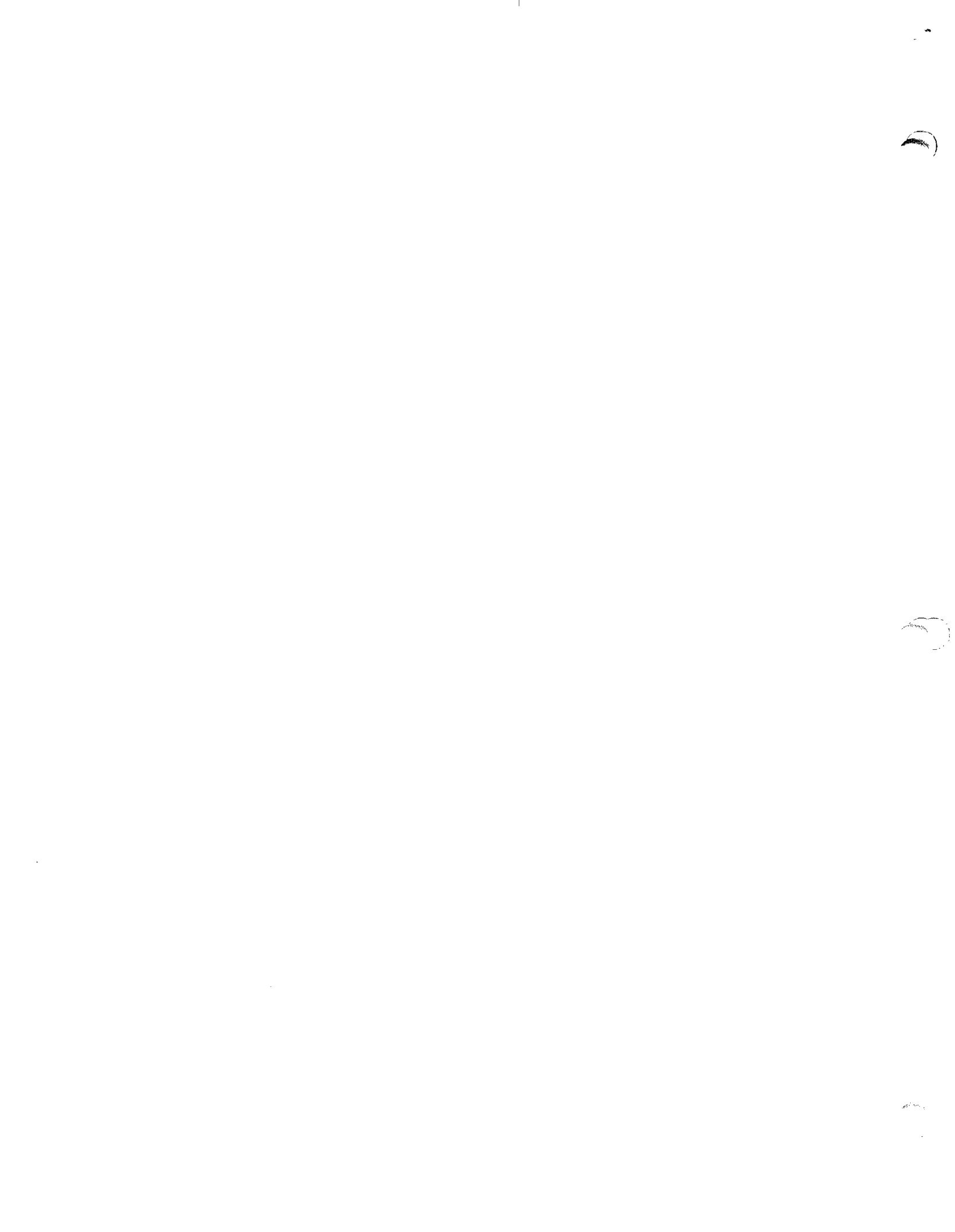
- Adjustable output: 78 to 103 dB
- 400 hour rating at 50% duty cycle

### 873 DC Series

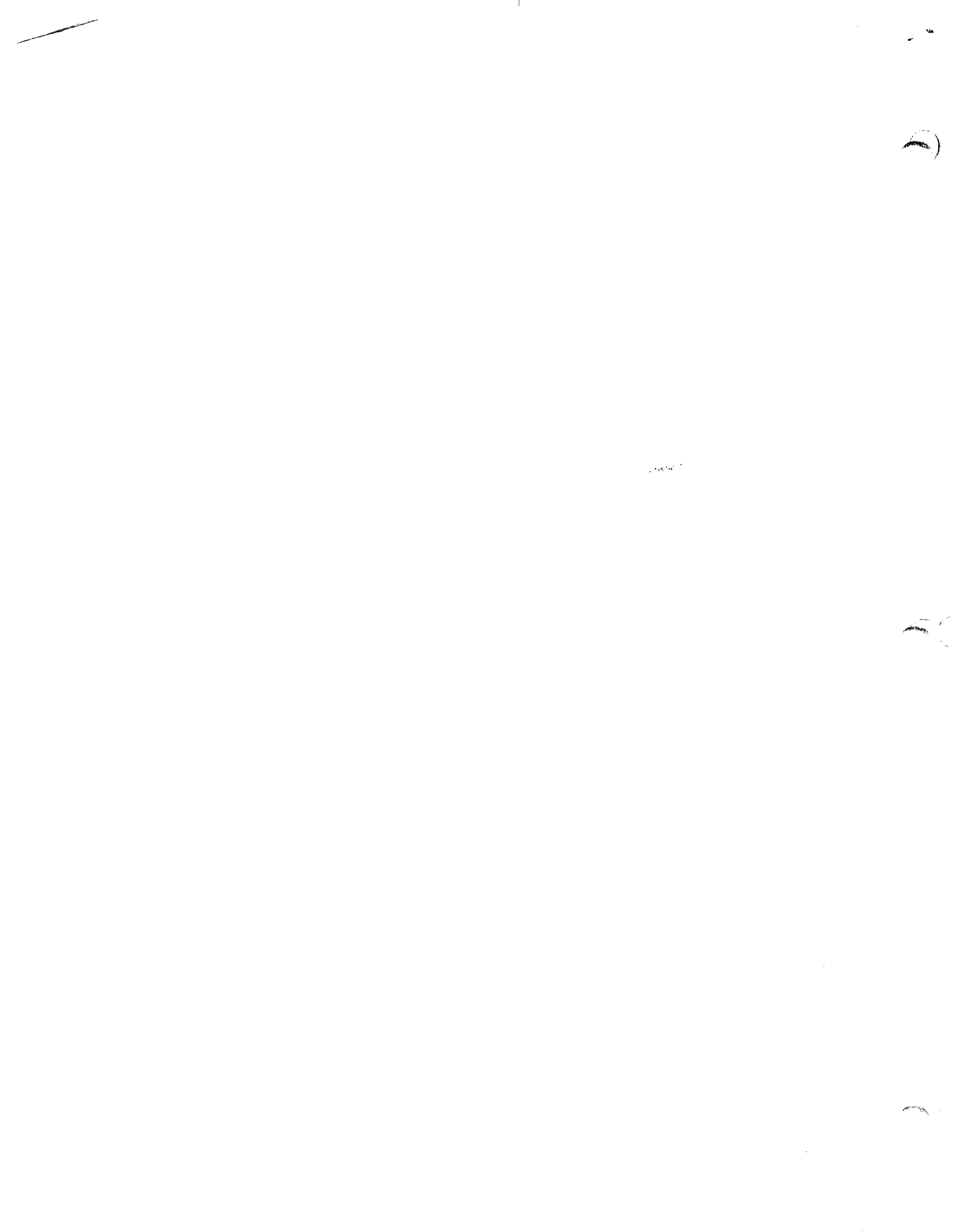
- Adjustable output: 78 to 101 dB
- 200 hour rating

### Images











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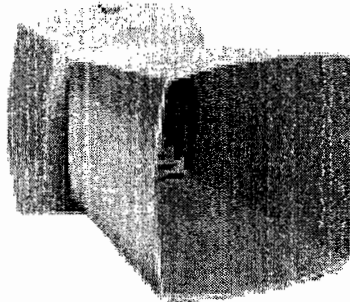
**Menu Selections**

- ▶ Bells
- ▶ Buzzers
- ▶ Horns
- ▶ Chimes
- ▶ Sirens
- ▶ Klaxon Signals
- ▶ Electronic Signals
- ▶ Hazardous Location

# Product Features

## 872 / 873 Series

AdaptaHorn Single Projector Vibrating Horn Indoor Applications



872 & 873 Series

- PLC compatible models
- Corrosion resistant finish
- Volume adjustable ←
- Completely assembled

The Edwards 872 AC & 873 DC Series low-current, high decibel single projector vibrating horn for heavy-duty use. The projector is designed to channel sound direction without decibel loss. Supplied complete with AdaptaPlate for easy installation.

Supplied AdaptaPlate allows quick plug-in connection. Horn simply plugs into receptacle on mounting plate. See AdaptaHorn installation and Accessories | Also mounts on any single gang, 3 1/4" (83mm), 3 1/2" (89mm), 4" (102mm) or 4" (102mm) square box.

Used in industrial, commercial, and institutional applications for timing, paging, alarm signaling.

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# Installation Instructions for Indoor AdaptaHorns

## Description

The AdaptaHorns are UL listed vibrating horns. AC models are FM listed. They are low current, high decibel horns designed for heavy-duty use indoors. The horns are intended for general signaling applications.

### PLC Compatibility

The electrical input load requirements for PLC compatible signaling devices are listed in Table 1. Signaling devices may be directly connected to output cards that meet these input load requirements.

24V DC electromechanical horns such as the 871-G1, 873-G1, 873DPO-G1 and 875-G1 can produce transient spikes and should only be used on PLC output cards that have inherent transient spike suppression. The Process Control Engineer should consult the PLC manufacturer when connecting 24V DC electromechanical devices to PLCs.

## Installation

### Flush Mounting (870 and 871 Series)

1. Using approved wiring methods, connect black wire leads to power source wires. Polarity is not important.

2. Ground to wiring system.
3. Insert horn connector into connector receptacle and secure horn to backbox with (4) oval head screws (supplied).

### Surface Mounting (872, 872DPO, 873, 873DPO, 874, and 875 Series)

1. Loosen screw at bottom of horn and remove backplate.
2. Mount plate using one of the following methods:
  - a. Mount on any outlet box cover having single gang opening using #6 screws (supplied).
  - b. Mount on a 3 1/4" (83mm), 3 1/2" (89mm), 4" (102mm) octagon or 4" (102mm) square box using #8 screws supplied with backbox.
  - c. Mount on the wall, for open wiring, using #8 wood screws (supplied).
3. Using approved wiring methods connect one wire to each terminal in backplate. Ground to wiring system.

Table 1. PLC Compatibility

Cat. No.	Operating voltage*	Maximum off state leakage current (mA)	Continuous on current (mA)	Surge (inrush/duration) (A/ms**)
870-N5	120V AC	25	120	1.02/0.000026
871-G1	24V DC	25	150	1.7/0.000042
872-N5	120V AC	25	120	1.02/0.000026
872DPO-N5	120V AC	25	120	1.02/0.000026
873-G1	24V DC	25	150	1.7/0.000042
873DPO-G1	24V DC	25	150	1.7/0.000042
874-N5	120V AC	25	120	1.02/0.000026
875-G1	24V DC	25	150	1.7/0.000042

\*All AC volts at 60 Hz

\*\*Amps/milliseconds

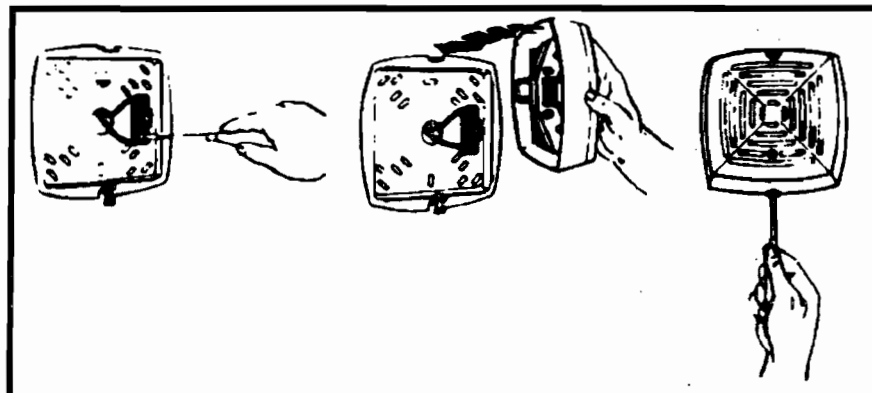


Figure 1. Mounting the Horn on the AdaptaPlate

4. Place the horn on the mounting plate so that the tab at the top seats in slot on horn. Press horn firmly against plate and tighten screw at bottom of unit. See Figure 1.

### Volume Adjustment

These devices have a volume adjustment screw (located on the grille front) factory set to maximum. To reduce volume level, turn set screw clockwise using the supplied 1/16" (1.6mm) allen wrench.

Table 2. Electrical Specifications

<b>Cat. No.</b>	<b>Voltage</b>	<b>Current</b>
870-G5	24V 50/60 Hz	0.63A
870-N5	120V 50/60 Hz	0.13A
870-R5	240V 50/60 Hz	0.07A
871-E1	12V DC	0.27A
871-G1	24V DC	0.16A
871-K1	48V DC	0.07A
871-P1	125V DC	0.025A
871-S1	250V DC	0.014A
872-E5	12V 50/60 Hz	1.25A
872-G5	24V 50/60 Hz	0.63A
872-N5	120V 50/60 Hz	0.13A
872-R5	240V 50/60 Hz	0.07A
872DPO-G5	24V 50/60 Hz	0.63A
872DPO-N5	120V 50/60 Hz	0.13A
872DPO-R5	240V 50/60 Hz	0.07A
873-G1	24V DC	0.16A
873-K1	48V DC	0.07A
873-P1	125V DC	0.025A
873-S1	250V DC	0.014A
873DPO-E1	12V DC	0.27A
873DPO-G1	24V DC	0.16A
873DPO-J1	32V DC	0.13A
873DPO-P1	125V DC	0.025A
873DPO-S1	250V DC	0.014A
874-E5	12V 50/60 Hz	1.25A
874-G5	24V 50/60 Hz	0.63A
874-N5	120V 50/60 Hz	0.13A
874-R5	240V 50/60 Hz	0.07A
875-C1	6V DC	0.70A
875-E1	12V DC	0.27A
875-G1	24V DC	0.16A
875-J1	32V DC	0.13A
875-P1	125V DC	0.025A
875-S1	250V DC	0.014A

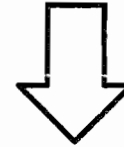
# QUICK START GUIDE – VERBATIM

## CONNECT



- Connect Inputs
- Connect Battery
- Connect AC power
- Connect Phone Line

Section 2.2 of  
Owners Manual



## PROGRAM DIALER:

To program dialer at the front panel press PROGRAM. Put in program code followed by ENTER for each instruction. Press NORMAL to exit program mode.

### Procedure

**Clear Memory:**  
use code 935911

**Enter Phone Numbers** (you must enter at least 1 phone number)

**Set Touch Tone dialing**  
(recommended setting)

**Set Alarm Criteria for all channels:**  
with inputs connected and all points being monitored in their normal condition, enter code 500. This tells the dialer that the present condition is normal, and the opposite condition is the alarm condition.

**Enter Speech** if desired:  
1ZZ enters alarm speech  
2ZZ enters normal speech  
**Remember:** hold the Record button while you are speaking.

### Example

935911 ENTER  
*Section 3.1*

701 658 6713 ENTER  
(phone #1) *Section 3.2*

9011 ENTER  
*Section 3.2*

500 ENTER  
*Section 3.3*

Alarm Speech for Channel 1:  
101 ENTER  
Press and hold RECORD  
"High Level Alarm"  
Release RECORD button  
*Section 4.3*

## TEST

- Verify that each sensing device will trip the dialer
- Verify that the dialer will reach each phone number on call out
- Clear dialer of all test alarms

*Section 3.4*

\* This diagram is intended to be used as a guide for the initial installation and programming of your Verbatim. For complete instructions, you must reference your Verbatim owner's manual.







*Verbatim*<sup>TM</sup>

*Owner's Manual*

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## Warranty

RACO Manufacturing and Engineering Co. Inc., Emeryville, California warrants this product to be in good working order for a period of five years from date of purchase as a new product. In the event of failure of any part(s) due to defect in material or workmanship occurring within that five year period, RACO will, at it's option repair or replace the product at no charge for parts or labor.

Any alteration of the product without instruction from RACO's Engineering Department will automatically void this warranty. If alterations of the unit are authorized by RACO, please complete the authorization form in the Owners Manual and return the form to RACO to ensure the warranty. Under no circumstances will RACO be responsible for consequential or secondary damages.

The defective product should be returned, insured and freight prepaid, securely packaged to the address listed below. Please include a copy of your sales receipt, the dialers serial number, and a detailed description of the problem you are experiencing.

RACO Manufacturing and Engineering Co. Inc.  
Service Department  
1400 62nd Street  
Emeryville, CA 94608

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*Verbatim*<sup>TM</sup>

*Addendum to  
Owner's Manual*

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2

2

4

# Addendum to Verbatim Owner's Manual

## Changes in Verbatim Firmware Revision 2.12

Raco Manufacturing and Engineering continually makes improvements in the operation and functionality of its products. This addendum describes Verbatim firmware revision 2.12 and its differences to the previous firmware revisions.

### **Are You Familiar with the Operation of the Verbatim Autodialer Yet?**

Changes to a few, very specific features of the Verbatim are described in this addendum. It is assumed that the reader of this addendum is already familiar with the basic operation and programming method of the Verbatim. If this is not the case, please take the time necessary to familiarize yourself with the Verbatim autodialer by reading the Verbatim Owner's Manual.

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## App. 1 Use New Programming Code for Total Clear-down

Section 3.1 of the Verbatim User's Manual (Starting Up and Clearing the Unit) advises that it's a good procedure to completely clear down the unit back to factory defaults. This step clears out all programming and should be performed prior to installation and before programming the unit for the application.

The User's Manual says to use programming code 9359 for the total clear-down operation. In firmware revision 2.12 programming code 9359 still operates identically to the way it did in previous firmware revisions. However, a new programming code, 935911, performs a more thorough clear-down, including a hardware reset.

For total clear-down press:

9 3 5 9 1 1 ENTER

This operation will perform a special type of hardware reset which clears all memory including user speech messages and resets all user programming back to factory defaults.

Note: If you perform this operation while programming the Verbatim over-the-phone the unit will hang up the phone without even saying "good-bye". However, the Verbatim will be ready to receive another a call from you immediately.

## App. 2 Modbus Protocol & Local Data Logger (LDL) Now User Settable

In previous Verbatim firmware revisions, network protocols were always "hardcoded" at the factory and could not be altered. With firmware revision 2.12 and above the user may reconfigure networks and protocols as desired (within the basic capabilities of the unit as specified at time of purchase).

In fact, units are now shipped with *NO* protocols enabled. The user *must* enable the desired protocol at the time of installation according to the intended application of the product.

### App. 2.1 Determining Network Port Number & Protocol Identifier

The Verbatim supports four device ports, named NET1-4. Connections to any of these ports are completely separate from each other. Each will need to be configured independently. The table below describes how they may be used. NET3, usable only for the Modbus Plus protocol, is only available in the Verbatim Gateway product. Consult the factory for details.

Port Name	NET1	NET2	NET4
Location:	J307 on expansion card (diagram in chapter 2)	J303 on expansion card (diagram in chapter 2)	inside door front panel card (see section 2.3)
Connector Type:	RJ-45	RJ-45	VPPC-1
Interface Specification:	RS-232C	RS-232C	Centronics
Supported Protocols:	Modbus, LDL	Modbus, LDL	LDL only

Network Device Ports

The general steps for connecting the Verbatim to a Modbus network or to a Local Data Logger printer are as follows:

- Determine which network interfaces are needed for the application. This step is beyond the scope of this manual. Consult the equipment vendors, or contact RACO Customer Service for advice.
- Prepare the external network connection. The following subsections describe usage and configuration for many interfacing devices. Follow the vendor's procedures for installation and configuration.
- Connect the correct cable between the autodialer and the network. Section 2 provides a diagram. Appendix F contains wiring diagrams for all cables. It now ought to be safe to power up all equipment.
- Use code 4906 to configure the desired protocol driver on the autodialer port.
- Use the other 490 codes to alter default settings for the autodialer's baud rate, data bits, stop bits, parity, node number, and communications timers as appropriate. If necessary, use the 495 codes to further optimize performance.

### App. 2.1.1 User Codes for Enabling a Protocol on a Port

To enable a protocol on a particular port enter:

**4906 net \* N**

Function: Sets protocol for network.  
Omit \*N to just read the value

Range: See Table below

Default: NONE. All protocols must be explicitly configured by the user.

Response: <net ID> protocol is <current protocol>

N	Protocol	Description	Nets
0	NONE	device disabled	All nets
5	MODBUSM	Modbus Master	Net 1 or Net 2 on VCP card
128	LDL	Local Data Logging May only be used on one device	Net 2 only on VCP Otherwise - Net 4

Protocol Identifiers

If there is any error setting a protocol then the error response is made, and the prior protocol and operations are restored. If the configuration is successful the following things happen:

- All network parameters are set to their default values, and all diagnostics are cleared. These default values depend on the protocol.
- If the new protocol is different than the old, all RCs using that device are completely cleared down. If the old and new protocols are identical, then only the diagnostic information is cleared.
- If the new protocol is Modbus, RC scanning on the net is enabled.



- If the new protocol is LDL then the prior LDL device (if any) is closed and output will resume on the new device with no data loss.
- If the old protocol is LDL and the new one is not, then all unprinted data will be lost.

## **App. 2.2 Local Data Logger Specifics**

The Local Data Logger (LDL) interface (either serial or parallel) may now be turned ON/OFF or reconfigured by the operator. If your LDL printer is interfaced via the Asynchronous Communications option (VCP Card), you may now set serial interface parameters to match the settings of your serial printer. The serial parameters of baud rate, data bits, stop bits and parity may be read and changed by programming codes.

***NOTE: The Local Data Logger now must be turned ON by the operator before any LDL output will be sent to the printer. LDL is set to OFF by factory default.***

### **App. 2.2.1 Determining Your Local Data Logger Method of Interface**

There are two possible ways to interface a printer to the Verbatim for Local Data Logging — parallel or serial. The remainder of this section describes these two methods and the steps necessary to connect and configure LDL.

Parallel interfaced printers are the most common type of printers and are usually the least expensive. Raco Verbatim autodialers always include a parallel interface for Local Data Logging at no extra cost. However, there is one disadvantage of parallel interfaced printers. The parallel interface requires that the cable between the Verbatim and the printer be short — about 15 feet maximum.

Serial interfaced printers can have comparatively long cables — up to several thousand feet if the baud rate is derated with the increase in cable length. The major disadvantage of serial printers is that the serial interface usually increases the cost of the printer.

### ***Is Serial Local Data Logging a Possibility?***

Your Verbatim autodialer may have been configured at the factory with the Verbatim Asynchronous Communications Option. This Verbatim expansion card is sometime also called the Async. Com. Card and is label on the expansion circuit card as VCP.

You may not have specifically requested this option. However, you may have received it as a result of ordering the Modbus PLC interface option. If your Verbatim unit *does* have the Async. Com. Card then it is possible to interface a serial printer for Local Data Logging. That is, if you are using the Async. Com. Card for just one Modbus (PLC) network connection then you may use the remaining network port to interface a serial printer for Local Data Logging.

### ***Required Cables***

Serial printers are interfaced via Raco cable VSER-01 (cable drawing is Owner's Manual Appendix G-2) connected to the modular jack J303 on the VCP card. (Refer to Owner's Manual Appendix F-4)

The parallel interface for Local Data Logging uses Raco cable VPPC-1 (cable drawing is Appendix G-3) connected as per the instructions in section 2.3 of the Verbatim Owner's Manual.

### **App. 2.2.2 Turning ON LDL**

To turn ON the Local Data Logger interface press:

4 9 0 6 Net \* 128 enter

Where Net is:

2 for the Serial Interfaced LDL (Modular Connector J303 on VCP Card)

4 for the Parallel Interfaced LDL (Dual-row Connector on Front Door)

Note: \* is the key labeled 'POINT' on the top portion of the key and '\*' on the lower portion..

### **App 2.3 Setting Serial LDL Parameters**

Note: The following is not applicable to parallel interfaced LDL.

To read the serial communication parameters for serial interfaced LDL press:

4 9 0 0 2 enter

To reset all serial communications parameters for serial LDL to factory defaults press:

4 9 0 0 2 \* enter

To set the baud rate for serial interfaced LDL press:

4 9 0 1 2 \* N enter

Where N, if present, is 50, 75, 110, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 14400, 19200, 28800, or 57600. All other values are ignored.

To set the data bits for serial interfaced LDL press:

4 9 0 2 2 \* N enter

Where N, if present, is 5, 6, 7 or 8. All other values will be ignored.

To set the stop bits for serial interfaced LDL press:

4 9 0 3 2 \* N enter

Where N, if present, is 0 for NO parity, 1 for ODD parity, 2 for EVEN parity, 3 for SPACE parity, or 4 for MARK parity. All other values will be ignored.

### **App 2.4 LDL Notes and Exceptions**

NOTES:

- 1) Factory defaults for serial interfaced LDL are: 9600 baud, 8 data bits, 1 stop bit, NO parity.
- 2) Setting serial communications parameters applies only to printers interfaced via the Asynchronous Communications Option (NET 2). When a Local Data Logger printer is interfaced via the parallel printer interface (NET 4) there are no communications parameters to be set.
- 3) Only one interface method, either serial or parallel, may be used at a time. Turning ON the serial interfaced LDL turns OFF the parallel interfaced LDL and vice versa.

### **App. 3 Programming Code 917 Removed But Features Still Exist**

The combined programming code for *Phone Fault Detection & Automatic Tone/Pulse Selection* has been removed.

#### **App. 3.1 Automatic Tone/Pulse Selection**

Automatic tone/pulse selection can no longer be configured by the operator. However, the Verbatim still performs automatic selection of tone or pulse dialing.

The unit performs automatic tone/pulse selection only after the following events occur:

- 1) power is applied to the unit *and* dialing mode had not been altered from default tone mode.
- 2) the operator performs programming code 9 3 5 9 1 1 to set all programming to factory defaults.
- 3) jumper blocks JB-3 or JB-5 shorted together for hardware reset.

#### **Notes:**

- 1) performing programming codes 9 3 5 9 or 9 3 5 9 1 1 or shorting jumper block JB-3 will erase all programming.
- 2) If the operator has explicitly programmed the dialing mode (using code 901) cycling power or shorting jumper block JB-5 will *not* change the dialing mode programming.

If the Verbatim has automatically selected the dialing mode the resulting setting may be read by using programming code 901. And, as in all versions of Verbatim firmware, the operator may also use code 901 to manually select tone or pulse dialing mode. Refer to the Verbatim Owner's Manual section 3.2

#### **App. 3.2 Phone Fault Detection**

Use programming code 916 to turn ON/OFF Phone Fault Detection. In prior firmware revisions programming code 916 was only used to set the Phone Fault Detection Interval. Now, also use code 916 to turn ON/OFF the Phone Fault Detection feature as follows:

Turn Phone Fault Detection OFF by setting the Phone Fault Detection Interval to a value of 0.  
Turn Phone Fault Detection ON by setting any valid Phone Fault Detection Interval.

To turn OFF Phone Fault Detection press:

9 1 6 0 enter

To turn ON Phone Fault Detection press:

9 1 6 V enter

Where: V a valid Phone Fault Detection interval of 0.1 hours to 24.0 hours.

### **App. 4 Personal Identification Numbers**

The personal identification number (PIN) feature is provided as a way both to limit telephone access to the Verbatim autodialer and to provide an audit trail of acknowledgments. The use of PINs is always optional, and the default configuration omits them. PINs do not alter operations of the programming mode security feature (code 910) in any way.

Each authorized operator is assigned a unique PIN to identify them. This PIN will appear in the printed Local Data Logger reports of telephone sessions and alarm acknowledgments. The remainder of this section describes operations in more detail.

### **App. 4.1 PIN Operations**

A PIN consists of 1-5 digits. It is not possible to use any letters or other symbols. Up to 32 distinct PINs may be configured.

Once any PIN has been configured, thereafter all over-the-phone sessions will require entry of a valid PIN. The session begins with the station ID message followed by a prompt to enter a PIN. The entry is made by pressing the DTMF keys, followed by the double pound-key termination.

This prompt is given a maximum of three times at 10 second intervals. If no valid PIN is entered, the Verbatim says *good-bye* and then hangs up. The calling sequence then proceeds as if the call had not been answered at all.

If a valid PIN is entered, that event is logged and the session continues as standard. Entry of the PIN does not automatically acknowledge anything. Use of the usual DTMF tones is still required. Any acknowledgments during the session will cause that operator's PIN to become associated with the acknowledgment status of the channel. That PIN will then be printed as part of any subsequent LDL status reports. Voice status reports omit this PIN information.

Only the most recent PIN to have acknowledged a channel (either ALARM or RTN) will be logged. Any operator working from the front panel is always given the PIN of 00000. Standard operations may be restored at any time by clearing all PINs (code 48\*).

#### **App. 4.1.1 PIN Local Data Logger Output Examples**

The following text provides a sample of the LDL output when PINs are active. All PIN-specific entries are shown in boldface italics>. The first segment shows a sample alarm session:

```
ALARM MODE 13:39:10 Mon. 8/14/95
Alarm session with phone #1. # is 1. 13:39:16 Mon. 8/14/95
Valid PIN 50000 entered 13:39:39 Mon. 8/14/95
Channel                               Status
-----
    1                                  ALARM
    2                                  ALARM
    3                                  ALARM
Acknowledgment for linked alarms via phone #1 (1) PIN was 50000.
13:39:46 Mon. 8/14/95
HUNG-UP at 13:39:47 Mon. 8/14/95
NORMAL MODE at 13:39:47 Mon. 8/14/95
```

This next segment shows a sample phone-in session. Note that the PIN '00000' indicates operator acknowledgment from the front panel.

```
CALL-IN MODE 13:41:52 Mon. 8/14/95
```

Valid PIN 50000 entered 13:42:02 Mon. 8/14/95

Channel	Status
1	ALARM, Acknowledged by PIN 50000
2	ALARM, Acknowledged by PIN 00000
3	ALARM, Acknowledged by PIN 40032
4	NORMAL

HUNG-UP at 13:42:19 Mon. 8/14/95

#### App. 4.2 Programming Personal Identification Numbers

The following programming codes are provided for configuring and controlling the PIN functionality. For security reasons, all commands in this group are available only from the front panel. If entered over the telephone, the *error, enter program code* response is made.

48 dddd  
 Function Establishes 'dddd' as a valid PIN.  
 'dddd' must consist of 1 to 5 numeric digits.  
 Response *P-I-N is dddd* (success)  
*P-I-N exceeded* (32 PINs already configured, invalid characters, too long, or '00000' is specified.  
 Note The sequence '00000' is reserved to indicate any front panel operator.

48 dddd \*  
 Function Deletes 'dddd' as a valid PIN.  
 Response *P-I-N dddd is cleared* (success)  
*P-I-N error* (failure)  
 Note Any channels currently acknowledged by PIN 'dddd' will thereafter appear acknowledged "by PIN 00000".

48  
 Function Lists all PINs currently configured  
 Response *All P-I-Ns programmed are ...list...* (PINs currently configured)  
*No P-I-N is programmed* (No PINs currently configured)

48 \*  
 Function Erases all PINs currently configured  
 Response *All P-I-Ns programmed are cleared*

Note: This effectively turns off all PIN functionality. No more "acknowledged by PIN ....." messages will be logged.

#### App. 5 Totalizer Alarm Reset Timers Now Affected by Programming Codes 904 and 922

In prior firmware revisions changing the setting of either code 904 (Read/Set Alarm Reset Time) or code 922 (Alarm Reset Timer On/Off) had no effect on the alarm reset timers for totalizer alarm channels. Now,

with Version 2.11, changing the setting of code 904 or 922 will clear the alarm reset timers for totalizer channels in exactly the same manner as for discrete and analog alarm channels.

### **App. 6 Feature Codes 923 and 981 Now Mutually Exclusive**

Programming code 923 is used to program the Verbatim to cease the alarm calling sequence when all inputs have returned-to-normal status. Programming code 981 is used to program the Verbatim to make calls to personnel when the inputs to channels with acknowledged status return-to-normal (no violation). These two features have now been made mutually exclusive. That is, setting one feature ON sets the other OFF. Refer to page K-5 for details on code 923. Refer to section E.1 for details on code 981.



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# 1

## Overview

### 1.1

#### Product Description

The Verbatim™ autodialer functions as a remote alarm monitor, typically monitoring critical facilities which are not staffed 24 hours a day.

The Verbatim autodialer may be factory configured for different input and output configurations. Your Verbatim may have as many as 32 discrete inputs, 16 analog inputs, 8 digital outputs and 96 Remote Channels. The minimum configuration of the Verbatim autodialer monitors 4 internal input channels.

The internal inputs are sometimes called Physical Channels (PCs). PCs monitor user-supplied external sensors such as float switches, limit switches, etc. Sensors connected to discrete inputs are usually dry (non-powered), isolated contacts which close or open to indicate the sensed condition. In most cases, the outputs of logic controllers may be connected directly to Physical Channel inputs without the need for interfacing relays or other signal conditioning.

Remote Channels (RCs) do not directly connect to sensors. RCs monitor PLC I/O and data table locations as defined by the user. RC data is kept current by the Verbatim constantly making queries to PLC data registers over the industrial network connection.

An alarm condition can be indicated by change at a sensor, by new data from a Remote Channel (RC), or by loss of AC power. When an alarm occurs, the Verbatim accesses the standard phone line to which it is connected, dials the appropriate phone numbers and delivers the user's own pre-recorded voice message corresponding to those particular alarm conditions that are currently active.

Dialing continues repeatedly through the entire list of up to 16 programmed phone numbers, until the alarm is acknowledged by touch tone command or by calling the Verbatim autodialer back.

The Verbatim autodialer incorporates many flexible, voice-supported programming and message recording options, to meet a wide range of user requirements. Yet, in most cases, the user may rely on pre-existing default programmed parameters, greatly simplifying programming. Even default voice alarm messages are provided.



**Note:**

All user programming except access code and voice message recording may be entered, reviewed or changed either from the front panel or from a remote telephone at any time. Thus, installation and programming may easily be done by separate personnel at separate times.

Most programming is entered in the form of 3-digit codes as described in this manual. All user programming, including recorded messages, is maintained in permanent non-volatile memory.

The Verbatim autodialer incorporates extremely thorough and effective electrical surge protection and overall rugged construction, to deliver reliable operation under real-world conditions.

**1.2****Manual Description**

This manual guides you through the following procedures:

- Location and mounting
- Initial programming
- Configuring Remote Channels to monitor PLCs
- Voice message recording
- Using Your Verbatim autodialer
- Advanced programming

A glossary explaining the terms used in this manual is included the end of the manual, along with a troubleshooting guide, an index, a return authorization form, and FCC notice to users.

Worksheets are provided to document and clarify your programming and message recording steps.

Please take a moment to read, complete, and mail the warranty registration card at the back of this manual.

**1.2.2****Conventions**

Throughout this manual various icons are used to visually identify information. They are as follows:

- ◆ The solid diamond symbol shows a list of procedures, decisions, or single step tasks.
- The bullet symbol shows a list of items.



The bomb indicates a warning message. The information concerns process that may result in damage to equipment or harm to a person.



The hand indicates a caution message. The information concerns a process that may result in equipment failure.



The pencil indicates general information.



The open diamond pattern indicates one or more exceptions or special considerations for a process.



The phone indicates that you can access the Verbatim autodialer through your phone.



Other icons include button or keys on the Verbatim autodialer front panel.

“items in quotes”

Quotation marks indicate titles of sections and messages.

*italic*

Italic text indicates items for emphasis, message text, and sample text.

ALL CAPITALS

Capital letters reference the names of keys, lights, and LEDs.

Initial Capital Letters

Capitalization of the first letter of a set of words indicates mode and function types.

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# 2

## Installation

This section describes how to install the Verbatim autodialer and how to install a parallel printer to use the Parallel Printer Local Data Logging feature.

### 2.1

## Location and Mounting

Choose a mounting location which is not exposed to condensing humidity or temperatures beyond the limits of 20°-130°F. This location should ideally be within 5 feet of a standard RJ-11 phone jack and a *grounded* 120 VAC power outlet.

1. Mount the Verbatim autodialer on centers of 6" x 11 3/8" using the external mounting ears on the enclosure. #10 or 3/16" bolt sizes are best.
2. Install the NEMA 4X weatherproof outer enclosure, (optional purchase).

This allows the Verbatim autodialer to be mounted outdoors as long as temperature limits are not violated. It is best to provide at least an overhead shelter to minimize direct precipitation and solar heating effects.

3. Install the heater/thermostat for cold or humid environments, (optional purchase).

The 120 VAC heater dissipates 75 watts, providing a temperature rise of approximately 30 degrees, or 60 degrees when enclosed in the optional NEMA 4X enclosure.

### 2.2

## Wiring

Refer to the diagram on page 2-3 for an example of the wiring connections.

1. Inspect and remove any foreign materials which might create short circuits.
2. Connect the red (positive) battery lead to the positive terminal on the gel-cell battery.
3. Plug the power cord into a *grounded* 120 VAC outlet.

Or, remove the power cord from the Verbatim autodialer and install well-grounded 120 VAC power to terminal strip TS3, located on the lower right of the main circuit board.

If there are any green grounding wires in place on TS3 originating from plug-in expansion cards, leave those green grounding wires in place on the terminal marked GRN (Green). If the Verbatim autodialer turns on when power is applied, turn it off with the red POWER ON/OFF key.

4. Connect dry (unpowered) contacts to the terminal strip connection points. The connection point for basic four-channel units is terminal strip TS1, located on the lower left of the main circuit board. Note that there are four common return terminals marked "C"; any combination of these internally grounded terminals may be used. Terminal strip TS1 may be unplugged for convenience. All terminal points are screw clamp type, eliminating the need for wire termination lugs.

The contact input wires should ideally be light (18 to 24 gauge) signal wire rather than heavy power wire. This reduces problems of bulk and stiffness.

5. If your unit has 8 or more inputs, the VX32 Channel Expansion Card should be plugged into connector J4.

If your unit has this card installed, then use TS1 for common return connections only, and connect one side of each contact to the appropriately marked channel input number on the VX32 card. Leave TS1 terminals 1,2,3 and 4 disconnected.



### Notes:

- ◆ The common *return* side of the contacts will need to be consolidated into not more than four wires coming into the TS1 terminals marked "C".
- ◆ Route the wires to the VX32 card so that they do not protrude above the top of the card, other wise they will interfere with the front panel board when the door is closed.
- ◆ Terminal strip TS1, and the terminal strips on the VX32 card if any, are not removable terminal blocks. Be sure that the terminal strips do not become unplugged due to wires being stressed when the door is closed.



### Caution:

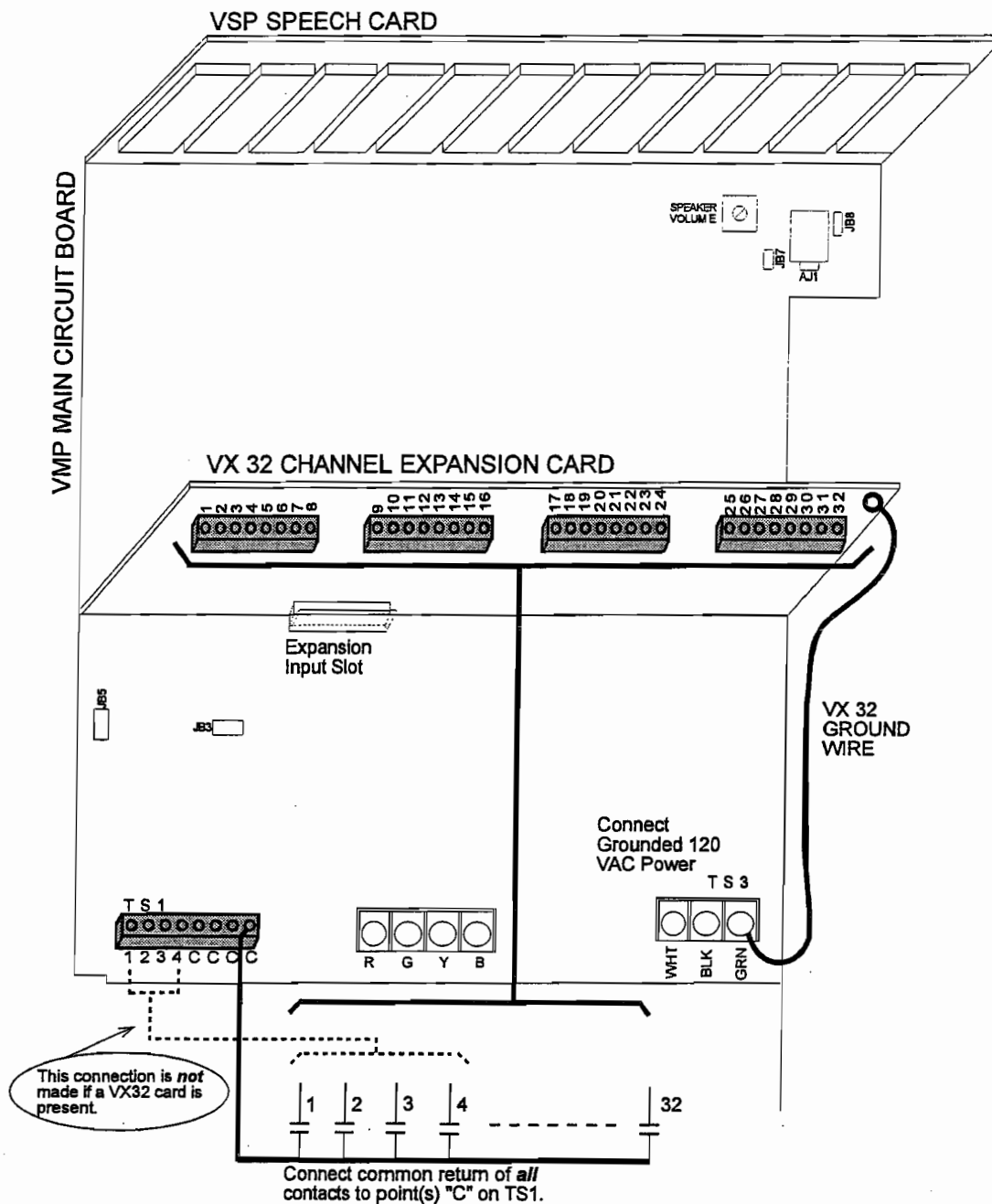
**NO 120 VAC INPUT CIRCUITS!** Please verify that the circuits you connect to these inputs are "dry" (unpowered) and are *not* directly connected to 120 VAC power. Connecting such circuits will damage the unit.



### Exception:

If your inputs are coming from a logic controller with TTL, CMOS or 5-volt DC logic outputs, direct connection may be made as long as the controller has the same electrical ground as the Verbatim autodialer.

*Electrical Connection Diagram For Dry Contact Inputs*



The common returns for all inputs are connected to TS1 terminals marked "C". These four "C" terminals are connected together and to electrical ground.

**4 Channel Verbatim:** Connect one side of each contact to the corresponding numbered terminals on TS1. The other side of each contact connects to the common return (the "C" terminals on TS1).

**8 Or More Channel Verbatim:** Connect one side of each contact to the corresponding numbered terminals on the VX32 expansion card. Connect the other side of each contact to the common return (the "C" terminals on TS1 of the main board). Note that TS1 terminals 1 through 4 are not used in this case.

## 2.3

### Installing the Parallel Printer

The Verbatim Parallel Printer Local Data Logger feature will print reports on a local printer which is connected via a standard parallel interface. The local printer will automatically print out each action that occurs; e.g., alarms, acknowledgments, programming entries, inquiry calls, etc. You can cause a printout, upon command, at any time. Also, you may program the Verbatim for automatic printout of all input conditions at regular intervals. A time/date stamp will be included with each printed item.

You will need to:

- ◆ Connect the parallel printer to the Verbatim front panel using the RACO PPC-1 cable (or equivalent).
- ◆ Set the time and date so that each printout will be accompanied by the proper time and date stamp.

#### 2.3.1



### Installing the Printer Cable

#### *Note:*

If you ordered the Verbatim Parallel Printer Port Adapter Cable from RACO at the time you ordered your Verbatim autodialer it should already be properly installed. (The cable may be ordered from RACO using the part # VPPC-1.) You may also use an identically wired cable from a separate source. If you wish to acquire or fabricate the cable yourself, please refer to the, "*VPPC-1 Serial Cable Connection Diagram*," in Appendix G.

The front panel circuit board must show a designation of VFP4 or higher. Also, the firmware version for the program chips U3 and U4 (on the main circuit board) must be V2.01 or higher. If your hardware does not conform to these revision levels contact your RACO Sales Representative about getting the proper upgrade modules.

The VPPC-1 cable attaches to the front panel circuit board where the mating pins protrude, just inside the front door of the Verbatim. Orient the connector so the cable's Pin 1 index (a red stripe on the cable or an arrow on the connector) is near the corner of the front panel board. The cable extends out of the Verbatim chassis and overlaps the lower chassis wall at the bottom of the chassis. When the front door of the Verbatim is closed the flat ribbon cable will be safely folded around the lower wall of the Verbatim chassis.

At the other end of the VPPC-1 cable is a standard "Centronics" style 36 pin connector. This 36 pin connector is the proper gender to mate with the data connector on the back of your parallel printer. However, if the printer cannot be located within the three-foot length of the VPPC-1 cable, install a standard

“Centronics” parallel printer extension cable (male on one end, female on the other). The extension cable extends from the end of the VPPC-1 cable to the printer.



**Note:**

The maximum length of the printer extension cable should be no greater than 10 feet. If you need to extend the printer greater than 10 feet from the Verbatim please consider ordering the RACO Serial Local Data Logger Option. Serial interfaces may be extended to a few hundred feet if necessary. Furthermore, if a serial interface is used together with special “line driver” devices, the printer cable may be extended for thousands of feet.

### 2.3.2

#### **Load Paper and Place Printer On line**

The printer must be properly loaded with paper and be on line in order for the Verbatim to print reports. (Some printers have a button labeled “select” rather than “on line.”) If the printer runs out of paper or is taken off line, printing will cease immediately. A limited amount of printout data can be saved in the Verbatim internal print buffer while the printer is off line or out of paper. The size of the Verbatim printer buffer depends on several factors such as which Verbatim options are configured (i.e., analog, RSC, PLC interface, etc.). If the printer is off line or out of paper, printout data is sent to the Verbatim buffer each time it would otherwise be printed on the printer. Once the amount of data sent to the buffer exceeds the size of the buffer, printout items will continue to be copied to the buffer but will begin to overwrite buffered data. The printer buffer “wraps” around and new printout data is copied over the oldest printout data.

It is possible that no data will be lost while your printer is out of paper or off-line if you manage to restore the printer to operation before the Verbatim buffer “wraps.” Then as soon as the printer is restored to operation, the Verbatim sends the buffered reports to the printer. (Note that the date/time stamp eventually printed will show the time and date of the event; not the time and date of the printing activity.)

### 2.3.3

#### **Programming Time and Date**

Time and date may be entered or changed with the following programming code entries:

- ◆ To check the date:

9 4 1 ENTER



- ◆ To set the date:

9 4 1 MM DD YY DW ENTER

MM is the month (01 for January, etc.), DD is the day of the month (07 for the 7th day of the month, YY is year (93 for 1993) and DW is the day of the week (1 for Sunday, 2 for Monday, etc.) Entry of the DW is optional.

- ◆ To check the time:

9 4 2 ENTER

- ◆ To set the time:

9 4 2 HH MM SS ENTER

HH are the hours in 24 hour format (13 for 1 PM), MM for minutes (don't forget the leading zeros) and SS is the seconds. Entry of SS is optional.

- ◆ To clear the time and date back to a default time and re-initializes the real-time clock chip:

935 7 ENTER



**Note:**

The preceding operation should only be necessary if the real-time clock chip has been added or replaced in the field.

## 2.3.4

### Printout at Regular Intervals

The Verbatim autodialer may be programmed to automatically log (print on the printer) all input conditions at regular intervals, by entering the following code:

943 XXX.X ENTER

where XXX.X is the desired printing interval in hours, from 0.1 to 999.9 The first such printout will occur when the period elapses, rather than immediately upon programming.

- ◆ To check the presently programmed printing interval enter the following code:

943 ENTER

- ◆ To turn off the regular interval printing function enter the following code:

943 0 ENTER

- ◆ To immediately print a record of all current user programming enter the following code:

944 ENTER

### 2.3.5

#### Turning Off the System With a Printer

Some parallel printers tend to “leak” electrical current through the parallel interface into the Verbatim when it is powered off, resulting in the Verbatim not remaining turned off. It is possible that a few seconds after powering off the Verbatim it will turn itself back on again. To remedy this condition simply turn off the printer whenever turning off the Verbatim .

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# 3

## Programming and Testing

### 3.1

### Starting Up and Clearing the Unit

Basic set-up and testing of the Verbatim involves:

- ◆ Program at least one phone number.
- ◆ Program the input channels to reflect alarm conditions.
- ◆ Test the alarm conditions to be sure wiring and programming are correct.
- ◆ Record voice messages, trip delays and other programming as desired.



All programming operations must be done with the unit in the Program mode.

1. To put the Verbatim autodialer in the Program mode, press PROGRAM.  
Program mode is indicated by the lighted PROGRAM LED.



#### **Note:**

Before you begin programming the Verbatim for your monitoring application it is best to first clear the unit's memory of any old programming. This step also ensures that memory corruption, which might have occurred during shipment or due to anomalous power disturbances, will be wiped away. See Step 2 below.



#### **Caution:**

The following step erases all user programming including recorded messages so normally it is done only at initial start-up.

2. To clear the system memory, press:

9 35 9 ENTER

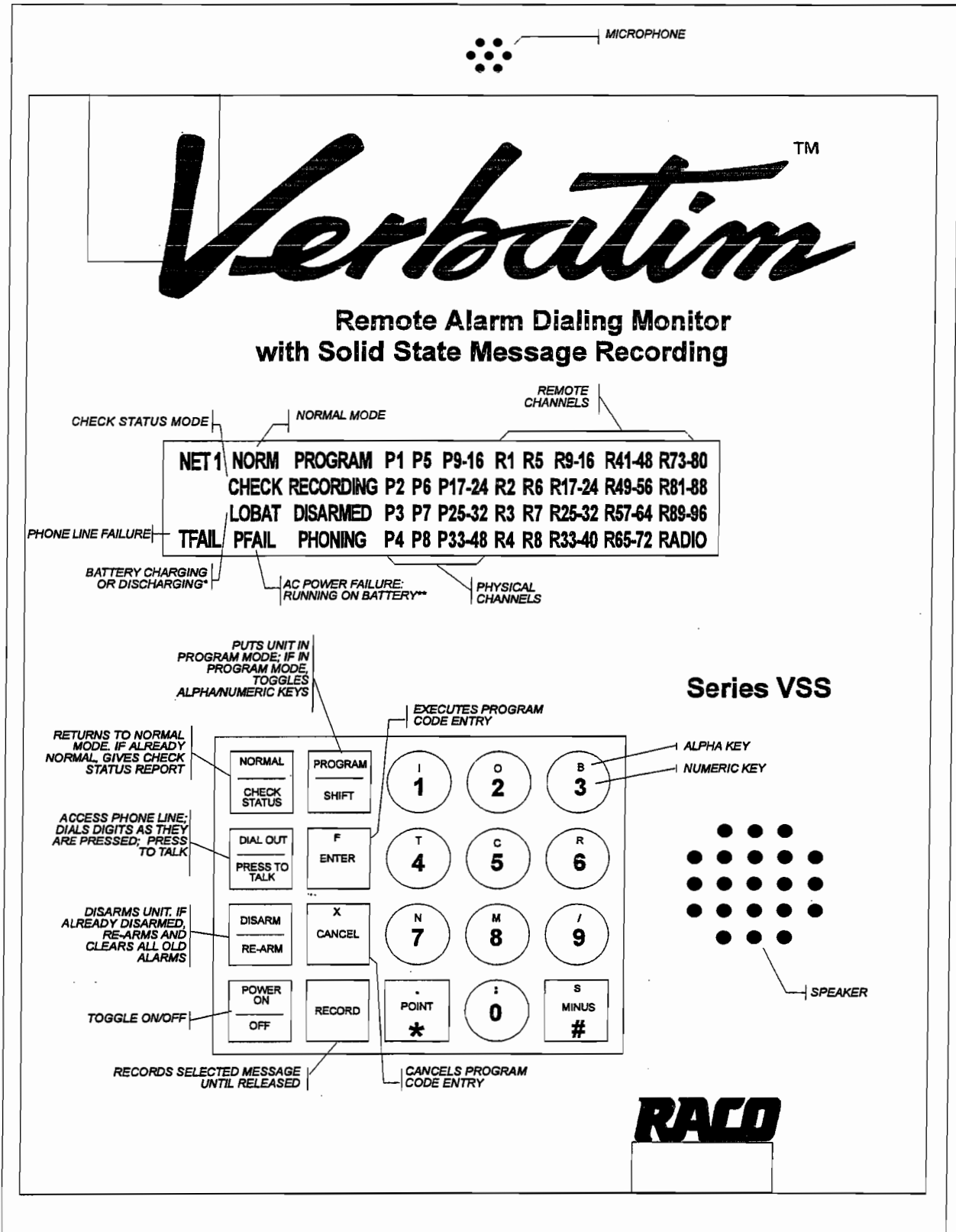
If you make an error in code entry, press CANCEL and start again.



#### **Exceptions:**

If you have powered up your Verbatim without connecting a live telephone line to the unit you may observe that the TFAIL indicator is on. This indicates that the unit is checking for the presence of a telephone connection and attempting to determine the line configuration. If you are planning to program your unit without a live telephone connection you may wish to disable the Telephone Line Fault Detection (Phone Fault) feature by pressing 9 17 0 ENTER. See Section 6.2.6 for information on temporarily disabling this feature.

Front Panel Keys and Indicators Diagram



\* A discharged battery may take up to a day to fully charge. \*\* During AC power failure, all illuminated LED's will flash to conserve battery power.

## 3.2

### Programming Phone Numbers

Refer to Programming Worksheet A (See Appendix J). You are encouraged to write down the phone numbers you want to program, along with a person's name for each phone number.

- ◆ To program the first dial-out phone number, press:

7 01 (then the complete phone number) ENTER

For example, to program 1 (510) 658-6713 as the first phone number, press:

7 01 1 5 1 0 6 5 8 6 7 1 3 ENTER

- ◆ To program a second phone number:

Use code 7 02 instead of 7 01, progressing to a maximum of code 7 16 for the 16th phone number.

Each number may be up to 60 digits in length. Be sure to include any necessary area codes or "1" prefixes.



#### *Exceptions:*

- ◆ To use touch tone dialing, press:

9 01 1 ENTER

- ◆ To go back to standard pulse dialing, press:

9 01 0 ENTER

- ◆ To insert delays between dialed digits.

Press the MINUS key once for each additional delay desired in the phone number programming process. Default delay is one second.

- ◆ Refer to Section 6. "Advanced Programming," for specialized programming such as *grouping* phone numbers with input channels, *Call Progress Monitoring* phone fault detection, etc., or to establish and use a *call forward* phone number, etc.

## 3.3

### Programming Input Channels

Your Verbatim autodialer needs to know whether its input channels are to be *normally closed* (alarm on Open Circuit), or *normally open* (alarm on Closed Circuit).

All contact inputs are initially set normally closed (i.e. they will alarm on Open Circuit). This is the default setting and, therefore, any open circuits, including any inputs left disconnected during installation, will appear as alarms until the inputs are programmed.

- ◆ To automatically program the inputs:

Make sure all inputs are in their normal (non-alarm) state. Then press:

5 0 0 ENTER

The Verbatim autodialer automatically examines all inputs and programs them to alarm on the opposite input state from their present status. This code 500 does not affect any channels that have been programmed for Disabled Channels, Status Only, Run Time Meter, or Pulse Totalizer function.



### *Exceptions*

In most cases, no further programming of contact inputs is necessary. However, the following configuration options are available:

- ◆ To set any input to be disabled and never be annunciated, press:

5 ZZ 0 ENTER

where ZZ is the 2 digit channel number you are programming. Be sure to always use a leading 0 for channels 1 through 9 to keep the channel number a two-digit entry.

- ◆ To set an individual contact input for normally closed operation (i.e. to alarm on Open Circuit), press:

5 ZZ 1 ENTER

- ◆ To set an individual contact input channel for normally open operation (i.e. to alarm on Closed Circuit), press:

5 ZZ 2 ENTER

- ◆ To set inputs to report status only, program each individual channel as follows:

5 ZZ 3 ENTER

This setup never causes an alarm to dial out.

- ◆ To set contact inputs for the run-time meter function, program each channel as follows:

5 ZZ 4 ENTER

See Section 6.2.3, "Channel Programming (Configuring)." This setup never causes an alarm to dial out but reports the total accumulated hours that the input contact is closed.

- ◆ To set any of your contact inputs for the Pulse Totalizer function, see Section 6.2.3, "Channel Programming (Configuring)."

## 3.4

### Initial Testing

Perform the following steps to ensure that your Verbatim autodialer is properly installed.



1. First, temporarily disarm the unit by pressing:

DISARM/RE-ARM until the DISARM LED is flashing. This prevents the unit from dialing out.

2. Next, physically trip each sensing device in turn (manipulate float switches, relays, etc.).

Verify that the corresponding input channel LED lights at the front panel, and then restore all sensors to their normal state.



3. Now press DISARM/RE-ARM. This will clear out the channel input LEDs and restore the unit to a ready condition.

4. To test the phone line connection, with the unit's phone cord plugged into its phone jack, temporarily remove the AC power cord to the unit.

The PFAIL LED will illuminate. At this point all illuminated LEDs will flash on and off in order to conserve battery power. Since the unit is not disarmed this time, after a 0.1 minute Alarm Trip Delay the PHONING light will illuminate and the unit will access the phone line and will begin dialing the first phone number.



The unit will recite its station ID and power failure messages. You may converse with the person answering by pressing and releasing DIALOUT/PRESS TO TALK. Press this key again when you wish to speak, and release this key to listen. This action will suspend message recital. In this case, when the conversation is done, you should end the call by pressing NORMAL. Ordinarily the alarm call would end automatically.



5. Now press DISARM/RE-ARM twice.

This step disarms and then rearms the unit clearing all acknowledged alarms. This clearing also occurs automatically after the Alarm Reset Time has elapsed (default value 1 hour). See Section 5.6, "Alarm Reset Time-out After Acknowledgment."



6. Your Verbatim autodialer is now able to operate, having at least one dialout phone number programmed and having its input channels configured.

However, you may wish to record your own voice messages (see the next section) or perform special advanced programming items (see Section 6, "Advanced Programming") before referring to Section 5, "Using Your Verbatim autodialer."

# 4

## Recording Voice Messages

This chapter describes how to record your own voice messages. Messages may be recorded for the Station ID and for the Alarm and Normal condition for every channel in your Verbatim autodialer.



### **Note:**

Be sure to complete the programming of the input channels as described in the previous chapter before recording any messages.

### **Using Default Messages Instead of Recording Your Own.**

Recording messages is an optional step. Your Verbatim autodialer comes with built-in default normal and alarm messages for all channels. Recording voice messages can be postponed until you have become more familiar with your unit. You may even choose to record or re-record your own messages from a remote telephone at any time.

Using default messages for selected channels or for the Normal condition of channels is an excellent way to conserve speech memory for certain important and lengthy alarm messages.

### **Types of Default Messages**

- Discrete (i.e. digital, contact) physical channel inputs:  
“Channel N Normal” and “Channel N Alarm.”
- Discrete remote channel inputs:  
“Remote Channel N Normal” and “Remote Channel N Alarm.”
- Discrete Status-only or Run-time meter physical channel inputs:  
“Channel N is ON” when input circuit is closed, and “Channel N is OFF” when input circuit is open.
- Discrete Status-only remote channel inputs:  
“Remote Channel N is ONE” or “Remote Channel N is ZERO.”
- Analog (integer) physical or remote channel inputs:  
[“Channel N, present reading is ...”] followed by the recited analog value.
- Station ID message:  
“ID Number N.”

There is also a default Network ID message. See Appendix F for details.

## 4.1

### Planning Messages

Worksheet C in Appendix J is provided to assist you with this. Please use the Worksheet! Not only will you then have a written record of your messages for future reference, you will also then be prepared to record your messages with the greatest ease and efficiency.

In general, two different messages are used for each input channel: One message for the Normal Condition, and another for the Alarm (fault) Condition.

When you have written down the messages that you want to record, you are ready to verify/extend your recording time.



#### *Exceptions:*

- ◆ Status-only or Run-time Metering Channels. See Section 6.2.3, "Channel Programming (Configuring)."

To record your own messages for these specially configured channels rather than relying on the default "Channel N is ON" or "Channel N is OFF" messages:

- Plan a message for the Closed Circuit condition and another message for the Open Circuit condition for each channel.

For Run-time channels, the unit will add a report of the run-time in hours, using built-in speech, after the Closed or Open Circuit message.

- ◆ Pulse Totalizer Channels

See Section 6.2.3, "Channel Programming (Configuring)," for special guidance in planning Pulse Totalizer messages.

## 4.2

### Managing Available Speech Memory

The table below shows the total available message recording time for units with differing total number of channels. The available message recording time may be extended in two ways. First, you may explicitly change the recording rate from the default Rate 1 to Rates 2, 3, or 4 (See Section 6). Secondly, you may automatically extend the message recording time by using the Autoextend™ feature described in this section.

Unit type	Initial recording time (at Rate 1):	Extendable to: (Rate 2, 3 or 4)
4-8	26 sec	40, 54 or 79 sec
16-32	104 sec	160, 216 or 318 sec
33-40 chan. unit	130 sec	200, 270 or 399 sec
41-48 chan. unit	156 sec	240, 324 or 476 sec
49-56 chan. unit	182 sec	280, 378 or 555 sec
57 or more	208 sec	320, 432 or 624 sec

## 4.2.1

**Verifying/Extending Recording Time**

Initially, the unit is set for the fastest memory use rate ("Rate 1"), giving the highest fidelity sound recording. If you are sure that your messages take less than the "initial" time shown above for your unit (14 seconds total for a 4-channel unit), go to Section 4.3, "Record Your Messages." You may also verify your unit's current rate setting and corresponding total message recording time by pressing:

9 1 1 ENTER.

If, after performing this step, you think you may need more recording time perform the Autoextend™ step described next. The Autoextend™ feature will automatically extend the available recording time, selecting the optimum recording rate (speech memory rate) to give you the highest possible recording sound quality for your length of recording.

**Warning:**

The following step will erase any existing recorded messages.

To use the Autoextend™ feature to extend recording time, have your message Worksheet handy as you press:

9 1 2 ENTER

The Verbatim autodialer will prompt you to immediately begin reciting your entire list of messages at the sound of the beep, one after another, at the same speed that you will want to later record them.

During this time, the Verbatim autodialer will *not* be recording your spoken messages. Instead, it will be timing you.

When you have finished reciting (not recording) the last message, immediately press ENTER.



Over the phone, press ZERO to start the timing, and ZERO again to end the timing. See Section 5.7, "Programming by Phone."

Based on how long your message recital took, the Autoextend feature will automatically calculate which recording rate is optimum for your length of recording time, and will then automatically select that rate. It will tell you how many seconds your message took, and how much total recording time it has now given you.

## 4.3

**Record Your Messages**

First, minimize any background sounds. Then proceed as follows:

- ◆ Have your message Worksheet in front of you and be prepared to recite the first Alarm (fault) Condition message in a loud clear voice within about 6 to 12 inches of the microphone located at the top of the front panel. Press:

1 ZZ ENTER

where ZZ is the appropriate 2-digit channel number, such as 01 for channel 1. Be sure to use leading zeroes, in order to keep ZZ a 2-digit entry. Use 00 for the Station ID message.



The voice specifically identifies the message you are about to record, and then prompts you to press the RECORD key and hold it just for the duration of your spoken message. Note that the RECORDING light comes on during recording.

Over the phone, since there is no RECORD key, the voice will prompt you to press ZERO to begin recording, and press ZERO again to stop recording. See Section 5.7, "Programming by Phone."

The Verbatim autodialer will immediately play back the message you have just recorded, allowing you to determine if you need to re-record it louder, softer or more clearly, etc.

Experiment with different volume levels to get the best message clarity. If there is too much background noise at the Verbatim autodialer site, record your messages over the phone.

Always stop the recording promptly to avoid wasting recording time.

- ◆ To record an alternate "Normal Condition" message for channel ZZ, press:

2 ZZ ENTER

and follow the same procedure as above.

- ◆ To review both existing messages for channel ZZ, press:

3 ZZ ENTER

The Verbatim autodialer will replay both existing messages for channel ZZ. This will include any default messages remaining in use.



### *Exceptions:*

- ◆ For any channels programmed for “Status Only” or for Run Time Meter function, use code 1 ZZ for the Open Circuit message, and 2 ZZ for the Closed Circuit message.
- ◆ If you run out of recording time, you will hear the message “No more message time.” See Section 4.2 above to re-establish total available recording time. You may elect to shorten some messages, or rely more on selected default messages, or you may Autoextend the available recording time. Then, re-record all messages.
- ◆ If you wish to extend the available time for a specific message while leaving the other messages unaffected, enter the code for recording that message, but add an extra digit 1 through 4, before pressing ENTER. The digit 1 (Rate 1) gives the shortest time and the best sound quality, while 4 (Rate 4) gives the longest time with poorest sound quality.
- ◆ If you wish to reinstate a default message, enter the code for recording that message, and an extra POINT before pressing ENTER. For example:

1 ZZ POINT ENTER

- ◆ If you wish to use the default Station ID message but with a different ID number in place of the “one”, press:

9 1 4 N ENTER

where N is the desired ID number which may be up to 16 digits long. Some users program the Verbatim autodialer’s own phone number as its ID number.

- ◆ If you want to set a specific recording rate rather than letting Autoextend do it, press:

9 1 3 N ENTER

where N is the desired recording rate 1, 2, 3 or 4.

- ◆ You will then need to re-record any messages that were previously recorded at a different rate.



# 5

## Using Your Verbatim Autodialer

### 5.1

### Placing Inquiry Calls to the Verbatim Autodialer



You may call the Verbatim autodialer at any time from any phone. The unit will wait the programmed number of rings before answering and then will begin a full status report. The status report starts with the Station ID Message, followed by any special warning messages (e.g.: no phone numbers programmed, or the unit is disarmed, etc.), and concludes with the listing of the status of each channel input.

If there are no alarm conditions on any channel, then the Verbatim autodialer will say "All channels normal" just prior to beginning the complete channel status report.

If there are channels with unacknowledged alarms conditions prior to the call, placing a call to the unit will result in the acknowledgement of these alarms. The Verbatim autodialer will say "Alarm is acknowledged" immediately after reciting the Station ID message.



#### *Exception:*

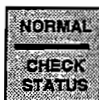
The Call in Acknowledge Mode command (Code 925) may be used to set the Verbatim so that calls to the unit will not automatically acknowledge alarms.

The channel status report will be recited the programmed number of message repeats (default is 3 times). Between each recital the Verbatim autodialer will issue a prompting beep and then wait a few seconds for you to optionally enter a special Command Tone. See Section 5.7, "Programming by Phone." After all message repeats, if you have not entered a tone, the unit will say "Goodbye" and terminate the call.

See Section 6.2, "Programming Operations."

### 5.2

### CHECK STATUS Inquiry at Panel



When the NORM LED is lit, you may hear a report of current conditions by pressing the NORMAL/CHECK STATUS key. You may cut this report short by again pressing the NORMAL/CHECK STATUS key.



## 5.3

### Receiving Alarm Calls

When any input condition violates the programmed alarm criteria for an interval longer than the Alarm Trip Delay for that input (See Section 6.2.6), the unit goes into an Unacknowledged Alarm state. The unit begins dialing the first of up to 16 programmed phone numbers. See Section 6.1, "Program Codes," about optional Alarm Call Grouping if you want the numbers dialed to depend on which channel is in alarm. Whenever there is an Unacknowledged Alarm the corresponding channel alarm LED begins flashing.

The voice messages follow the same format as an inquiry call, including the prompting beep, except the channels having no alarm activity are not included in the alarm report. If there is no acknowledgment, the Verbatim autodialer will replay the message for the programmed number of repeats (default is 3) and then will say, "Goodbye," before terminating the call.

See Appendix I for information on alternate annunciator state models. Annunciator state models support various Return To Normal (RTN) calling sequences.

#### **Phrases Appended to Alarm Messages**

(user recorded or default)

*These appending phrases will continue to be included in any status reports until the Alarm Reset time expires for that channel.*

#### **ALERT**

Any channel with an input violation which has not been present longer than the Alarm Trip Delay for that channel will have its status message appended with the word "Alert."

#### **NOW NORMAL**

If the violation which originally caused the alarm has gone away the phrase "Now Normal" will be appended to the alarm status message.

#### **ACKNOWLEDGED**

Any channel which was in an unacknowledged alarm state but became acknowledged will have its status message appended with the word "Acknowledged."

#### **NOW NORMAL, ACKNOWLEDGED**

Any channel which is both acknowledged and whose input violation has gone away will have its status messages appended with the phrase "Now Normal, Acknowledged."

**Note:**

When the autodialer goes into alarm, it dials each phone number in sequence until it receives an acknowledgement. The alarm may be acknowledged after the warble tone by pressing a touch tone "9"; by calling the unit back after it says, "goodbye," or by pressing NORMAL on the front panel. After acknowledgement, the dialer will not call out again on that channel until it is reset. This is usually done automatically after a set period of time called the *Alarm Reset Time*, which allows the person who acknowledged the alarm time to go fix the source of the problem without further callouts from the dialer. After the reset time, the unit is automatically reset, and any alarms present at that time will cause a dial out.

**Exception:**

Power Failure alarms only cause two spoken messages: 1) When power has been off for longer than the Power Failure Trip Delay, "Power is Off" is reported. 2) When power has been off and is later restored the message "Power is On" is reported.

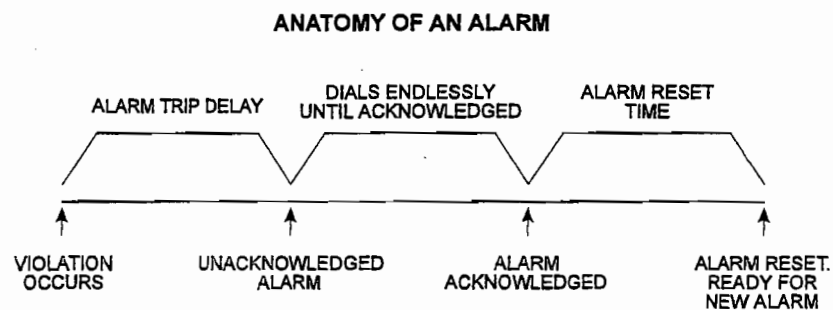
## 5.4

## Continued Dialing in the Absence of Acknowledgment

The Verbatim autodialer will then wait for the programmed Time Between Alarm Calls (default 2 minutes; See Section 6.2.12, "Miscellaneous Programming Tips," to change default time), during which you may call the Verbatim autodialer back to acknowledge the alarm. If no acknowledgment is received at the end of this period, the next phone number will be dialed. The process will be repeated indefinitely, repeatedly going through all the designated phone numbers, until acknowledgment is received.

**Exception:**

If you want further calling terminated when channels return to normal you may so program the unit by using the "Set Return to Normal" command (Code 923). See Appendix K.



## 5.5

### Acknowledging the Alarm Call

To acknowledge the alarm during the alarm call wait to hear the prompting "warble" tone then enter a touch tone '9' (Also 1, 2, 4, or 0 will acknowledge in this situation). The Verbatim autodialer will say "Alarm is acknowledged, Goodbye" and terminate the call. See Section 5.7, "Programming by Phone," for additional ways of acknowledging an alarm without ending the call.

Alternative methods of Acknowledging:

Wait for the alarm call to end then place a call to unit.

At the front panel press NORMAL, PROGRAM, DISARM, or DIALOUT .

Upon acknowledgment, the channel LED changes from flashing to steady illumination.

At the end of the Alarm Reset period the channel alarm LED turns off, the Acknowledged Alarm status is cleared for that particular channel input, and it is again ready to go into Unacknowledged Alarm whenever a violation occurs at that input. In particular, if a violation has not been removed (prior to timeout), dialing begins immediately upon the Alarm Reset period timeout. To reactivate the alarm before the alarm reset timeout period is over, re-arm the alarm.

## 5.6

### Alarm Reset Timeout After Acknowledgment

As shown in the figure, "Anatomy of an Alarm," p. 5-3, when an acknowledgment is received, the Verbatim autodialer begins timing out the Alarm Reset Time, (default 1 hour).

Further calling on behalf of that channel is suspended, regardless of further activity at that particular input during this period. If new alarms occur on other channels during this period, the unit will go back into the Unacknowledged Alarm state and dial the first appropriate phone number, with dialing continuing until a new acknowledgment is received.

## 5.7



### Programming by Phone

During any phone call (inquiry call or alarm call), at the end of each round of messages, the prompting warble tone is issued. If you press a Command Tone "1" at the sound of the warble tone, the Verbatim autodialer will prompt you to enter a program code. (Or, if you have established a Security Access Code, you will first be prompted for this code).

To enter programming codes over the phone:

- Enter a touch tone "1" after the warble tone.
- Enter the program code followed by # #.
- Enter an additional # # when you are ready to hang up.

You may enter codes for most of the programming operations described in this manual except reading or changing the optional security access code. See Section 6 for more information about the 910 Security Access feature.

Since some of the front panel keys are not found on a touch tone keypad, some special conventions apply for over-the-phone programming:

In Place Of:	Enter:
CANCEL	* *
ENTER	# #
POINT	*
MINUS	#

- ◆ To enter the Program Mode press "1" after the warble tone.
- ◆ To end a phone call after programming:

Press # # without a prior digit entry.

The Verbatim autodialer will then issue a prompting beep which is another opportunity to enter a "1" if you didn't want to end the call. It will then say "Goodbye" and end the call.



### ***Exception:***

Over the phone, you may not program more than one consecutive dialing delay, because # # (two in a row) is interpreted as ENTER when programming. However, you may extend this delay using code 928. See *Program Code Table* p. 6-9.

- ◆ If you initially enter a Command Tone "2" in place of the "1", you will be in a special Program Review Mode, which allows you the safety of checking any of the programming items or messages, without the possibility of altering any of them.
- ◆ If you initially enter a Command Tone "3" in place of the "1", you will hear a report of each channel that has any acknowledged or unacknowledged alarm condition.
- ◆ If you initially enter a Command Tone "4" in place of the "1", you will hear a listing of all programmed phone numbers, plus any other basic programming items that you have altered from their default values. This is particularly useful in diagnosing operating problems.

- ◆ If you initially enter a Command Tone "8" in place of the "1", the unit will not be acknowledged and will immediately say "goodbye" and end the phone call.
- ◆ If you initially enter a Command Tone of "0, 5, 6, 7, or 9," in place of the "1", the alarms will acknowledge an alarm and the unit will immediately say "goodbye" and end the phone call.



**Note:**

Command tones "1, 2, 3, and 4" will acknowledge all alarms, even those not in their Alarm Call Group (ACG). See Section 6.2.13. Command tones "0, 5, 6, 7, and 9" will acknowledge only alarms in their ACG. Command tone "8" will not acknowledge any alarms, but will give the status of all alarms.

## 5.8

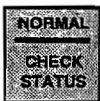
### Dialing Out and Conversing Through the Verbatim Autodialer



At the panel, starting in the Normal Mode, press the DIALOUT/PRESS TO TALK key. Next press the digits of the phone number you want to dial. Each digit you press will be dialed as you press it. You will then hear the sound of the ringing.

When you hear the phone answered, press and hold the same DIALOUT/PRESS TO TALK key as you speak to the person on the line, and release the key to listen. Continue the conversation in this manner.

- ◆ To end the call press NORMAL. If the DIALOUT/PRESS TO TALK key is not pressed for more than 2 minutes (or as previously set), the Verbatim autodialer will automatically end the call.
- ◆ To automatically re-dial a number that was previously manually entered by this method, press DIALOUT/PRESS TO TALK as before, then press ENTER rather than entering digits manually.



If you are at the panel when a phone call is in progress, you may suspend the message report and converse with the person on the other end by pressing the DIALOUT/PRESS TO TALK key as described above. There will be no additional dialing, since connection has already been established. To end the call, press NORMAL.

# 6

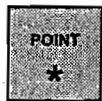
## Advanced Programming

### 6.1

### Program Codes

This chapter provides the Program Codes table which summarizes the wide variety of available programming operations, along with a description and comments. Additional information may be found in referenced notes below as well as in the referenced sections elsewhere in the manual.

When the overall programming is cleared out at initial start-up, all programming is automatically set to factory default values as shown in the table. Most of these default values are quite suitable for most users and only selected items may need to be programmed to different values.



- ◆ To read the existing programmed settings:

*Enter a code* and then ENTER without any intervening value. This reads the existing programmed setting without changing it.

- ◆ To clear a program:

Enter POINT *after the code* and before ENTER. This clears the program item, or returns it to its default value.

In the Program Codes table, several forms of numeric value entries are shown:

#### Value Definition

<b>V</b>	A value of one or more digits which may include a decimal point or minus. Examples: .5, 2.8, 300.6, 60.
<b>N</b>	One or more digits giving a whole number; no decimal points allowed. Examples: 1, 5, 20.
<b>DN</b>	A two-digit Designation Number for phone numbers (01 for first number, 02 for second, etc.).
<b>1/0</b>	Used to turn a function ON (1) or OFF (0).
<b>ZZ</b>	2-digit channel number (use ZZ=00 for ID message).

## 6.1.1

**Notes for Programming Code Table:**

Refer to these numbered items under the "Notes" column in the following *Programming Code Table*.

1. ZZ = 2 digit channel number. Use ZZ=00 for Station ID message.
2. For any channels you have programmed as "Status Only" or "Run Time Meter", use code 1 ZZ for the Open Circuit message, use code 2 ZZ for the Closed Circuit Message. See Section 6.2, "Programming Operations," for message information for any Pulse Totalizer channels.
3. DN (Designation Number) is 01 for first dialout phone number, 02 for second number, etc. DN = 00 for special "callback" phone number. Use MINUS to insert any needed delays between digits. Each such delay is 1 second unless extended using code 928.
4. Actual power failure trip delay may be a fraction of a second longer than programmed value, due to power supply discharge time which varies with the number of option boards.

**Caution:**

5. If Alarm Reset Function is turned OFF, acknowledged alarms will NEVER RE-ARM, preventing further alarm calls after acknowledgment for each channel.
6. Speaker always operates during front panel programming, even if programmed to be off.
7. Cannot be read or changed over the phone.
8. Does not change channels that have been configured for "Status Only," "Run Time Meter," or "Pulse Totalizer."

**Caution:**

9. High Speed Dialing setting may not work reliably with some telephone company exchanges.
10. Add POINT to restore default message.
11. To pre-set a Run Time value, include the value before ENTER.
12. Maximum value that can be entered is 4,294,967,294.
13. Omits all mention of disabled channel. Restore by setting for Normally Closed, Normally Open, etc.

## Programming Code Table (Page 1 of 8)

Code	Description & Comments	Default	Range/Values	Notes	Section
<i>See p. 6-2</i>					
<b>Channel Status Reading</b>					
0ZZ	Reads status of channel ZZ				6.2.1
0ZZ0	Reads actual open/closed circuit status directly				6.2.1
<b>Message Recording and Reviewing</b>					
100	Records Station ID message			1, 2, 10	4.3, 6.2.2
1ZZ	Records channel ZZ alarm message			1, 2, 10	4.3, 6.2.2
2ZZ	Records channel ZZ normal message			1, 2, 10	4.3, 6.2.2
3ZZ	Reviews channel ZZ both messages ZZ=00 for Station ID msg			1	4, 4.3, 6.2.2
911	Reads current record rate and available record time				4.2
912	Autoextend: sets optimum record rate for recited msg				4.2
913 N	Sets recording rate	Rate 1	Rate 1-4		4.3
914 N	Inserts N in place of 1 in canned station ID message	Station 1	1-16 digits		4.3
<b>Channel Programming (Configuration)</b>					
500	Sets current status as normal for all channels				3.3, 6.2.3
500 N	Sets all inputs to config parameter N	normally closed	0/1/2/3 0 = disarmed 1 = normally closed (default) 2 = normally open 3 = no alarm		3.3, 6.2.3
5ZZ	Reads alarm criteria for channel ZZ	1			6.2.3
5ZZ 0	Disables channel ZZ			13	3.3, 6.2.3
5ZZ 1	Sets chan ZZ normally closed			1	3.3, 6.2.3
5ZZ 2	Sets chan ZZ normally open			1	3.3, 6.2.3
5ZZ 3	Sets chan ZZ for no alarm (status report only)			1	3.3, 6.2.3
5ZZ 4	Sets chan ZZ for run time meter operation			1	3.3, 6.2.4
5ZZ 4 V	Preset starting value	0.0 hrs	0.0-99,999.9 hrs	1	6.2.4
5ZZ 7 N	Pulse totalizer: ACTIVATES with starting value N			12, 2	6.2.5
5ZZ 8 N	Pulse totalizer: sets scale factor N			12	6.2.5
5ZZ 6 N	Pulse totalizer: sets alarm setpoint N with starting value N			12	6.2.5



## Programming Code (Page 2 of 8)

Code	Description & Comments	Default	Range/Values	Notes	Section
<i>See p. 6-2</i>					
<b>Alarm Trip Delays</b>					
600	Reads power failure alarm trip delay				6.2.6
600 V	Sets power failure alarm trip delay to V	0.1 min	0.1-999.9 min		6.2.6
6ZZ	Reads chan ZZ alarm trip delay				6.2.6
6ZZ V	Sets chan ZZ individual alarm trip delay to V	2 sec	0.1-9999.9 sec	1	6.2.6
6ZZ	Returns chan ZZ individual alarm trip delay to default	2 sec		1	6.2.6
POINT					
902 V	Sets global (all channels) alarm trip delay to V seconds	2 sec	0.1-9999.9 sec		6.2.6
902	Returns global (all channels) alarm trip delay to default	2 sec			6.2.6
POINT					
<b>Phone Numbers and Pulse/Tone Dialing</b>					
700	Reads special "callback" phone number			See Code 924	6.2.18
700 N	Sets special "callback" phone # to N		1 - 60 digits		6.2.18
7DN	Reads phone number DN		01 - 16 DN = 01-16		3.2, 6.2.7
7DN N	Sets phone number DN to N phone #		1 - 60 digits N can = up to 60 digits	3	3.2, 6.2.7
7DN	Clears out phone number DN				3.2, 6.2.7
POINT					
900 0/1	Read/Set Call Progress Monitoring	0 (OFF)	0/1 0 = OFF 1 = ON		6.2.12
901 0/1/2	Sets dialing mode	Pulse mode	0/1/2 0 = pulse 1 = tone 2 = high speed	9	6.2.7
903 V	Sets time between callouts to V	2 min	0.1-99.9 min		6.2.18
906 N	Sets ring answer delay to N N = whole number	1 ring	1 - 20 rings		6.2.18
908 0/1	Sets Autocall ON/OFF	OFF	0/1 0 = OFF 1 = ON		6.2.18
909 V	Sets Autocall interval to V	24 hrs	0.1-99.9 hrs		6.2.18
916 N	Set Automatic Phone Fault Detect frequency	24 hrs	0.1 - 24 hrs	916 POINT resets to default	6.2.10
917 0/1/2/3	Set Phone Fault and Auto Tone-Pulse	3	0/1/2/3 0 = Phone Fault OFF/Auto Tone-Pulse OFF 1 = Phone Fault ON/Auto Tone-Pulse OFF 2 = Phone Fault OFF/Auto Tone-Pulse ON 3 = Phone Fault ON/Auto Tone-Pulse ON		6.2.10
918	CPM Ring Count	10 rings	5 - 20 rings		6.2.12
928 N	Extends length of inserted dialing delays to N sec	1 sec	1 - 10 sec		6.2.7

## Programming Code (Page 3 of 8)

Code	Description & Comments	Default	Range/Values	Notes	Section
<b>Alarm Call Grouping</b>					
5ZZ 9	Reads channel ZZ alarm call grouping linkage			1	6.2.13
5ZZ 9 DN	Links channel ZZ to phone numbers DN.	Calls all phone #s	01 - 16 DN = 01-16	1	6.2.13
5ZZ 9 POINT	Clears channel ZZ alarm call grouping linkage.			1	6.2.13
<b>Alarm Ready Scheduling</b>					
935 7	Initializes real-time clock chip on install to 1/6/92 2				2.3, 6.2.19, 7.9
941 MMDDYYD	Sets date	01/06/92 2	01/01/94 - 12/13/20 <u>D (Day Code) is optional:</u> 1 = Sunday 2 = Monday 3 = Tuesday 4 = Wednesday 5 = Thursday 6 = Friday 7 = Saturday		2.3, 7.9
942 -- HHMMSS	Sets time	08:00:00	00:00-23:59:59 (military-24-hour-clock)		2.3, 7.9
961 --	Read weekday rearm/disarm times				7.9
961 RRRR DDDD	Sets weekday rearm/disarm times	1700, 0800		RRRR=rearm time, DDDD=disarm time (military-24-hour-clock)	7.9
962	Reads weekend rearm/disarm times				7.9
962 RRRR DDDD	Sets weekend rearm/disarm times	1700, 0800		RRRR=rearm time, DDDD=disarm time (military-24-hour clock)	7.9
963	Reads weekend rearm/disarm day of week				7.9
963 R D	Sets weekend rearm/disarm day of week	Friday, Monday		R = rearm day D = disarm day	7.9
964	Reads holiday rearm date				7.9
964 MMDDYY	Sets holiday rearm date	12/24/90	Today - 12/31/20 MM = month DD = day YY = year		7.9
965	Reads holiday disarm date				7.9
965 MMDDYY	Sets holiday disarm date	12/24/90	The day after the holiday rearm date (see Code 964) - 12/31/20		7.9

Programming Code (Page 4 of 8)

Code	Description & Comments	Default	Range/Values	Notes	Section
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See p. 6-2

**Alarm Ready Scheduling** - - - Continued from p. 6-5

966	Reads alarm ready schedule control number				7.9
966 N	Sets alarm ready schedule control number	0	N control 0-7		7.9

0 = OFF  
 1 = Weekday  
 2 = Weekend  
 3 = Weekday and Weekend  
 4 = Holiday  
 5 = Weekday and Holiday  
 6 = Weekend and Holiday  
 7 = Weekday, Weekend and Holiday

**Local Data Logging Programming Codes**

935 7	Initialize real-time clock chip on install to 1/6/92 2				2.3, 62.19, 7.9
941	Sets date.	01/06/92 2	01/01/94-12/31/20		2.3, 7.9
MMDDYYD			<u>D (Day Code) is optional:</u> 1 = Sunday 2 = Monday 3 = Tuesday 4 = Wednesday 5 = Thursday 6 = Friday 7 = Saturday		
942	Sets time	08:00:00	00:00-23:59:59		2.3, 7.9
HHMMSS			(military-24-hour clock)		
943 V	Sets regular interval local printing	OFF	0 = OFF .1 - 999.9 hrs		2.3, 7.9
944	Prints all current programming immediately				2.3, 7.9

**Analog Input Programming**

5 ZZ 1	Sets low signal input value				B.1.5
X.XX					
5 XX 1	Sets low signal input value to real world point				B.1.5
POINT					
5 ZZ 2	Sets low signal input spoken value				B.1.5
X.XX					
5 ZZ 3	Sets high signal input value				B.1.5
X.XX					
5 ZZ 3	Sets high signal input value to real world point				B.1.5
POINT					
5 ZZ 4	Sets high signal input spoken value				B.1.5
X.XX					

## Programming Code (Page 5 of 8)

Code	Description & Comments	Default	Range/Values	Notes	Section
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See p. 6-2

**Analog Input Programming** . . . Continued from p. 6-6

5 ZZ 5 X.XX	Sets low setpoint alarm value				B.1.5
5 ZZ 6 X.XX	Sets high setpoint alarm value				B.1.5
5 ZZ 7	Sets analog input signal type	0	0/1/2 0 = 4-20 ma signal 1 = 0-1 VDC signal 2 = RACO TS-705A		B.1.3

**Remote Supervisory Control**

**For all items in this section: N = output number, Range = 01, 02, 03, 04, 05, 06, 07, 08**

95 N	Reads RSC output #N ON/OFF condition			14	C.1.3
95 N 0	Turns RSC output #N OFF				C.1.3
95 N 1	Turns RSC output #N OFF				C.1.3
95 N 2 V	Turns RSC output #N ON for V seconds only	1 sec	1 - 99,999 sec		C.1.3
95 N 3 V	Turns RSC output #N OFF for V seconds only	1 sec	1 - 99,999 sec		C.1.3
9500	Reports ON/OFF status of all outputs				C.1.3
9500 0	Turns OFF all outputs				C.1.3
9500 1	Turns ON all outputs				C.1.3
9500 8 V	Establish default pulse duration in minutes (When using 95 N 2 or 95 N 3)				C.1.3
9500 9 V	Establish default pulse duration in seconds (When using 95 N 2 or 95 N 3)				H.2.3

**Data Acquisition/Central Data Logging**

919 V	Sets quick intercall time	60 sec	35-999 sec		E.2
981 V	Return To Normal (RTN) calling	0	0/1/2/3/4/5	See Code 923	E.1, K.4
982 0/1/2	Acknowledgment calls to central station	0	0/1/2 0 = 1 1 = ON 2 = resets all alarm acknowledgment call status		E.3
983 0/1	Modem Automatic Speed Select	1	0/1 0 = OFF 1 = ON		E.4

## Programming Code (Page 6 of 8)

Code	Description & Comments	Default	Range/Values	Notes	Section
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See p. 6-2

**Data Acquisition/Central Data Logging . . . Continued from p. 6-7**

984 0/1	Modem High/Low speed selection	1	0/1 0 = 300 1 = 1200		E.5
985 N	Data call attempts	3	1 - 10		E.6
986 0/1	Sets answer mode	0	0/1 0 = Data-to-Voice 1 = Voice Only		E.7
987 N	Data/Voice autocal calls	0	0/1/2 0 = Autocalls to Central Station only 1 = Autocalls to personnel numbers only 2 = Autocalls to all numbers		E.8

**Miscellaneous Programming Items**

902 V	Sets global (all channels) alarm trip delay to V	2 sec	0.1-9999.9 sec		6.2.6
904 V	Sets alarm reset time to V	1 hour	0.1-99.9 hr		5.6, 6.2.18
905	Clears all acknowledged alarms and clears reset timers				6.2.18
907 N	Sets number of alarm message repeats to N N = whole number	3 repeats	1-20 repeats		5.3, 6.2.18
910 N	Establishes a security access code N	None	0-8 digits	7	6.2.18
920 V	Power failure trip delay (duplicates function of code 600)	0.1 min	0.1-999.9 min	4	6.2.6
921 0/1	Sets power failure alarm	ON	0/1 0 = off 1 = on		6.2.6
922 0/1	Sets alarm reset timers	ON	0/1 0 = off 1 = on	5	6.2.18
923	Annunciator Sequence	1	1-4 <u>Values:</u> 1 = M-1 designations 2 = A-1-4 designations 3 = A-1 designations 4 = A-1-4 variant	See also Code 981	K.4
924	Initiates test callback to phone # 00			unit must be ARMED	6.2.18
925 0/1	Turns on/off alarm acknowledgment on call-in to dialer.	ON	0/1 0 = OFF 1 = ON		
926 V	Sets delay before return to normal (Exit Delay) to V	2 min	1-99.9 min	Nonrecurring Function	6.2.18

## Programming Code (Page 7 of 8)

Code	Description & Comments	Default	Range/Values	Notes	Section
<b>Miscellaneous Programming Items . . . Continued from p. 6-8</b>					
927 0/1	Sets intercall delay parameter	0	0/1	** Firmware version 2.01+ only**	
			<u>Values:</u> 0 = Normal operation of intercall delay. 1 = If new Unacknowledged alarms occur during the intercall delay period, the unit will begin a new dialout immediately. The unit will dial the next phone number in the dialing sequence. It will not start over at the top of the list.		
928 N	Extends length of inserted dialing delays to N sec	1 sec	1-10 sec		5.7, 6.2.7
930 0/1	Sets arm or disarm unit for alarm callouts	armed	0/1 0 = disarms 1 = arms unit		6.2.18
932	Invokes one-time 15-second listening period	OFF			6.2.18
933 0/1	Sets local microphone ON or OFF	OFF	0/1 0 = OFF 1 = ON		6.2.18
934 0/1	Sets speaker ON or OFF	ON	0/1 1 = ON 0 = OFF	6	6.2.18

**Clear Out Operations**

935 0	Clears out phone numbers; sets all delays to defaults				6.2.19
935 1	Clears out phone numbers only				6.2.19
935 2	Clears out all alarm call grouping linkage				6.2.19
935 3	Sets the following delays to their factory default values: 902, 903, 904, 920, 921, 926, 928			921 sets power failure alarm ON	6.2.19
935 4	Clears all user recorded messages				6.2.19
935 5	Clears all programming except messages			does not clear 913, 930, 941, 942	6.2.19
935 6	Clears all totalizers to 0 (not to preset) reading				6.2.19
935 7	Clears real-time clock chip (reinitialize)				2.3, 6.2.19, 8.9
935 9	Total clearout: Erases all programming & messages			does not clear 941, 942	3.1, 6.2.19

**Diagnostic Readouts**

940	Reads all 4 diagnostic counts (add 0 to clear all 4)				6.2.20
940 1	Reads call in count (add 0 to clear)				6.2.20
940 2	Reads dial out count (add 0 to clear)				6.2.20
940 3	Reads acknowledged alarm count (add 0 to clear)				6.2.20
940 4	Reads power failure alarm count (add 0 to clear)				6.2.20

## Programming Code (Page 8 of 8)

Code	Description & Comments	Default	Range/Values	Notes	Section
<b>Local Alarm/Line Seizure</b>					
960 0	Read local alarm relay/line seizure				H.8
960 00/01	Set local alarm relay/line seizure 00 = local alarm relay 01 = line seizure	00	00/01		H.8

## 6.2 Programming Operations

The following descriptions show the relevant program codes in parenthesis, and are organized according to their appearance in the preceding Program Codes table located in Section 6.1, "Program Codes."

Refer also to Section 5, "Using Your Verbatim Autodialer," for a description of over-the-phone programming.

### 6.2.1 Channel Status Reading

Code	Function	Description
0 ZZ	Read Status of Channel ZZ	Plays the message that corresponds to the present input condition of Channel ZZ.
0 ZZ 0	Read Open/Closed Circuit Status Directly	Says "Channel ZZ is closed" if channel ZZ input is presently Closed Circuit, or "Channel ZZ is open" if the input is Open Circuit. Useful in troubleshooting, especially at setup time.



#### Note:

If a channel is disabled, its status will never be mentioned.

### 6.2.2 Message Recording and Reviewing

Be sure to refer to Section 4, "Record Voice Messages," for important details on message recording, including codes 911, 912, 913, and 914.

Code	Function	Description
100	Record Station Message	
1 ZZ	Record Channel ZZ Alarm Message	Used for Open Circuit message for channels programmed for NO ALARM (status only), or for Run Time Meter operation. Also used for a preamble message for channels programmed for Totalizer or Analog function.

2 ZZ	Record Channel ZZ Normal Message	Used for Closed Circuit message for channels programmed for NO ALARM (Status Only) or for Run Time Meter operation. Also used for "units of measure" portion of a message following preamble and digit readings, for channels programmed for Totalizer or Analog function.
3 ZZ	Review Channel ZZ Messages	Use 3 00 to review Station ID message

### 6.2.3

## Channel Programming (Configuring)

Also see Section 3.3, "Programming Input Channels."

Code	Function	Description
500	Set Present Input Status as Normal Condition for All Contact Input Channels	Used at setup time as the most expedient way of programming the Normally Open/Normally Closed configurations ("Alarm Criteria") of contact input channels. Special configurations such as Status Only, Run Time Meter or Totalizer may then be programmed for specific individual channels. This code does not affect channels already programmed for Status Only, Run Time Meter, or Pulse Totalizer. <b>APPLIES ONLY TO CONTACT INPUTS.</b>
500 0	Sets the Alarm Criteria for all contact channels to DISABLED	Used at setup time as the most expedient way of programming all channels to the same alarm criteria. <b>APPLIES ONLY TO CONTACT INPUTS.</b>
500 1	Sets the Alarm Criteria for all contact channels to NORMALLY CLOSED	Same as above
500 2	Sets the Alarm Criteria for all contact channels to NORMALLY OPEN	Same as above
500 3	Sets the Alarm Criteria for all contact channels to STATUS ONLY	Same as above
5 ZZ	Read Channel ZZ Programming ("Alarm Criteria")	
5 ZZ 0	Disables Channel from Being Monitored and Reported	
5 ZZ 1	Set Channel ZZ for Normally Closed Operation	An Open Circuit condition will cause an alarm. <b>APPLIES ONLY TO CONTACT INPUTS.</b>
5 ZZ 2	Set Channel ZZ for Normally Open Operation	A Closed Circuit condition will cause an alarm. <b>APPLIES ONLY TO CONTACT INPUTS.</b>
5 ZZ 3	Set Channel ZZ for No Alarm (Status Only)	<b>APPLIES ONLY TO CONTACT INPUTS.</b>



## 6.2.4

### Run Time Meter Programming

You may program any of the ordinary contact (digital or discrete) input channels to accumulate and report the number of hours that their respective input circuits have been closed. Any such channels will never cause an alarm, but on inquiry will recite the channel's Closed Circuit message or the Open Circuit message according to the status of the input, and will then report the accumulated Closed Circuit time (run time) to the tenth of an hour.

- ◆ To program channel ZZ for Run Time Meter operation, press:

5 ZZ 4 ENTER

- ◆ To preset a starting value, press:

5 ZZ 4 V ENTER

where V may be any value from 0 to 99,999.9.

- ◆ To delete the Run Time Meter programming, you must reprogram the channel for any other type of alarm criteria.

As with channels programmed for NO ALARM (Status Only) operation, the default Open Circuit message is "Channel N is off." To record your own Open Circuit message for channel ZZ, use program code 1 ZZ. The default Closed Circuit message is "Channel N is on." To record your own Closed Circuit message for channel ZZ, use program code 2 ZZ.

## 6.2.5

### Pulse Totalizer Function Programming

The Totalizer function counts the accumulated number of pulses (momentary contact closures) occurring at the contact input for a channel which you have programmed for Totalizer operation. This function is typically used to accumulate the pulse output of rotary flow meters.

An alarm set-point may be programmed to create an alarm call upon reaching a particular total value. Scale and offset factors are programmable, and user-recorded messages may be used.

Any contact input channel may be programmed for the Totalizer function, up to a total of 8 Totalizers. The input pulse rate must not exceed 100 pulses per second, and if the rate is over 50 pulses per second, the pulses must have a 50% duty cycle.

- ◆ To program channel ZZ for Totalizer operation, press:

5 ZZ 7 ENTER.

#### *Note:*

This function must be done to Activate the Totalizer. It is only possible to program up to 8 contact input channels for Pulse Totalizer. However, any 8 inputs may be used from the full set of contact inputs in your unit.

- ◆ To establish a non-zero starting value for the spoken reading, add the desired starting spoken value after the 7 and before ENTER.
- ◆ To establish a scale factor (so that a number of pulses will be translated into a single spoken unit count), press:

5 ZZ 8 N ENTER

where N is the number of pulses corresponding to a single spoken unit count. For example, if a pulse from a flow meter occurs for each 1/10 gallon of water flow, but the desired report is needs to be in thousands of gallons, a value of 10,000 would be used for N. The unit uses the word "percent" in speaking of the scale factor.

The spoken scaled value will "roll over" to zero upon reaching 4,294,967,294 (2<sup>32</sup>). Values above this should not be entered at the keyboard.

The default message for Totalizer channels is "Channel N Totalizer count is N." User-recorded messages are normally done in two segments. Use program code 1 ZZ to record a preamble message such as "The total water flow reading is". Use program code 2 ZZ to record an ending units-of-measure message such as "thousand gallons". During the report, the unit will insert the digits comprising the actual scaled value. In this example, the resulting complete report would be "The total water flow reading is (spoken value) thousand gallons".

- ◆ To establish a Totalizer alarm set-point, press:

5 ZZ 6 N ENTER.

When the scaled value reaches N, the unit will go into Unacknowledged Alarm and begin dialing. After the initial alarm has occurred, a new alarm will not occur until the user has reset the criteria. You may program a value of zero for N to cancel any previously programmed Totalizer alarm set-point for channel ZZ.

- ◆ To clear out all Totalizer readings to zero in one step, press:

9 3 5 6 ENTER.

## 6.2.6

### Alarm Trip Delays

The Alarm Trip Delay is the length of time after a violation occurs before the unit goes into Unacknowledged Alarm and begins dialing. The default value is 2 seconds for all inputs and 0.1 minute (6 seconds) for power failure. During this time, if a status is read, the message will be the ALARM message, with the extra word "alert" appended. If the violation is corrected before the Alarm Trip Delay times out, no alarm or dialout will occur.

There are two ways to change this Alarm Trip Delay: global (common for all channels except power failure) programming, and individual programming for each channel and power failure.

- ◆ To program a new global Alarm Trip Delay, press:

9 0 2 V ENTER

where V is a value consisting of 1 to 4 digits, between .1 and 9999.9 seconds. For example, possible entries include .1, 5, 5.1, and 600.1 (seconds).

- ◆ If you wish to program a new Alarm Trip Delay for an individual ZZ channel, press:

6 ZZ V ENTER

- ◆ To set a different Power Failure Trip Delay, press:

6 00 V ENTER (code 920 does the same thing)

- ◆ To turn off the Power Failure Alarm function, press:

9 2 1 0 ENTER

- ◆ To turn on the Power Failure Alarm function, press:

9 2 1 1 ENTER



**Note:**

The global code 902 overrides any previously set individual channel Alarm Trip Delays. Therefore, if you wish to establish a different global Alarm Delay and also program selected inputs for still different individual trip delays, perform the global programming first, and then any individual trip delay programming.

The default trip delay is 2 seconds for the contact channels and 6 seconds (.1 hour) for power failure. If you are getting a lot of "nuisance" alarms, with a call saying, "alarm now normal," you might think about setting the alarm trip delay up a bit. A good example of this would be the power fail trip delay. In some areas of the country, it is very common to have short periods of power failure -- ten seconds or less. These may not be of particular concern, so setting the power fail trip delay to .2 or .3 hours could save unnecessary phone calls.



**Caution:**

When leaving program mode all timers for unacknowledged alarms and violations will be reset.

## 6.2.7

### Phone Numbers and Pulse/Tone Dialing

Also see the section 6.2.13, "Alarm Call Grouping," and Section 3.1, "Starting Up and Clearing the Unit."

**Note:**

DN is the 2-digit Designation Number: 01 for the first phone number, 02 for the second number, up to 16 for the 16th phone number.

Refer to Programming Worksheet A. Write down each phone number you wish to program, along with a person's name, for future reference.

- ◆ To program the first phone number to be dialed on alarm, press:  
7 01 (then the complete phone number) ENTER.
- ◆ To program the second phone number to be dialed on alarm:  
Use code 7 02 in place of 7 01, progressing to a maximum of code 7 16 for a 16th phone number.

Each phone number may be up to 60 digits in length. Be sure to include any necessary area codes or "1" prefixes.

- ◆ To erase phone number DN, press:  
7 DN POINT ENTER.
- ◆ If you need Touch Tone dialing, press:  
9 01 1 ENTER.
- ◆ For high speed dialing, press:  
9 01 2 ENTER.

**Caution:**

"High speed dialing" may not work reliably with some older telephone company exchanges.

- ◆ To switch back to pulse dialing, press:  
9 01 0 ENTER
- ◆ To insert delays between dialed digits (e.g. after a leading "9" in PBX systems), in the programming process, press the MINUS key once for each one-second delay desired. To extend the length of each delay beyond 1 second, press:  
9 28 N ENTER

where N is the number of seconds of delay desired for each delay invoked with the MINUS key.

## 6.2.8

### Enhanced Telephone Interface Features

The Enhanced Telephone Interface features give the user additional power to solve unusual telephone system interface problems and to provide more reliable and efficient notification of alarms.

The Enhanced Telephone Interface Features include the following functions:

- ◆ 60 Digit Phone Numbers
  - For all 16 telephone numbers and the call-back number.
- ◆ Telephone Line Fault Detection (Phone Fault)
  - Tests phone line at regular programmed interval
  - Flashes TFAIL LED on dialer front panel upon failure
  - Logs Phone Faults and phone line restoration to Local Printer
- ◆ Automatic Selection of Tone versus Pulse Dialing
  - Tests for tone capability upon first power up without user intervention
  - May be overridden for PBXs with "non-standard" dialtones
- ◆ Call Progress Monitoring (CPM)
  - Detects busy and ringing signals
  - Waits until phone is answered to annunciate voice reports
  - Abandons call if busy or no answer and quickly tries next number
- ◆ Numeric Pager Support
  - Designate Pager only numbers - no voice annunciation
  - Insert pager system terminator characters such as '#' or '\*\*'
  - Insert DTMF A, B, C & D tones in phone number strings for unique IDs
- ◆ PBX Support
  - Ignore "non-standard" PBX dialtones
  - Insert "wait for outside line" dialtone into phone number strings

The Enhanced Telephone Interface Features are included on Verbatims with a mainboard Revision of VMP-5a and above and firmware revisions 2.09 and above ONLY.

Contact your RACO Representative about upgrading if the Enhanced Telephone Interface is required.

**6.2.9****60 Digit Phone Numbers**

Telephone numbers may be as long as 60 digits. This allows, for instance, the Verbatim autodialer to make calls using long distance companies which require entry of access codes. Even with many digits occupied by long distance numbers and access codes there will still be sufficient digits remaining for calls to pager systems requiring complex sequences of terminators, ID numbers, time delays, tone detects, etc.

**6.2.10****Telephone Line Fault Detection (Phone Fault)**

The Phone Fault Detection feature tests the telephone line whenever the unit needs to make a phone call and at a regular programmable time interval (as long as there are phone numbers programmed).

Phone Fault is turned ON by default but may be disabled if so desired. Also, the Phone Fault Detection interval is user programmable.

Phone Fault shares a user code with the Automatic Tone/Pulse Selection capability. The basic user command is code 917. Entering code 917 with no parameter will cause a recitation of the current settings for Phone Fault and Automatic Tone/Pulse Selection.

The following parameters may be entered:

- ◆ Turns OFF BOTH Phone Fault Detect and Auto. Tone/Pulse Select  
9 1 7 0
- ◆ Turns ON Phone Fault Detect, turns OFF Auto. Tone/Pulse Select  
9 1 7 1
- ◆ Turns OFF phone fault detect, turns ON Auto. Tone/Pulse Select  
9 1 7 2
- ◆ Turns ON BOTH Phone Fault Detect and Auto. Tone/Pulse Select  
(default)  
9 1 7 3

**Note:**

The factory default setting for code 917 is parameter 3, BOTH Phone Fault Detect and Auto. Tone/Pulse Select ON.

The command code 916 is used to set the Automatic Phone Fault Detection interval. This time interval can range from 0.1 hour to 24 hours. The factory default setting is 24 hours. Enter the command 916 followed by a value from 0.1 to 24.0 to program the Phone Fault Detection interval.

- ◆ For example, to set the Phone Fault Detection interval to 0.3 hour., enter:  
916 0.3

Whenever a Phone Fault is first detected, a Local Data Logger (LDL) message will be sent to the printer with date and time stamp. Additionally, the Phone Fault LED, labeled TFAIL, will begin to blink.

If a Phone Fault is detected at the beginning of an outgoing phone call the TFAIL LED will flash and the unit will return to the NORMAL state. Then, while still in the NORMAL state, the unit will continually check the telephone line every 30 seconds for restoration of the telephone service.

When telephone service is restored, a message will be sent to the Local Data Logger's printer and the TFAIL LED will go from flashing to solid ON. The Verbatim autodialer will then resume making any pending phone calls. The TFAIL LED will remain ON until a voice message about the Phone Fault is communicated via the phone or to an operator at the front panel by pressing the CHECK STATUS button. The TFAIL LED and pending voice annunciation of the Phone Fault condition may also be cleared at the front panel by pressing the DISARM/RE-ARM button twice.

No Phone Fault Detection will be performed if there are no phone numbers programmed. If the unit needs to make an alarm call when there is a Phone Fault the numbered channel LEDs will blink continuously even though the unit is in the NORMAL state. This unusual condition will only be seen while there is a Phone Fault and the unit is constantly testing for the return of telephone service.

## 6.2.11

### Automatic Tone/Pulse Selection

When Automatic Tone/Pulse Selection is ON the Verbatim autodialer will test for the ability to use tone dialing. This test will be performed only once, one minute after the unit is powered on or is reset. Automatic Tone/Pulse Selection enables the installer to not be concerned about whether the telephone line supports tone dialing.

Automatic Tone/Pulse Selection shares a user code with Phone Fault Detection. The basic user command is code 917. Entering code 917 with no parameter will cause a recitation of the current settings for Phone Fault and Automatic Tone/Pulse Selection. The following parameters may be entered:

- ◆ Turns OFF BOTH Phone Fault Detect and Auto. Tone/Pulse Select  
9 1 7 0
- ◆ Turns ON Phone Fault Detect, turns OFF Auto. Tone/Pulse Select  
9 1 7 1

- ◆ Turns OFF phone fault detect, turns ON Auto. Tone/Pulse Select

9 1 7 2

- ◆ Turns ON BOTH Phone Fault Detect and Auto. Tone/Pulse Select (default)

9 1 7 3



### **Note:**

The factory default setting for code 917 is parameter 3, BOTH Phone Fault Detect and Auto. Tone/Pulse Select ON.

Setting Automatic Tone/Pulse Selection ON when it was previously OFF will cause the Verbatim autodialer to perform the test for Tone/Pulse Selection even though it has been longer than one minute since the unit was last powered on or reset.

After powering the unit on, Automatic Tone/Pulse Selection may be temporarily suspended by any front panel activity. Automatic Tone/Pulse Selection will then be resumed one minute after the front panel activity has ceased.

No Tone/Pulse Selection will be done while the unit is being programmed over the phone or if there are not phone numbers programmed.

## **6.2.12**

### **Call Progress Monitoring (CPM)**

Call Progress Monitoring (CPM) operates by listening for the presence or absence of busy and ringing signals. These are the same signals you hear after you dial a phone number. Proper operation of CPM requires that the busy and ringing signals are composed of standard Call Progress frequencies.

The possibility exists that CPM may not function properly because the CPM tones on a particular phone system are not standard.

Unlike other equipment with Call Progress Monitoring, CPM on the Verbatim autodialer does not include detection for the dial tone at the beginning of the dialout session. However, dialtone detection is an integral part of Phone Fault Detection. This allows CPM to be operational even when the Verbatim autodialer is installed inside of a PBX phone system which has a non-standard dialtone.

CPM is intended to detect the following phone line states:

- phone line is busy - both subscriber and trunk busy signals are detected
- non-existent phone number
- phone unanswered - still ringing
- phone answered - ringing stopped



When CPM determines that a call is not complete, an appropriate report will be sent to the local printer.

Reasons for a non-completed call:

- CPM determines the line is busy
- CPM does not detect cessation of ringing before end of programmed CPM ring count
- CPM does not detect either busy signal or valid ring signals

Reason for a completed Call:

- CPM detects at least one ring followed by cessation of ringing

If a call is not completed, the Verbatim autodialer will disconnect the call and enter the intercall delay state. At the end of the intercall delay, the next programmed telephone number will be dialed.

When a call is not completed, the intercall delay will always be shortened to 30 seconds. This CPM altered intercall delay is fixed at 30 seconds and is not affected by the user-programmed intercall delay. The normal programmable intercall delay will apply only to the delay between completed calls.

Call Progress Monitoring for firmware version 2.09 is set to ON by factory default. If CPM is OFF the Verbatim will deliver voice messages without regard to any ringing or busy signals. This unit will simply dial the number, then after a short delay, start annunciating voice reports.

As noted above, dialtone detection is actually a part of the Phone Fault Detection feature. It is possible to have CPM turned OFF and Phone Fault Detect turned ON. In this case, the unit will test for a dialtone but not for busy or ringing signals.

Use code 900 to read or set CPM programming. Use code 900 followed by a 1 or 0 parameter to program CPM ON (1) or OFF (0).

The CPM ring count is the number of rings Verbatim autodialer will wait for an answer before considering the call to be incomplete. Use code 918 to read or set the number of CPM rings. The factory default is 10 rings and the user may program any number of rings from 5 to 20.

- For example, to program the CPM ring count to 10 rings, enter:  
918 10 then ENTER

## 6.2.13

**Alarm Call Grouping**

This is a programming step that “links” selected channels to selected dialout phone numbers, so that when a given channel goes into alarm, only the phone numbers “linked” to that channel will be dialed. Ordinarily, an alarm on any channel will cause dialing of the entire list of phone numbers.

Alarm Call Grouping is typically done when certain channels are associated with a specific category of personnel, such as electrical, plumbing, security, etc. However, Power Failure to the Verbatim autodialer causes dialing of all phone numbers. If you need to limit Power Failure alarm calls to selected numbers:

1. Turn off the regular Power Failure alarm function using code 9 2 1 0, (described below)
2. Then connect an unused input channel for power failure monitoring, using the contacts of a relay.

To program for Alarm Call Grouping:

1. Enter your phone number. It is important to first write in your entire list of phone numbers on Programming Worksheet A in Appendix J.

**Note:**

There is a 2-digit “Designation Number” on the Worksheet associated with each phone number (01 for the first number, etc.). This number corresponds with the 3-digit program code for entering phone numbers (701 for the first number, etc.).

2. Group them by using code 5 ZZ 9 DN. Begin by filling in Programming Worksheet B in Appendix J.

Refer to the filled-in examples for guidance. The right-hand column will now contain the actual program code strings which you should now enter, terminating each string entry with the ENTER key.

For example, to link channel 1 to the second and fifth phone numbers, following the filled-in example, you would press:

```
5 01 9 02 05 ENTER
```

3. Phone numbers will always be dialed in ascending order of the 2-digit Designation Numbers, regardless of their order in your program code entry. Note that an alarm on any channel that is not “linked” with a program code entry will cause dialing of the entire list of phone numbers.

◆ To read the linkage programming on channel ZZ, press:

```
5 ZZ 9 ENTER
```

- ◆ To "un-link" channel ZZ so that it again calls all phone numbers, press:

5 ZZ 9 POINT ENTER

- ◆ To undo all existing linkage on all channels, press:

9 35 2 ENTER

## **6.2.14 Alarm Ready Scheduling**

Refer to Section 7, "Using the Alarm Ready Schedule Feature," for use and application information. See also Appendix E, "Data Acquisition/Central Data Logging."

## **6.2.15 Local Data Logging Programming Codes**

Refer to Chapter 2, "Installation," for use and application information.

## **6.2.16 Analog Input Programming**

Refer to Appendices B, C and D, "Analog Signal Input," "Remote Supervisory Control Output," and "Printer Options," for use and application information.

## **6.2.17 Remote Supervisory Control**

Refer to Appendices B, C and D, "Analog Signal Input," "Remote Supervisory Control Output," and "Printer Options," for use and application information. See also Appendix E, "Data Acquisition/Central Data Logging."

## **6.2.18 Data Acquisition/Central Data Logging**

Refer to Appendix E, "Data Acquisition/Central Data Logging."

## **6.2.19 Miscellaneous Programming Tips**

### **(903) Time Between Alarm Call Outs**

This is the length of time after ending one alarm call-out and before beginning the next call-out. Default value is 2 minutes; range is 0.1 to 99.9 minutes.

- ◆ To program a different number of minutes V, press:

9 03 V ENTER

**(904, 922) Alarm Reset Time**

This is the length of time after acknowledgment before a given channel (or Power Failure) is automatically reset to a clear condition, ready to act on a new alarm condition. Refer to the diagram "Anatomy of an Alarm" in Section 5, "Using Your Verbatim Autodialer," for a depiction of the various events involved in association with the Alarm Reset Time. Default value is 1 hour; range is 0.1 to 99.9 hours.

- ◆ To program a different number of hours V, press:

9 04 V ENTER

- ◆ To turn the Alarm Reset Timer function off, press:

9 22 0 ENTER

**Caution:**

You should not turn the alarm reset timer function off under normal circumstances because once a given channel's alarm has been acknowledged, it would never again cause an alarm call out.

- ◆ To turn the Alarm Reset Timer function on again, press:

9 22 1 ENTER

**(905) Clear All Acknowledged Alarms and Alarm Reset Timers**

Especially during setup and testing, it is useful to be able to re-trip an alarm after it has previously been tripped and acknowledged, without having to wait for the Alarm Reset Time to expire.

- ◆ To perform this clear out, press:

9 0 5 ENTER

At the panel, the same result may be more easily obtained by pressing DISARM/RE-ARM to disarm the unit, then pressing it again to rearm the unit.

**(906) Ring Answer Delay**

Represents the number of rings required when calling the Verbatim unit, before the unit will answer. A long ring delay might be programmed if you wish personnel to have the opportunity to answer a regular telephone on the same line, before the Verbatim autodialer would answer. Default value is 1 ring; range is 1 to 20 rings.

- ◆ To program a different number of rings N, press:

9 06 N ENTER

### **(907) Number of Alarm Message Repeats**

Represents the total number of times each message or set of messages is spoken during each alarm call out. Normally a value of 3 repeats (strictly speaking, the alarm message plus 2 repeats) should be programmed. The reason for this is that there needs to be adequate message recital time to allow adequate time to answer the phone call and hear at least one complete set of messages. Default value is 3 repeats; range is 1 to 20 repeats.

- ◆ To program a different number of repeats N, press:

9 07 N ENTER

### **(908) Autocall Test Function**

The Autocall Test Function causes the unit to place test calls at regular intervals for the purpose of ongoing verification of Verbatim autodialer and phone line functioning. Calls are placed only once for each interval, to each regular phone number programmed (7 01 through 7 16). The exception being the acknowledgement of a test call, where additional calls will not be placed for that time interval. Each call gives the station ID message and a statement that this is a test call, plus a report of all inputs.

- ◆ To turn this function on, press:

9 08 1 ENTER

- ◆ To turn it off, press:

9 08 0 ENTER

The first series of calls begins as soon as the Autocall Test Function is turned on. Therefore, if you want the unit to call at 5 PM each day, you will need to turn this function on at that time. The default interval is 24 hours; range is 0.1 to 99.9 hours.

- ◆ To program a different interval V, press:

9 09 V ENTER



### **Note:**

If the Verbatim autodialer is in the disarmed mode, call-outs/autocalls will not be made.

### **(910) Security Access Code**

Once you establish a Security Access Code, unauthorized personnel are prevented from altering your programming or messages over the phone without first entering the Access Code. This does not affect programming access at the panel.

- ◆ To establish an Access Code N of up to 8 digits, press:

9 10 N ENTER (at the panel)

Once established, whenever you press a Command Tone 1 at the prompting beep, the unit first prompts you to enter the Access Code before allowing you to perform programming or message recording operations. You may still read existing programming without using the Access Code by pressing a Command Tone 2 at the prompting beep. However, the Access Code itself cannot be read over the phone.

- ◆ To delete the Security Access Code so that no code is required in order to perform over the phone programming, press:

9 1 0 POINT ENTER (at the panel) **ONLY**

### **(921, 930) Power Failure Alarm Function ON/OFF; DISARM/RE-ARM All Alarms**

- ◆ To turn off the Power Failure Alarm function, press:

9 21 0 ENTER

- ◆ To turn the Power Failure Alarm function on again, press:

9 21 1 ENTER

- ◆ To disarm the unit, preventing any alarm call outs, press:

9 30 0 ENTER

- ◆ To rearm the unit, press:

9 30 1 ENTER

At the front panel, the same result is more easily obtained by using the DISARM/RE-ARM key.

### **(700, 924) Callback/Callforward**

This feature causes the unit to dial a special "zeroth" phone number on command. This is typically initiated over the phone, causing the unit to call back to the person who invoked the command, in order to verify the ability of the unit to successfully dial out. The unit gives a status report of all channels as part of this call.

- ◆ To program this special callback number, press:

7 00 (then the complete phone number) ENTER

- ◆ To initiate the actual dialing, press:

9 2 4 ENTER

If you have executed this command over the phone, the unit will advise you that it will be calling the callback number in 15 seconds. Then it will end the current call in preparation for placing the callback call. If you have executed this command at the front panel, the dialing will occur immediately.



**Note:**

If the Verbatim autodialer is in the disarmed mode, call-outs/autocalls will not be made.

**(926) Delay Before Return to Normal (Exit Delay)**

Sometimes it is desirable to prepare the unit for the ability to detect violations and dial out, but with an "exit delay" that allows the user time to exit or remove temporarily existing alarm violations before the unit becomes active.

To set delay before Return to Normal:

1. Press:

9 26 V ENTER

where V is the desired delay in minutes (range 1.0 to 99.9 minutes).

2. Then press DISARM/RE-ARM if necessary to extinguish the flashing DISARMED legend light. However, do not press NORMAL, but instead leave the unit in PROGRAM mode, with the PROGRAM light illuminated. The unit cannot go into alarm while in PROGRAM mode.

When the delay period times out, the unit will automatically return to NORMAL mode and will then be ready to act on any alarm violations that occur after that time. This code must be re-entered each time you wish an exit delay, since the delay value automatically returns to the default value of 2 minutes upon timeout.

The 2 minute default value provides protection against the possibility that someone might walk away leaving the unit in PROGRAM mode, or perhaps hang up the phone after performing over-the-phone programming without properly ending the call.

**(932, 933, 934) Microphone and Speaker Operation**

If you enable the front panel microphone using program code 933 as described below, the microphone will be automatically activated for a 15 second listening period at the end of each alarm or inquiry call, allowing you to hear the sounds near the unit from a remote telephone.

An additional warble tone is issued at the end of this listening period, allowing you to postpone tone acknowledgment until after the listening period.

- ◆ To turn this function on, press:

9 33 1 ENTER

- ◆ To turn this function off, press:

9 33 0 ENTER

If you have turned the microphone on, as above, then during any phone call, you may also invoke a one-time listening period by entering Remote Program Mode (press 1 at the warble tone) and then entering 9 3 2 # #.

- ◆ To turn off the speaker so that neither alarm call or inquiry call activity is heard at the unit, press:

9 3 4 0 ENTER

The speaker will still be heard when operating keys at the front panel.

- ◆ To turn the speaker on again, press:

9 3 4 1 ENTER



### Note:

The speaker volume may be adjusted via the trimpot marked SPKR VOL shown on the Electrical Connection Diagram. See Section A.1, "Adjusting Internal Speaker Volume."

## 6.2.20

### Program Clear Out Operations

The following list of program codes provides a flexible variety of operations to conveniently clear selected programming items in order to allow for a fresh start.

Code	Function
935 0	Clears out phone numbers; sets all delays to default.
935 1	Clears out phone numbers only.
935 2	Clears out all alarm call grouping linkage.
935 3	Sets the following delays to their factory default values: 902, 903, 904, 920, 921, 926, 928 (921 sets power failure alarm ON)
935 4	Clears all user recorded messages.
935 5	Clears all programming except messages. (Does not clear 913, 930, 941, and 942)
935 6	Clears all Totalizer counts to zero.
935 7	Clears and initializes clock.
935 9	Total clear out (Does not clear 941 and 942).



### Caution:

Code 9 3 5 9 erases all programming and messages.



**6.2.21****(940) Diagnostic Readouts**

To assist in analyzing the way the unit is operating, the following list of diagnostic count codes is provided.

Code	Function
940	Reads all 4 diagnostic counts (add 0 to clear all 4)
940 1	Reads Call In Count (add 0 to clear)
940 2	Reads Dial Out Count (add 0 to clear)
940 3	Reads Acknowledged Alarm Count (add 0 to clear)
940 4	Reads Power Failure Alarm Count (add 0 to clear)
940 0	To Clear all Counts

# 7

## Using the Alarm Ready Schedule Feature

### 7.1

#### Definition

An Alarm Ready Schedule is defined as an interval of time during which the Verbatim autodialer is ARMED and "Ready" to respond to alarm conditions. Alarm Ready Schedules can be automatically started according to times and dates entered by the operator. An Alarm Ready Schedule commences with the Verbatim autodialer becoming REARMED. (If the Verbatim autodialer was previously not DISARMED then the schedule will still be commenced at that time.) Once the Alarm Ready Schedule has commenced the Verbatim autodialer will continue in an ARMED state until the end of the Alarm Ready Schedule, at which time the Verbatim autodialer will be automatically DISARMED. Once an Alarm Ready Schedule has commenced it is said to be "active."

There are three steps to programming for Alarm Ready Scheduling:

- ◆ Date and time setting
- ◆ Enter alarm start and stop times
- ◆ Enable the Alarm Ready Scheduling feature using code 966 N.

### 7.2

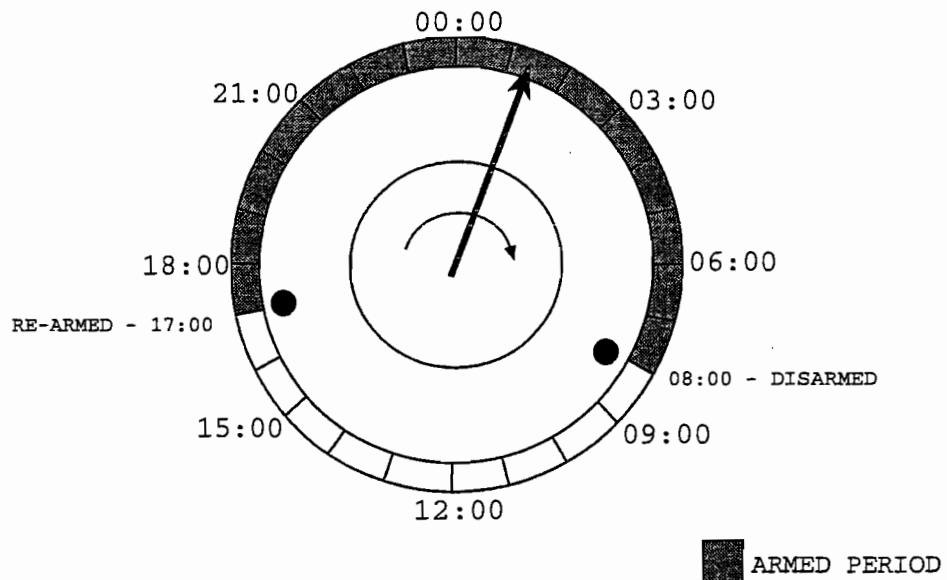
#### General Descriptions

Alarm Ready Schedules can be viewed as really nothing more than an automated way of pressing the REARM/DISARM button. Therefore, if an alarm occurs while the Verbatim autodialer is DISARMED, no dial-outs will be made and the alarm will be automatically acknowledged. Correspondingly, if there is an acknowledged alarm when the Verbatim autodialer becomes REARMED and the input violation is still present then the Verbatim autodialer will begin calling after the trip delay has elapsed.

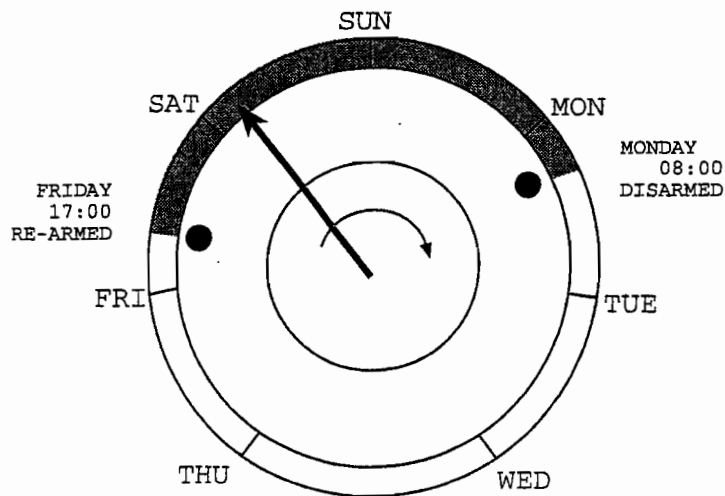
If the Verbatim autodialer is doing a sequence of alarm calls or Autocall calls at the time when an Alarm Ready Schedule should change the Verbatim autodialer's REARM/DISARM state the change will be delayed until after the end of the calling sequence.

Alarm Ready Schedules can be temporarily overridden by the operator pressing the REARM/DISARM button. However, if the REARM/DISARM button is pressed during an active Alarm Ready Schedule the schedule still remains active. If the operator DISARMS the Verbatim autodialer in the middle of an Alarm Ready Schedule the schedule will actually continue to its ending time. It will then deactivate itself and attempt to DISARM the Verbatim autodialer just as if the Verbatim autodialer was still ARMED. If the operator DISARMS the Verbatim autodialer in the middle of an active Alarm Ready Schedule, then REARMS the Verbatim autodialer once again before the end of the Alarm Ready Schedule the schedule will remain active until its ending time. The schedule will then be deactivated and the Verbatim autodialer will be DISARMED.

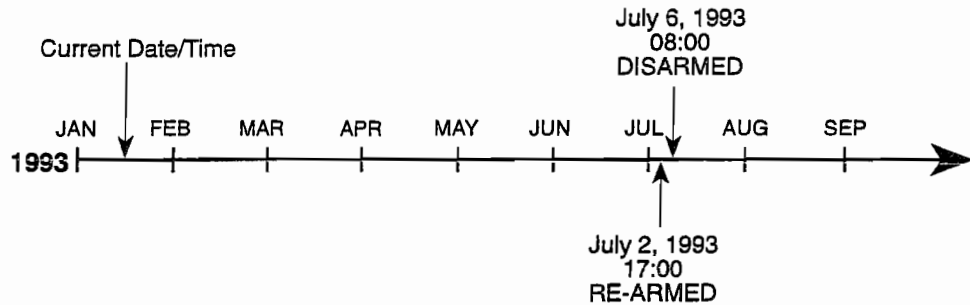
### Weekday Timer



### Weekend Timer



## Holiday Timer is Linear



### 7.3

## Alarm Ready Schedule Modes

There are three possible Alarm Ready Schedules modes: Weekday, Weekend & Holiday. Any combination of these three possible schedules may be enabled at one time, however, the Verbatim may only become REARMED or DISARMED by one mode at a time. See Section 7.7, "Alarm Ready Schedule Priorities." For example, you may have both weekday & weekend schedules enabled at the same time or you may have all three enabled at the same time. When the Verbatim becomes DISARMED or REARMED by an Alarm Ready Schedule it will verbally announce which mode caused the REARM/DISARM action. The Alarm Ready Schedule modes are as follows:

Mode	Schedule
Mode 1	Weekday Schedule
Mode 2	Weekend Schedule
Mode 3	Holiday Schedule

For example, if there was a weekday schedule enabled to REARM the Verbatim at 1700 daily, when the weekday schedule became active the Verbatim would say, "REARMED for mode 1". Also, when there is a local printer connected to the Verbatim, the mode of the Alarm Ready Schedule causing the REARM/DISARM (WEEKDAY, WEEKEND, or HOLIDAY) will be printed along with the current time.

## 7.4 Weekday Schedule Mode 1

The weekday schedule will REARM the Verbatim autodialer daily at the programmed weekday REARM time and DISARM the Verbatim autodialer daily at the programmed DISARM time. If no weekend schedule is enabled (via the Alarm Ready Control Number settings) then the weekday schedule applies everyday, Monday through Sunday. As noted below, the weekend schedule is overridden by the weekend and holiday schedules.

## 7.5 Weekend Schedule Mode 2

If programmed, the weekend schedule operates once a week. The weekend schedule is set by factory default to be Friday through Monday. If the defaults are used the Verbatim autodialer could be REARMED every Friday afternoon at 1700 and DISARMED again every Monday morning at 0800. The weekend schedule could be changed from the defaults, for example, so that the Verbatim autodialer would be REARMED on Saturday and DISARMED on Monday (for organizations with 6 day work-weeks).

When the weekend schedule is enabled the weekday schedule will be overridden. In other words, there would be no DISARMING of the unit at 0800 Saturday morning.

By default, the weekend REARM/DISARM times are set to be the same as the weekday REARM/DISARM times. However, non-default weekend REARM/DISARM times may be entered if the operator so chooses.

Therefore, if personnel regularly leave early on Fridays then the REARM time could be set to 1500 instead of the usual 1700.

## 7.6 Holiday Schedule Mode 3

The Holiday schedule is a one-shot, non-recurring schedule which overrides all of the other schedules.

The Holiday schedule will be set by factory default to some Holiday period in the past (such as last Christmas).



### *Note:*

For the Holiday schedule only, the exact date is entered including the year. Once, the Holiday schedule has been run it is complete and finished until a new schedule, for some date in the future, is entered.

To use the Holiday Alarm Ready Schedule, the operator must enter the REARM date (month/date/year) and DISARM date (month/date/year).

For the time-of-day, the Holiday Alarm Ready Schedule always uses the Weekend REARM/DISARM times.

## 7.7 Alarm Ready Schedule Priorities

There is a priority among the Alarm Ready Schedules. The Holiday Alarm Ready Schedule has the highest priority, then comes the weekend schedule and finally the weekday schedule.

If all three Alarm Ready Schedules are to be active, a Holiday schedule will always start at its scheduled time & date regardless of the state of the other schedules. When the Holiday schedule is over then the other schedules will resume.

Likewise, the Weekend Alarm Ready Schedule has priority over the Weekday Alarm Ready Schedule. The weekend schedule will always start at its programmed day-of-week and time regardless of the state of the weekday schedule. When the weekend schedule is over then the weekday schedule will resume.

## 7.8 Programming Alarm Ready Schedule Parameters

The following section explains the Verbatim autodialer codes to be used for programming Alarm Ready Schedules and the Alarm Ready Schedule Control Numbers. Alarm Ready Schedule parameters may be entered either at the front panel or over the phone.

There are some restrictions which must be remembered when entering DISARM/REARM times and ALARM READY SCHEDULE CONTROL NUMBERS.

1. When entering new schedule times, the REARM time must be later than the time the operator is programming the schedule. However, it may not be possible to "jump" into a schedule when exiting the programming mode. For example, if the current time is 1700 hours and the operator enters a weekday schedule to REARM daily at 1630 and DISARM daily at 0730, this new schedule would not start until the following day at 1630 hours.

Conversely, assume that the current time is 1700 hours and that the operator goes into PROGRAM mode and enters a new weekday schedule to REARM at 1705 and DISARM at 0800. At this time, the operator can either return to NORMAL mode or continue in PROGRAM mode and do other programming. Even though it may be after 1705 when finally returning to the NORMAL mode, the weekday schedule will still begin (or have begun) at 1705 hours.

2. You cannot enter any holiday date values which will cause the holiday REARM or DISARM date and time to be earlier than the current date and time. As explained below, the holiday schedule uses the weekend times for the time-of-day of the holiday REARM and DISARM.
3. It's useful to understand that the Verbatim autodialer's internal count-down timers used for REARM/DISARM times are re-calculated as a result of the operator making certain Alarm Ready Schedule programming changes. Anytime a new REARM or DISARM date/time is entered, a calculation is made to determine the next REARM and DISARM for that particular schedule.

Also, when the ALARM READY SCHEDULE CONTROL NUMBER is changed all REARM and DISARM date/times are re-calculated. Further, whenever the current date or time is set or changed by the operator, all REARM and DISARM date/times will be re-calculated.

## 7.9

### Starting the Real-Time Clock Chip, Time and Date Setting

Use Program Code 935 7 ENTER to start the real time clock chip. This needs to be done only once at the time of the installation of the chip.

Time and date may be set or corrected with the following programming code entries:

- ◆ To check the date:

941 ENTER

- ◆ To set the date:

941 MM DD YY D ENTER

MM is the month (03 for March); DD is the date (07 for the 7th day of the month); YY is the year (89 for 1989); and D is the day of the week (1 for Sunday; 2 for Monday, etc.). Entry of D is optional.

- ◆ To check the time:

942 ENTER

- ◆ To set the time:

942 HH MM SS ENTER

HH are the hours in military time (13 for 1 PM); MM are the MM (09 for 9 minutes); and SS are the seconds. Entry of SS is optional.

- ◆ To clear the time and date back to 00:00:00 on 01/01/89:

935 7 ENTER

## 7.10

# Setting Alarm Start & Stop Times

### CODE 961

**READ WEEKDAY REARM & DISARM TIME** (defaults: 1700 & 0800) Press 9 6 1 then ENTER to hear the Weekday REARM & DISARM times recited. Times will not be altered and new REARM & DISARM values will not be calculated.

**SET WEEKDAY REARM & DISARM TIME** Press 9 6 1 plus REARM & DISARM time. For example, 961 1600 0700 then ENTER to set REARM time to 1600 (4:00 P.M.) & DISARM time to 0700 (7:00 A.M.) The user is allowed to enter just the REARM time, i.e.; 961 1600 (enter). But, if the user wants to change the DISARM time then both the REARM & DISARM times must be entered.

### CODE 962

**READ WEEKEND REARM & DISARM TIME** (defaults: 1700 & 0800) Press 9 6 2 then (enter) to hear the Weekend REARM & DISARM times recited. Times will not be altered and new REARM & DISARM values will not be calculated.

**SET WEEKEND REARM & DISARM TIME** Press 9 6 2 plus REARM & DISARM time then ENTER, for example, 962 1500 0700 then ENTER to set REARM time to 3:00 P.M. & DISARM time to 7:00 A.M. The user is allowed to enter just the REARM time, i.e.; 962 1500 ENTER. But, if the user wants to change the DISARM time, then both the REARM & DISARM times must be entered.

### CODE 963:

**READ WEEKEND REARM & DISARM DAY-OF-WEEK** (defaults: Fri. & Mon.) - Press 9 6 3 then ENTER to hear the Weekend REARM & DISARM day-of-week (d-o-w) recited as a number from 1 to 7. Note: Sunday = 1, Monday = 2, etc. Day-of-week will not be altered and new REARM & DISARM values will not be calculated.

**SET WEEKEND REARM & DISARM DAY-OF-WEEK** Press 9 6 3 plus REARM & DISARM d-o-w then ENTER. For example, 963 6 1 then ENTER to set the weekend REARM day-of-week to Friday & REARM day-of-week to Sunday. The user is allowed to change only the REARM d-o-w if so desired, e.g.; 963 7 ENTER to set the REARM d-o-w to Saturday. But, if the user wants to change the DISARM d-o-w then both the REARM d-o-w & DISARM d-o-w must be entered.



**CODE 964:**

**READ HOLIDAY REARM DATE** (default: 12/24/95) Press 9 6 4 then ENTER to hear the Holiday REARM date recited. The Holiday REARM will not be altered.

**SET HOLIDAY REARM DATE** Press 9 6 4 plus REARM date. For example, enter 964 12 24 95 ENTER to set holiday REARM date to December 24, 1995. The new REARM date can not be before today's date.



**Note:**

The day-of-week date cannot be entered for a Holiday schedule.

**CODE 965:**

**READ HOLIDAY DISARM DATE** (default: 12/26/95) Press 9 6 5 then ENTER to hear the Holiday DISARM date recited. The Holiday DISARM will not be altered.

**SET HOLIDAY DISARM DATE** Press 9 6 5 plus REARM date. For Example, enter 965 12 26 95 ENTER to set holiday DISARM date to December 26, 1995. The new DISARM date can not be before today's date.



**Note:**

The day-of-week date cannot be entered for a Holiday schedule.

**7.11**

**Enabling the Alarm Ready Schedule Feature**

**CODE 966**

**READ ALARM READY SCHEDULE CONTROL NUMBER** (default: 0) Press 9 6 6 then (enter) to hear the Alarm Ready Schedule Control Number recited. The Control number will not be altered and new REARM & DISARM values will not be calculated.

**ALARM READY SCHEDULE CONTROL NUMBER HAS THE FOLLOWING MEANING:**

- 0 OFF No Alarm Ready Schedules executed. Also used to reset all active Alarm Ready Schedules.
- 1 Only the Weekday Alarm Ready Schedule will be active. (Daily: Monday-Sunday) Default: REARMED everyday 1700 & DISARMED everyday 0800.

- 2 Only Weekend Alarm Ready Schedule will be active. Default: REARM every Friday 1700 & DISARM every Monday 0800.
- 3 Both Weekday & Weekend Alarm Ready Schedules will be active. Default: REARM daily at 1700 Monday-Thursday & DISARM daily at 0800 Tuesday-Friday. REARM Friday at 1700 & DISARM Monday at 0800.
- 4 Only Holiday Alarm Ready Schedule will be activated. Default: REARM at 1700 December 24, 1990 then DISARM at 0800 December 26, 1990
- 5 Both Holiday & Weekday Alarm Ready Schedules will be activated. Default: REARM daily at 1700 & DISARM daily at 0800. REARM at 1700 December 24, 1990 then DISARM at 0800 December 26, 1990.
- 6 Both Holiday & Weekend Alarm Ready Schedules will be activated. Default: REARM every Friday at 1700 then DISARM every Monday at 0800. REARM at 1700 December 24, 1990 then DISARM at 0800 December 26, 1990.
- 7 Holiday, Weekend & Weekday Alarm Ready Schedules will be activated. Default: REARM daily at 1700 Monday-Thursday then DISARM daily at 0800 Tuesday-Fri. REARM every Friday at 1700 then DISARM every Monday at 0800. REARM at 1700 December 24, 1990 then DISARM at 0800 December 26, 1990.



**Note:**

Whenever a new Alarm Ready Schedule Control Number is entered all REARM & DISARM values will be recalculated. Any active Alarm Ready Schedules will be halted and the Verbatim autodialer will be left in which ever REARM/DISARM state it was last in.

## 7.12

### Factory Defaults

Activity	Schedule
Weekday REARM time	1700
Weekday DISARM time	0800
Weekend REARM day-of-week	Friday
Weekend DISARM day-of-week	Monday
Weekend REARM time	1700
Weekend DISARM time	0800
Holiday REARM date	12/24/90
Holiday DISARM date	12/26/90
Holiday REARM time	always same as Weekend REARM time
Holiday DISARM time	always same as Weekend DISARMtime
Alarm Ready Control Number	0 (all schedules disabled)



**Note:**

Both Weekend times are initially the same as their respective Weekday times, but can be reprogrammed.

## 7.13

### Weekday and Weekend Alarm Ready Schedule Programming Example

For the following example assume that personnel are present at a plant being monitored by the Verbatim autodialer during normal business hours, Monday through Friday, 7 A.M. to 4 P.M. Assume further that there is someone at the plant every Saturday from 7 A.M. until 12 Noon and that the personnel would be aware of any alarm conditions at the plant and would not want the Verbatim autodialer to be making calls to phone numbers in its phone number list.

In this example, the Verbatim autodialer should be:

- REARMED every weekday evening at 1600
- DISARMED every weekday morning at 0700
- REARMED every Saturday at 1200 noon
- Stay in the ARMED state until it is DISARMED every Monday at 0700

For the example, use the following steps:

1. Verify that the current time is one of the times when the Verbatim autodialer is DISARMED, i.e.; during normal workday hours. It is important that the time be the current time, since any Alarm Ready Schedule begins with the Verbatim autodialer becoming REARMED and ends with the Verbatim autodialer becoming DISARMED.

If a user were to set up a repeating Alarm Ready Schedule (weekday or weekend) during the time the Verbatim autodialer was to be ARMED, the programmed schedule would not actually begin until the next time that schedule was to take effect. For example, if the current time was 1630 and a weekday schedule was being programmed, that weekday schedule would not actually start until the next day at 1600.

2. Press the PROGRAM key to put the Verbatim autodialer into the program mode.
3. Set the current date and time: (if not already set)
  - a. Enter CODE "941 MM DD YY d" followed by ENTER

Where:

MM = 2 digits for month, DD = 2 digits for date,

YY = 2 digits for year, and d = 1 digit for day-of-week.

- b. Enter CODE "942 HH MM SS" followed by ENTER

Where:

HH = 2 digits for hours, MM = 2 digits for minutes,

SS = 2 digits for seconds.

4. Set the Weekday REARM/DISARM times:

Enter CODE "961 1600 0700" followed by ENTER to set the REARM time to 1600 and the DISARM time to 0700.

5. Set the Weekend REARM/DISARM times:

Enter CODE "962 1200 0700" followed by ENTER to set the weekend REARM time to 1200 and the weekend DISARM time to 0700.

6. Set the Weekend REARM/DISARM day-of-week:

Enter CODE "963 7 2" followed by ENTER to set the weekend REARM day-of-week to Saturday and the Weekend DISARM day-of-week to Monday.

7. Enable both the Weekday and Weekend Alarm Ready Schedules:

Enter CODE "966 3" followed by ENTER to set the Alarm Ready Schedule Control Number to 3 to enable both the Weekday and the Weekend Alarm Ready Schedules.



**Note:**

If the Verbatim autodialer is configured with a local printer, a summary of all of the REARM and DISARM times will be printed.

8. Return to the Normal mode and make sure the Verbatim autodialer is DISARMED.

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# 8

## Maintenance, Testing, and Battery Replacement

Regular testing is the main element of a maintenance program for ongoing Verbatim autodialer reliability. The test should include interrupting AC power to the Verbatim autodialer for at least 4 hours to verify the gel cell battery maintains Verbatim autodialer operation for that time. You may wish to disconnect the phone cord to avoid nuisance calls during the test period.



### *Note:*

The LOBAT light on the Verbatim activates whenever the charge or discharge current for the rechargeable battery exceeds a certain level. If the battery is not fully charged (as following installation or following a power failure) then the charging current will activate the light. If the battery is currently being discharged (as during a power failure) the light will be activated. The LOBAT light does not necessarily warn of a battery wearing out. It should be considered a secondary indication of battery and charger activity.

The gel cell battery is much like a car battery. That is, at the end of its life when called on to deliver power, it discharges very quickly without prior warning. The best protection is to replace the battery every 3 years regardless of any test results.

The battery is a *Power Sonic PS 640, 4 AH 6 volts*

You may order a replacement battery from RACO at the address below:

RACO Manufacturing and Engineering Co.  
1400 62nd Street  
Emeryville, CA 94608

Or from:

Power Sonic, Redwood City, CA; (415) 364-5001

See Section 9.2, "Phone Support Procedures," and Section 9.3, "Returning Parts to the Factory," for more information.

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# 9

## Troubleshooting Tips

### 9.1

### What's The Problem?

#### **Unit is dead: no lights or voice.**

If the unit will not respond to the ON/OFF key, verify that the battery is connected. Verify that there is 120 volts AC between the WHITE and BLACK wire terminals on TS3. Verify that the fuse (1/4 amp slow blow) is not blown.

#### **Unit seems OK but will neither answer nor dial out on phone line.**

This assumes that you hear a voice report at the panel when you press CHECK STATUS. With the NORMAL light lit, test the phone line by pressing DIAL-OUT. The PHONING light should light and you should hear a dial tone.

If you do not hear a dial tone, open the door of the unit and verify that relay K1 is correctly seated in its socket, with its indentation mark facing downward. Check the phone line and its connection with a DC voltmeter and/or a separate telephone handset. Verify the presence of about 50 volts DC between the RED and GREEN conductors on phone line terminal strip TS2. This voltage will drop to just a few volts when the Verbatim autodialer or other connected phone device goes off hook (PHONING light lit).

If you do hear the dial tone after pressing DIALOUT, press the digits of a valid phone number. You should hear the loud clicks of relay K1 (for pulse dialing) or else the tones of tone dialing, as you press each digit. The dial tone should cease after you have entered the first digit. Continue until you have dialed the complete phone number. You should now hear the sound of ringing and someone answering at the other end. End the call by pressing NORMAL.

#### **Unit answers incoming calls, and also goes into alarm when it should and attempts to dial out, but does not reach dialed number.**

First, verify whether the unit is actually attempting to dial out, as evidenced by pulse dialing clicks or tone dialing sounds followed by message recital. If not, then see the separate problem below, "Unit does not go into alarm when it should".

If your unit has previously been programmed for Automatic Tone/Pulse select (via code 917 2 or 917 3) and has been left connected to a phone line for several minutes, then you can assume that the correct dialing mode for your phone line has already been selected. Again, refer below to "Unit does not go into alarm when it should."



If Automatic Tone/Pulse select is programmed OFF (via code 917 0 or 917 1) and you hear the clicks or tone dialing sounds, but the dial tone does not cease, perhaps your phone system requires the opposite mode of dialing (pulse vs tone) from its presently set mode. Read the present mode by pressing PROGRAM 9 0 1 ENTER. Then set the opposite by entering 9 0 1 1 (to change to tone dialing), or 9 0 1 0 (to change to pulse dialing). Then press NORMAL and repeat the manual DIALOUT procedure as described above.

Verify that you have programmed complete phone numbers including any area codes or "1" prefixes that might be required to complete the call.

Consider whether your phone system requires a prefix such as 9 to be dialed, followed by a delay period (to access an outside phone line) before dialing out. If so, see Section 3.2, "Programming Phone Numbers."

### **Unit dials out, but will not answer incoming calls.**

Check programmed ring delay by pressing PROGRAM 9 0 6 ENTER. If it is set for a number larger than one, the Verbatim autodialer is not supposed to answer until the corresponding number of rings has been received. Try setting it back to 1 using code 9 0 6 1 ENTER. If the unit still will not answer incoming calls but is able to dial out, try plugging a regular telephone into the same phone jack in place of the Verbatim autodialer and see if it rings. If the problem is not the phone line, try temporarily connecting test point C to test point D on the main circuit board, for a period of about 5 seconds and see if it "answers" with the PHONING light and a voice report, then call the factory for advice.

### **Unit will not go into alarm when it should.**

This is usually the result of incomplete understanding of how the Verbatim autodialer manages alarms.

For the Verbatim autodialer to go into Unacknowledged Alarm and Dial Out, a violation must be continuously present for the Alarm Trip Delay time. At least one phone number must be programmed. The unit must not be in the DISARMED state. And, the channel that has the violation must not already be in an acknowledged alarm state, since acknowledged alarm status for a given channel (including power failure) precludes further activity on that channel until that status is cleared. Refer to Section 5, "Using Your Verbatim autodialer," for a discussion of how the unit manages alarms.

To clear the acknowledged alarm status of all channels including power failure, starting with the NORMAL light lit, press DISARM/RE-ARM to get the flashing DISARMED indication, then press it again to re-arm the unit with all acknowledged alarm statuses cleared. Now any violations lasting longer than the Alarm Trip Delay will cause unacknowledged alarms and dialing.

Unacknowledged alarm status is indicated by the corresponding channel number flashing. Acknowledged alarm status is indicated by the same light remaining on continuously without flashing.

If you don't observe this, press PROGRAM and then press 7 0 1 ENTER to check your first phone number. Press 9 0 2 to check the Global (overall) Alarm Trip Delay. For the specific channel ZZ (2 digits) that you are attempting to create an alarm on, also press 6 ZZ to check for any longer Individual Alarm Trip Delay setting.

Check the Normally Open/Normally Closed alarm criteria programming for this channel by pressing 5 ZZ. Make sure it is not set for No Alarm or for Run Time Meter, since these settings would not allow an alarm. Now, for example, if the channel is configured Normally Open, you will want to temporarily provide a Closed Circuit at its input to trip the alarm. You can directly read and verify the Open/Closed status you are applying by pressing 0 ZZ 0. You may also use a DC voltmeter to trace your circuit connections. With the Verbatim autodialer turned on, an Open Circuit to a channel contact input reads 5 volts DC with respect to the "C" terminals or electrical ground. A Closed Circuit reads zero volts.

### **Unit keeps calling when it should not.**

Be sure that the initial alarm call is in fact being acknowledged. The unit will specifically state "alarm is acknowledged" at the moment you successfully acknowledge the call. The unit will accept a tone acknowledge only following the prompting warble beep.

Also, be sure that the alarm violation has been corrected. Otherwise, even if the alarm is acknowledged, when the Alarm Reset period times out, dialing will begin again.

Write down exactly what the unit recites when it gives the unwanted call. This provides valuable guidance as to the cause and correction of the problem. You may need to lengthen the Alarm Trip Delay in order to minimize nuisance alarms, particularly the power failure Alarm Trip Delay (code 920). If you hear an alarm message with the phrase "now normal" added at the end, it means that the violation occurred long enough to trip the alarm but has returned to normal by the time you are hearing the report. In the case of power failure, if the power has been restored by the time the message is being heard, the message will be "Power is on". The fact that power is mentioned at all lets you know that there has been a power failure lasting longer than the power failure Alarm Trip Delay. Power will continue to be mentioned in any phone call or front panel status check, until the Alarm Reset time expires.

**Unit is continuously "locked" in on state, or is behaving erratically.**

Environmental factors such as lightning or power surges may have caused program lockup. With the unit turned on, use a screwdriver blade to momentarily connect the two pins on Jumper Block JB5 (see diagram Appendix H, p. H-26).

If this does not return the unit to normal operation, next try jumping the 2 pins on JB3. This latter step will erase all user programming and recorded messages, so all user programming and messages will need to be re-entered.

## 9.2

### **Phone Support Procedures**

**Make sure you have the following before you call:**

- Serial #: Found inside front panel. If you are not at the unit, call the unit up and enter program code 968. This will give you a number that our Customer Support Department can reference.
- Note the unit's symptoms: Exact speech pattern, what it is saying, if it is calling or not. The more specific and accurate you are in describing the symptoms, the quicker the Customer Support Department will be able to diagnose and troubleshoot the problem. In many cases, it may save a return to the factory.

**THEN** call 1-800-449-4539 for Customer Support.

If the Customer Support determines that the unit needs to be sent to the factory for repair, you will be given a Return Materials Authorization (RMA) number.

## 9.3

### **Returning Parts to Factory**

**Pack all parts well!** To avoid extra charges, return any removed chips card guides or daughter boards to the factory at the address below:

RACO Manufacturing and Engineering Co.  
1400 62nd Street  
Emeryville, CA 94608

**Remember to:**

- Put return address on package.
- Include a packing slip.
- Have serial # and RMA # handy when you call in for tracking.





# A

## Verbatim Series SFP Autodialer

The following is an instruction supplement for the Verbatim Series SFP autodialer. This supplement describes differences between the Verbatim Series SFP, and the Series VSS.

The Series SFP is a modified Verbatim autodialer which omits the front panel keypad and some of the front panel LED indicators. The primary practical difference between the two models is that the programming for the Series SFP must be done over the phone, whereas programming for the Series VSS may be done over the phone or at the front panel.

The enclosed diagram of the front panel of the Series SFP (p. A-2) replaces the Series VSS diagram on page 2-5 of this manual. A supplemental diagram of the inside view of the front door panel (p. A-3) is also enclosed, showing the location of the ON/OFF switch.

The practical differences to consider in programming and using the Series SFP are explained below.

### A.1

## Programming the Series SFP from a Remote Telephone

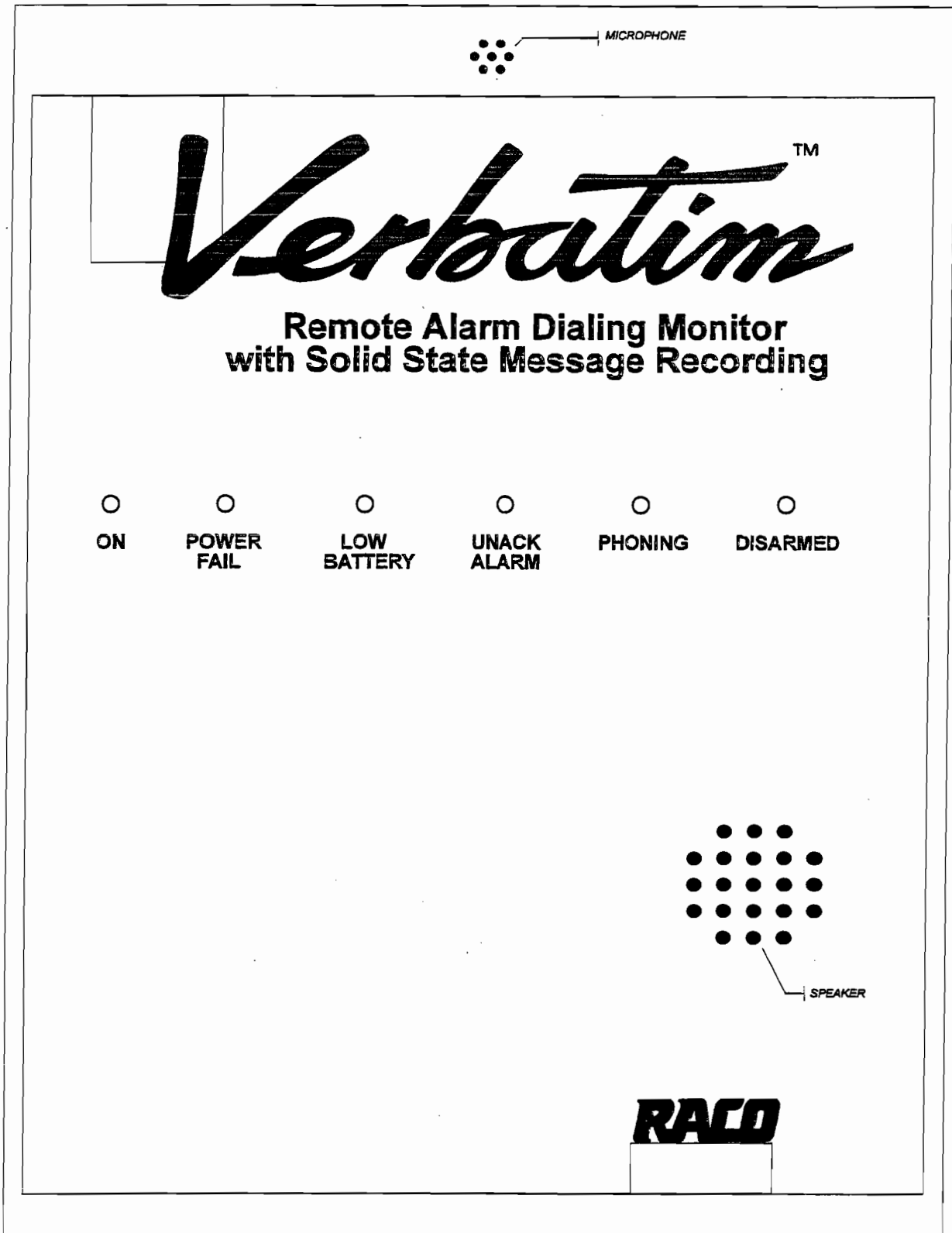
All programming of the Series SFP Verbatim autodialer is done from a remote Touch Tone telephone. This method of programming the product is described in Section 5.7 of this manual, and it is also more briefly referred to at other places in the manual such as Sections 4.2 and 4.3. With the Series SFP, this is the sole applicable means of programming. Therefore an "advance" description of over-the-phone programming follows.

When you call the Verbatim from any Touch Tone telephone, it will answer and begin reciting its message. At the end of each round of messages, you will hear a warble tone. If you press a command tone "1" immediately following this tone, you will the Verbatim autodialer will then be in Program Mode, and you will be prompted to enter a program code.

A chart listing the program codes is located in Section 6.1 of this manual. This section also includes some guidelines for using the program codes, and a more complete description of the programmable items is located in Section 6.2.

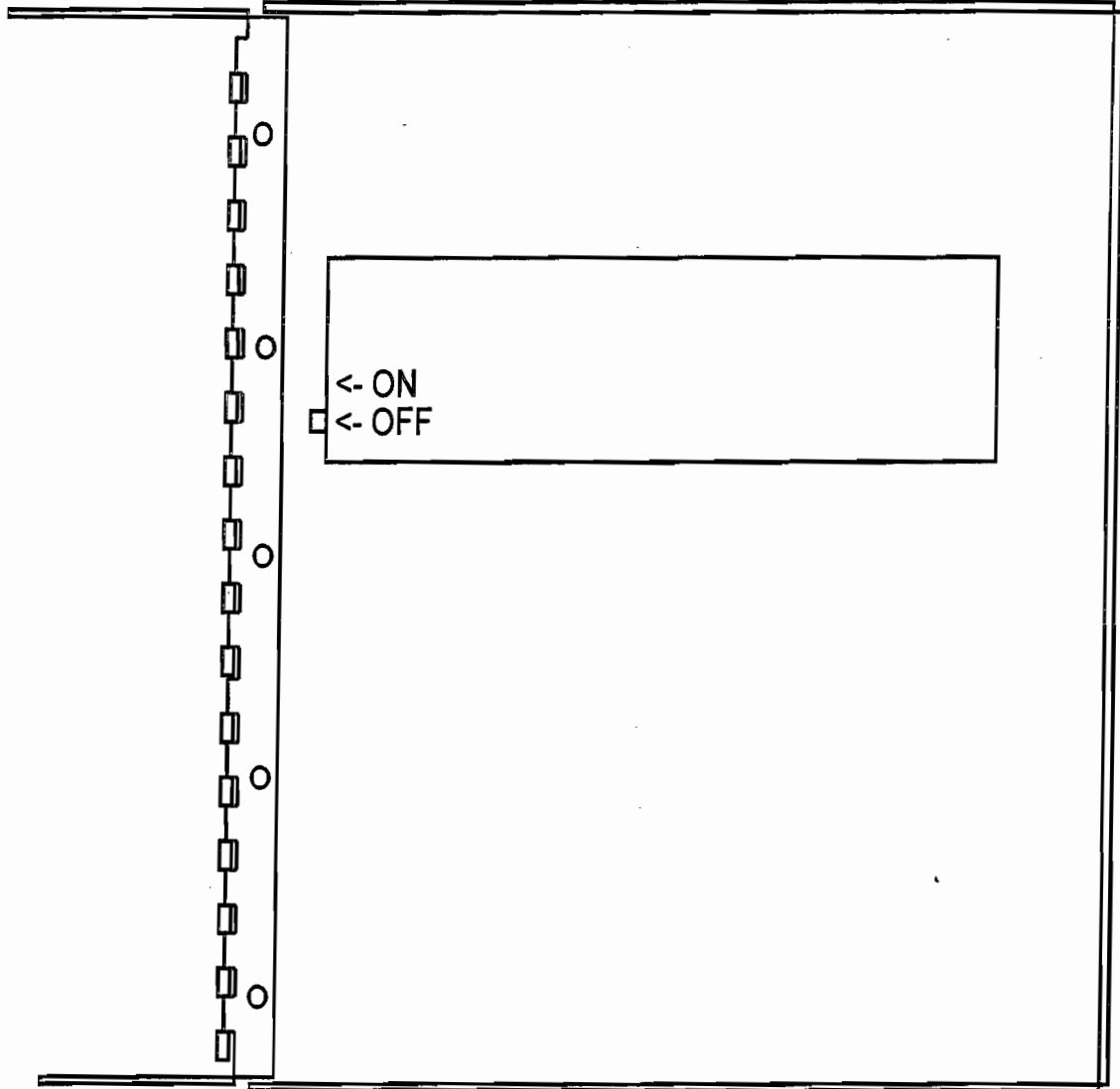
Program code entries generally consist of three digits, which may or may not be followed by additional followup values, before you complete the entry by pressing the # key twice. You will hear a spoken confirmation of each numerical tone digit as you issue it. There is no spoken response to the # or \* key.

*Verbatim Series SFP Front Panel Diagram*



\* A discharged battery may take up to a day to fully charge. \*\* During AC power failure, all illuminated LED's will flash to conserve battery power. Meanwhile, light may remain on.

*Verbatim Series SFP Inside Front Panel ON/OFF Switch*



Inside view of front panel, showing ON/OFF switch



**Note:**

The procedure of pressing the # key twice, is to be used in relation to all references throughout this manual to the term, "ENTER."

In general, if you enter just the three tone digits followed by ##, you will hear the present setting or value for that program item. If you include additional values before the ##, the new value will replace the existing setting or value. In either case, the voice report will provide confirmation of the updated program setting or value.

Sometimes there is need to include a decimal point or a minus as part of a value entry. Also, if you make a mistake as you are issuing tone digits, you will want to cancel the entry. The conventions for these functions are as follows:

CANCEL	**
ENTER	##
POINT	*
MINUS	#

To end a phone call after programming, press ## without any prior tone digit. The Verbatim autodialer will then issue a prompting warble tone which is an opportunity to re-enter a "1" if you did not really want to end the call. It will then say, "Goodbye," and end the call.

Refer to Section 5.7 for a description of the other command tones that may be used in place of the "1" for special purposes.

**A.2****Programming and Testing**

The following sections provide a sequential reference to this manual regarding the relevant differences and similarities in instructions for the Verbatim Series SFP.

**A.2.1****Resetting (Clearing) the Unit****Caution:**

The following step erases all user programming including recorded messages so normally it is done only at initial setup.

Turn the unit on if it is not already on, via the switch at the rear of the front panel door. From a touch tone telephone, place a call to the phone number of the unit, and at the sound of the warble tone, issue a command tone "1" as described above.

To clear the system of all programming, in program mode as described above, issue:

9 3 5 9 # #

As always, if you make an error in issuing tone digits, press \* CANCEL and start again.

## **A.2.2 Programming Phone Numbers**

Essentially the same as Section 3.2 in this manual.

## **A.2.3 Programming Input Channels**

Essentially the same as Section 3.3 in this manual.

## **A.2.4 Initial Testing**

Temporarily place all input signal sources into their alarm state, long enough to satisfy the alarm trip delay. The unit will begin dialing the first phone number, perhaps before you have managed to get all the inputs into an alarm indication state. You should hear the a dial tone and then the sound of ringing, and then the sound of someone answering the call. Testing consists in verifying that the call is actually received at the first phone number, and that all the alarm messages are recited.

Your Verbatim Series SFP autodialer is now able to operate, having at least one dialout phone number programmed, and having its input channels configured. However, you may wish to record your own voice messages (Section 4) or perform special advanced programming items (Section 6) before referring to Section 5 on using your programmed Verbatim Autodialer.

## **A.3 Recording Messages In Your Own Voice**

Essentially the same as Section 4 in the Owner's Manual, but following the guidelines for over-the-phone programming and recording.

## A.4

### Using Your Programmed Verbatim Autodialer

Section 5.7 is largely replaced by the discussion in Section 4 regarding over-the-phone programming, except for discussion of the alternative command codes "2," "3," "4," and "0."

Disregard Section 5.8.

## A.5

### Remainder of the Manual

All other descriptions in this manual may be followed and applied to the SFP with no practical limitations.



#### *Note:*

The lack of front panel programming has specific impact on some minor aspects of specific programming items, as follows:

- ◆ **CODE 910:**

**SECURITY ACCESS CODE** No Security Access Code may be programmed since this could only be programmed from the front panel keyboard.

- ◆ When a delay between dialing digits is needed (as for pager applications), it will only be possible to insert one delay period, since this is done over the phone by pressing the # key, and if this were pressed more than once in succession it would be interpreted as a Cancel Entry command. Therefore to get the length of delay desired, use 928 to extend the duration of the single delay from its default value of one second, to whatever value is needed.

- ◆ **CODE 926:**

**EXIT DELAY FUNCTION** The Exit Delay function is not applicable in the absence of the front panel keyboard.

- ◆ The Speakerphone/Dialout function is not applicable in the absence of the front panel keyboard.
- ◆ There is no Parallel Printer Output.

- ◆ The speaker and microphone are present. However the microphone is limited to the function of optionally "listening in" since voice recording must be done via remote telephone.
- ◆ The On/Off function is controlled via the slide switch inside the front panel door. See diagram on page A-3 .

## A.6

### **Enhanced Telephone Interface Features**

The manual Section entitled, "Enhanced Telephone Interface Features," is generally applicable except that there is no front panel indication for telephone line failure.

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# B

## Analog Signal Input

### B.1

#### Analog Connections

Refer to the diagram (page B-10) showing the VAN analog boards for connection of analog inputs. Be sure you follow the indicated positive and negative polarity indications, except in the case of TS705 temperature sensor inputs, for which positive and negative polarity does not matter. Two signal wires are required for each input. The terminal blocks can be unplugged for convenience. Because of the space constraints, it is best to use small gauge wire like telephone wire. If bulkier wire is needed outside the dialer, it is best to install a terminal strip outside the dialer to make the transition from the bulkier wire to the more compact wiring going into the analog input connection points.



#### *Note:*

Take care to route the incoming signal wires to one side of the enclosure or the other so that they do not interfere with the front panel circuit board when the unit's door is closed. Also, try to route the analog signal wires away from power wiring to minimize noise pickup.

### B.1.1

#### Programming for Analog Channels

Each analog input will need to be programmed to specify:

1. The analog Input Signal Type (if other than standard 4-20 ma input).
2. The numerical value to be spoken at a corresponding minimum signal level.
3. The numerical value to be spoken at a corresponding maximum signal level. Items 2 and 3 amount to programming the translating scaling factors for each analog input.
4. In many cases you will also want to program high and low setpoint limits for each analog input.
5. You may also elect to replace the generic default voice message with your own recorded messages for any analog channel, as described in section 4.

## B.1.2

### Assignment of Input Channel Numbers

The unit automatically assigns the lowest channel numbers to whatever number of contact input channels exist on the unit (whether or not you are using them) and the analog channels are assigned channel numbers beginning with the next available number.

For example, the first analog input on a unit with 24 contact inputs and 16 analog inputs would be "channel 25" and the last analog input would be "channel 40". Note that since the unit's maximum LED display capacity is a total of 32 channels, on such a unit the final 8 analog channels would not have corresponding LED status indicators on the front panel. Further, note that on units with remote channels, the LED display may group inputs into a single indicator.

It is important that you have correctly determined the channel number assigned for each analog input channel before performing the following programming steps.

## B.1.3

### Programming the Input Signal Type

(You may skip this step if you are using 4-20 ma inputs).

The analog inputs are very flexible and can accommodate a variety of Input Signal Types, but the unit needs to know which type each input is being used for a given analog input. Note that in addition to programming the Input Signal Type, the physical component configurations on the VAN plug-in circuit card must match the Signal Type used. Normally this will have been handled in the process of ordering the unit and will not require additional user attention. If there is any doubt about this, refer to the markings on the rear of the VAN circuit board. If there is still any question, refer to the markings you find and also your unit's serial number, when contacting the factory.

- ◆ To program the Input Signal Type for input channel ZZ:

5 ZZ 7 N ENTER

where ZZ is the two-digit channel number, and N is a single digit as follows:

- 0 for a 4-to-20 milliamp current loop input. This is the default setting, so if your inputs are 4-20 milliamp current loops, you may skip this step.
- 1 for 0 to 1 volt DC signal input. In the case of larger signal levels, such as 0 to 10 volts DC, the hardware input circuitry on the VAN card will have been factory configured to pre-scale the signal to a range within 0 to 1 volt DC, and corresponding special scaling information will be provided to fit the particular application.

- 2 for a Raco Temperature Sensor input (sensor model TS705A), used to measure temperatures from -20 to +120 degrees F.
- 3 for additional types of special custom-specified signals.

---

**Summary of Codes for Input Signal Type**


---

0 (default)	4-20 ma current loop
1	0-1 volt DC
2	Raco temperature sensor
3	Other special inputs

---

**B.1.4****Programming the Scaling and Offset Factors**

This set of steps is not necessary for inputs using a Raco Temperature Sensor, since these values will be automatically inserted if the parameter 2 is selected in the above step.

In the above step, accepting the default parameter of 0 for 4-20 milliamp inputs automatically provides for a spoken reading of 0.0 percent for the minimum (4 ma) signal input value, and 100.0 percent for the maximum (20 ma) signal, until you enter different factors.

In most cases, you will want to program the unit to give spoken reports in terms of the actual physical variables being monitored, such as water level in feet, etc. In general, you will need to determine the desired spoken numerical values corresponding to two widely separated (low end and high end) signal input values. Often this will be available from the overall system specifications. In other cases, this will be determined (or revised) based on actual on-the-spot observations. The Verbatim Autodialer offers the unique option of entering this scaling information based either on your particular system specifications (the System Specification method) or else on your real world observations (the Real World Method). Also, scaling information which you may have originally entered based on your system specifications may later be easily "fine tuned" based on real world observation.

In addition, you may wish to record your own identifying message to replace the default message, as described in the message recording section of the manual.

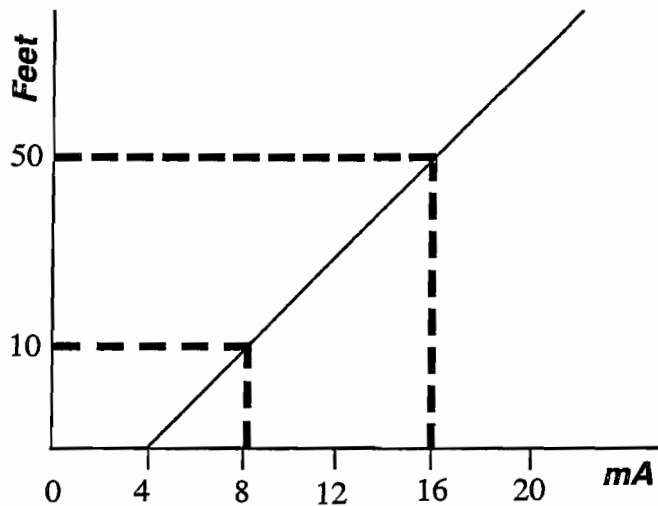


## B.1.5

**Additional Perspective on Scaling Factors****Analog Math**

It may be useful, in comprehending the process of establishing the scaling factors, to visualize a graph which relates the water level in a tank to the input from a 4-20 ma transducer. To establish the relationship on such a graph, it is necessary to define two separate points, or coordinate pairs ideally at two widely separated points on the graph. For such a linear relationship any point on the "reading" (Y) may be calculated from the formula:

$$y = mx + b$$



where  $m$  is the gain and  $b$  is the zero crossing point or Input (ma  $\rightarrow$  offset). The gain may be calculated from:  $m = (y_2 - y_1) / (x_2 - x_1)$

where  $x_1, y_1$  is one coordinate pair on the graph and  $x_2, y_2$  is the other.

Therefore, when you have chosen to enter non-default coordinates you are in fact setting the gain factor. This gain factor is taken along with the input signal type you have chosen which will define both the gain and offset.

Notice that each of the two points requires two separate coordinate pieces of information to define: the signal level and the corresponding water level. With two such points defined, an entire line or linear equation is defined, so that given any new signal level, we could use the graph to "look up" the corresponding water level. In operation, the Verbatim autodialer measures the signal level presented to it, and then calculates the corresponding physical value, all based on the line or linear equation defined by your entry of the high end and low end scaling information whether done by the System Specification Method or the Real World Method.

Be sure that the correct Input Signal Type setting is entered as described above, because changing the Signal Type setting will overwrite the programming described next.

### **System Specification Method of Programming Scaling Factors**

*The following four codes must be entered to invoke scaling:*

- ◆ For the low-end portion of the data for channel ZZ, enter the following pair of codes:

5 ZZ 1 X.XXXX ENTER

where X.XXXX is the low input signal value chosen, within the bounds of input signal type.

5 ZZ 2 YYY.YYYY ENTER

where YYY.YYYY is the desired spoken numerical value

- ◆ Then to complete the scaling factors for this channel, enter the following pair of codes for the high-end portion of the data:

5 ZZ 3 X.XXXX ENTER

or

5 ZZ 3 POINT ENTER

for the high-end signal value

5 ZZ 4 YYY.YYYY

for the high-end corresponding spoken value



#### **Note:**

For all analog value entries you may enter up to four digits before an optional decimal point, and up to four digits after, but simple entries (such as -20, 3.45, 500, 4, etc.) work as well.

### **Alternative Real World Method of Programming Scaling Factors**

If the system specifications for the scaling factors are not known, or if you wish to adjust a previous entry to reflect real-world as opposed to system specification conditions, wait until the input signal or the physical variable happens to be near the low end of the scale. Enter the following pair of codes:

5 ZZ 1 POINT ENTER

which will automatically accept the present moment signal value as the low input signal value, rather than having to enter the value shown as X.XXXX above. Then, enter:

```
5 ZZ 2 YYYY.YYYY ENTER
```

where YYYY.YYYY is the corresponding low-end physical value which you observe in real-world terms.

At another time, when the signal or physical variable is toward the high end of the scale, enter the following pair of codes:

```
5 ZZ 3 POINT ENTER
```

which accepts the present signal level as corresponding to the high-end physical value which you enter as:

```
5 ZZ 4 YYYY.YYYY ENTER
```

*Example:*

It may already be known from your system's specification that for channel 6, a low-end signal of 4 milliamps corresponds to a desired spoken value of 34.5 feet of tank water level. In such a case, you would use the System Specifications Method to enter:

- ◆ for 4 milliamps  
5 06 1 4 ENTER
- ◆ for a spoken reading of 20.5  
5 06 2 20.5 ENTER
- ◆ for 20 milliamps  
5 06 3 20 ENTER
- ◆ for a spoken reading of 34.6  
5 06 4 34.6 ENTER

Then, suppose with the system in operation, you observe that the tank level is 31.7 feet, but the Verbatim reports a value of 31.45 feet. The discrepancy will most likely be due to a discrepancy of the sensor's actual output versus the theoretical system specification. Regardless, to correct for it, keeping in mind that the signal is presently near the high end of the scale, you would use the Real-World Method, entering:

- ◆ To reference the present signal level  
5 06 3 POINT ENTER
- ◆ To recalibrate 31.7 as the corresponding spoken value  
5 06 4 31.7 ENTER

Continue the example, there might also be a discrepancy toward the low end of the scale. Suppose on another day you observe a tank level of 22.5 feet but the Verbatim report 2293 feet. Since this signal is at the low end of the range, you would enter:

```
5 06 1 POINT ENTER
```

and

```
5 06 2 22.5 ENTER
```



**Note:**

These Real-World Method adjustments did not require you to measure any actual signal levels!

From that time on, assuming that the sensor maintains its calibration and has a linear output, the spoken value should track the actual value very closely. The Verbatim itself is much more accurate and consistent than almost any sensor available to connect to it. Note that the signal does not need to be exactly at the end of its range (e.g. 4 ma or 20 ma) for these programming steps. However, in general the wider the spread between the signal levels used, the better informed the Verbatim will be to reflect the actual relationship between the sensor's output and the real value being measured.



**Note:**

While the unit reports with very high accuracy and resolution, you do not need to enter your programming value to the same high degree of accuracy unless you choose to.

### For TS705 Temperature Sensor Inputs

Selecting signal type "2" (TS705 sensor) will automatically load scaling factors as describe earlier. However, these automatically loaded scaling factors are not adjustable. If you want to be able to do Real World calibration adjustments for temperature sensor inputs, then instead of selecting sensor type "2", select sensor type "1" (0-1 VDC input) and enter scaling factors as follows:

```
5 ZZ 7 1 ENTER (Selects signal type 1)
```

```
5 ZZ 1 .843 ENTER
```

```
5 ZZ 2 -19.8 ENTER
```

```
5 ZZ 3 .316 ENTER
```

```
5 ZZ 4 120.1 ENTER
```

This gives the same scaling factors as would otherwise automatically result from selecting signal type 2, but it allows for subsequent adjustments using the Real-World adjustment method.

## B.1.6

### Programming High and Low Analog Setpoints

You should first enter the gain, offset and scaling factor programming described above before entering setpoints. Later, if you adjust the factors as described above, you may also need to adjust the setpoints correspondingly. Changing setpoint values after scaling is set could cause changes in the scaling values.

- ◆ To program a low limit setpoint for channel ZZ, use code:

5 ZZ 5 X.XX ENTER



#### Note:

X.XX is the desired setpoint in terms of spoken units, rather than in terms of the signal value. You do not need to enter all four possible leading and trailing digits. Simple entries like 7 and 3.68 work as well.

- ◆ To program a high limit setpoint for channel ZZ, use code:

5 ZZ 6 X.XX ENTER

Thereafter, whenever the measured value exceeds the setpoint for a continuous period exceeding the alarm trip delay, the unit will go into unacknowledged alarm and begin dialing to report the specific violation, also reporting the current measured value. As with contact inputs, if the input is no longer in violation at the moment of the report, the phrase "Now Normal" will be appended to that channel's report.

- ◆ To check an existing setpoint value, use the above codes but omit the value (X.XX).
- ◆ To turn off (completely disable) an unused analog channel so that it will not be included in status report, enter code:

5 ZZ 0. ENTER

where ZZ is the 2-digit channel number.

- ◆ To turn the channel on again, you must enter some high or low setpoint value for that channel.
- ◆ To turn off (disable) a high or low analog setpoint, while still leaving the channel able to report readings, enter a setpoint value of -0 for that particular setpoint. If you try to enter a setpoint value outside a wide signal range, the Verbatim will say "Error in number."



### Note

The scanning time required by the unit to check all analog readings against established setpoints increases with the number analog channels. With 16 channels, the time can total on the order of one second, and this imposes a limit on how fast the unit can detect analog setpoint violations. Normally, this will not be noticed unless you set Alarm Trip Delays of less than two seconds, and there is no effect on the trip delay for contact channels in any case.

Refer to the following section for recording the corresponding voice messages other than the spoken numerical values.

## B.1.7

### Summary of Analog Programming Codes

Code	Description
<b>Signal Type:</b>	
5 ZZ 7 N	Select input signal type. 0 is default for 4-20 ma
<b>Scaling:</b>	
5 ZZ 1 X.XX or POINT	Low end signal value
5 ZZ 2 YYYY.YYYY	Corresponding low end spoken value
5 ZZ 3 X.XX or POINT	High end signal value
5 ZZ 4 YYYY.YYYY	Corresponding high end spoken value
<b>Setpoints:</b>	
5 ZZ 5 X.XX	Low alarm limit setpoint
5 ZZ 6 X.XX	High alarm limit setpoint
5 ZZ 5(6) -0	Disable low (high) setpoint
<b>Disable Channel:</b>	
5 ZZ 0	Turn off (disable) channel ZZ

## B.1.8

### Recording Speech Messages for Analog Channels

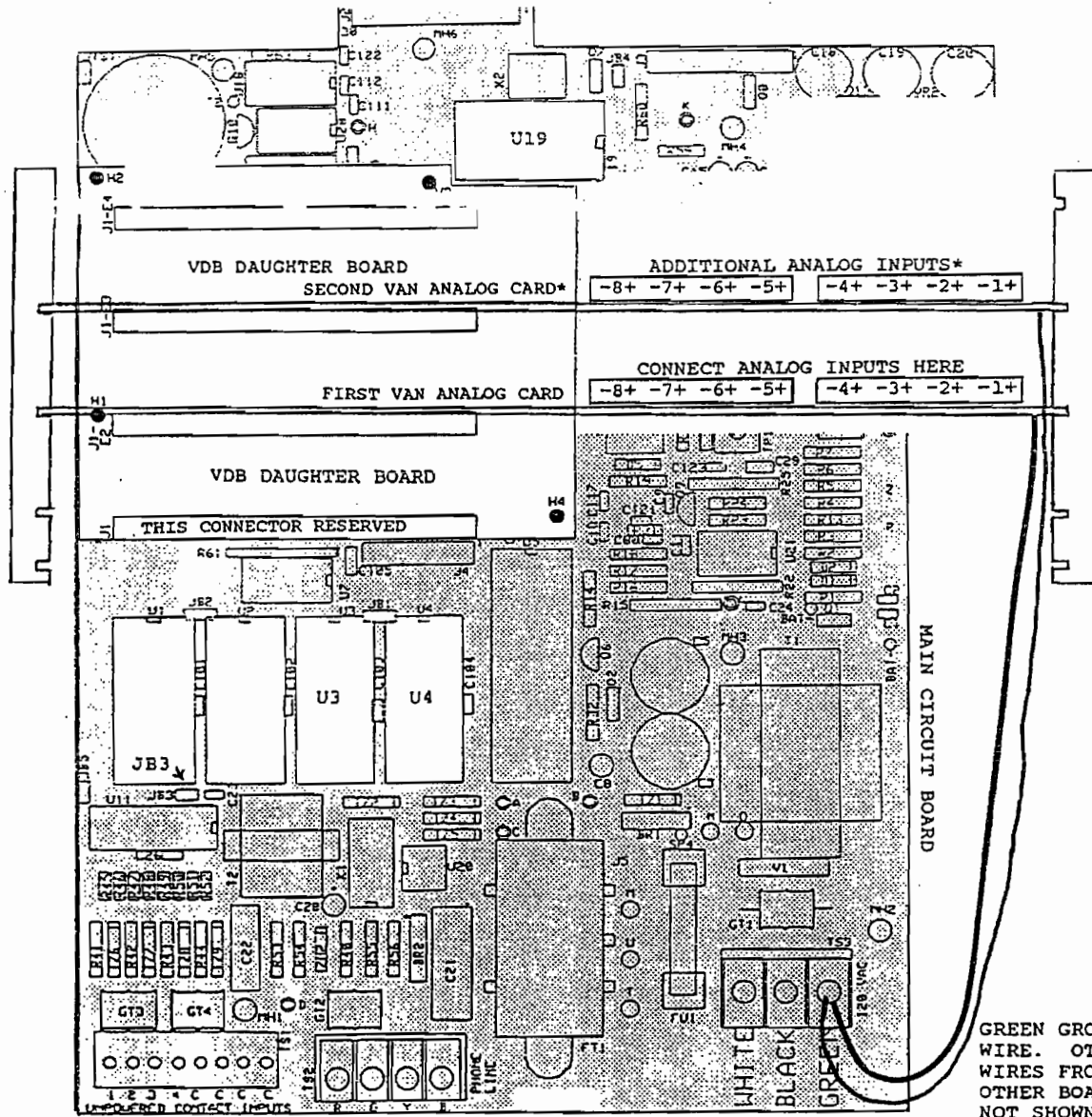
This information supplements the basic information in the manual on recording speech messages. Refer to that information before attempting to record any speech messages.

**For analog input channels**, the default message is “The present channel N reading is ...”

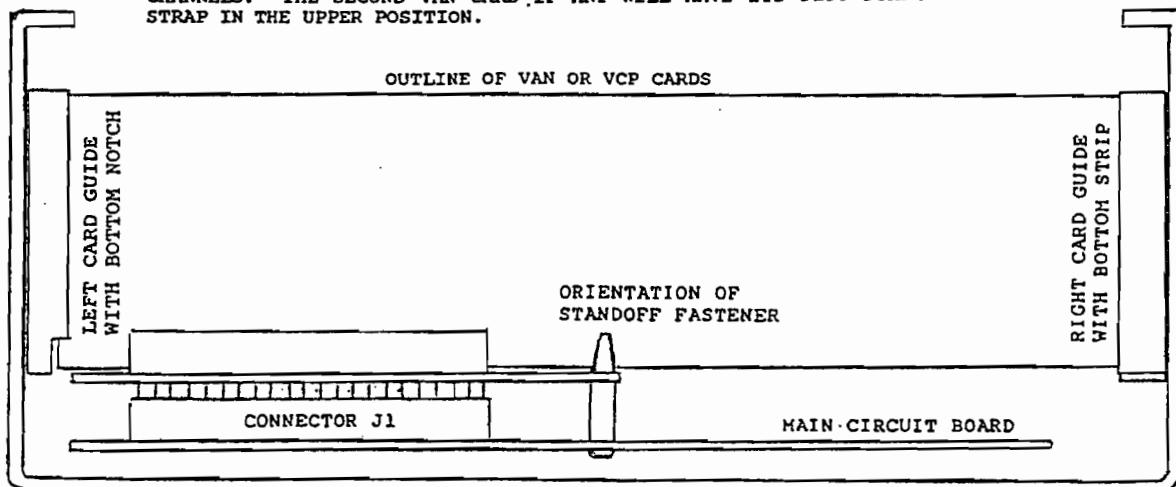
**For any analog inputs**, in place of the default messages you may plan to record a preamble message of the general form “The total water flow in gallons is” or “the main tank water level in feet is.”

Use program code 1 ZZ to record the analog preamble message.

# Analog Signal Input



\*UNITS EQUIPPED FOR 16 ANALOG CHANNELS WILL REQUIRE 2 VAN CARDS. THE SECOND (UPPER) CARD WILL BE FOR THE HIGHER NUMBERED ANALOG CHANNELS. THE SECOND VAN CARD IF ANY WILL HAVE ITS JB50 JUMPER STRAP IN THE UPPER POSITION.



## **B.1.9 If Analog Inputs Do Not Work Correctly**

Recheck programming settings, especially the Input Signal Type setting. Verify that the polarity of your input connections is correct.

In the case of 4-20 ma input, does the spoken value always reflect a 0 ma signal level? If so, the problem is presumably with the connection or the signal source. Use a DC meter to verify that both sides of the offending input are within 10 VDC of ground. A 4-20 ma current loop input should give a meter reading of about .07 volt per milliamp of current as measured across the two signal input terminals.

Are other instruments included in the same current loop? If they read correctly, temporarily disconnect the input to the Verbatim Autodialer. This should throw the readings of the instruments off scale. If there is no such effect, your wiring is not including the Verbatim autodialer in the loop. Verify that the type of signal source agrees with the physical configuration on the VAN card according to the marking on the back of the card.

## **B.1.10 Troubleshooting Analog Grounding Problems for Verbatim Analog**

The most common analog signal type in use in the Verbatim marketplace is current loops, wherein the signal is a controlled DC current ranging from 4 to 20 milliamperes.

The loop consists of a current transmitter (consisting of a transducer and a supporting power supply which may or may not be packaged into one unit), and one or more receiving devices which measure and respond to the current signal they detect on the loop. The power supply voltage is typically 24 volts DC.

The terms "transducer" and "transmitter" are used interchangeably. The transmitter's job is to ensure that the current level accurately reflects the physical parameter which the transducer is measuring (typically a pressure or liquid level), regardless of what impedance it sees in the loop.

In order to do this, it presents whatever voltage across its terminals is needed to achieve the correct current flow. This voltage must be great enough to accommodate the total resistance in the loop. The typical resistance contribution presented by each receiving device is 250 ohms. However, the DC resistance presented by the Verbatim analog inputs is around 70 ohms (49.9 ohm precision resistor plus two 10 ohm surge standoff resistors).

In theory, all elements in the loop are isolated from any connection to electrical ground. This is intended to eliminate concerns about errors in the signal caused by conflicting ground or other conflicting connections.



In practice it is not unusual to have some element of the loop in fact tied to ground or to some other voltage source away from ground -- or if not directly tied, at least limited in its ability to depart from the ground or other voltage. As long as only one element in the loop is so committed, there is no problem since the other elements can freely accommodate as needed.

The Verbatim has its own limitations in this respect. It can only accommodate a departure from ground voltage potential, of 8 volts nominal, before its protective tranzorbs begin to conduct and clamp the signal. Such clamping when in direct conflict with some other voltage commitment in the loop, will not only cause incorrect readings by the Verbatim, but also cause the other elements in the loop to read and respond incorrectly.

This ability to accommodate departures of both sides (positive and negative) or the analog signal input, is called the common mode input voltage range. A truly isolated input would have as much common mode input voltage range as the voltage limitation of the isolation, typically over 1,000 volts.

The reason we do not provide isolated inputs is because it is bulky, and expensive to achieve accurate translation across the isolation barrier. Also, these days there has been a large shift to transformer and capacitive coupling schemes to achieve DC isolation, but these provide almost zero protection against the fast rise time transients induced by lightning. So, we need to be able to troubleshoot when a customer places one of our analog inputs into a current loop where there is another conflicting voltage commitment.

When this problem occurs, the customer will typically report that his loop works but is thrown off when our analog input is placed in the loop. Sometimes the disturbance takes the form of not just altering the DC current but causing parasitic oscillations in the loop. It may not be easily discernible whether the disturbance is or is not taking the form of a parasitic oscillation. Regardless, temporarily ungrounding the dialer or unplugging the analog card, will usually eliminate the disturbance.

The procedure for troubleshooting and correction of this problem is generally as follows: First we need to find out as much as we can about any preexisting, conflicting voltage commitments. To do this, have the customer unplug the card or unground the dialer so that the loop is not disturbed, and then use a voltmeter to check both the AC and the DC voltage readings at each node around the loop, with respect to electrical ground.

We hope there is not much AC signal present. If there is a strong enough AC component on top of the DC voltages, there will be disturbance to the extent that the peak level in the AC waveform exceeds the common mode input limitation of our analog input. In such a case the cause of the AC component of the signal needs to be found and eliminated, if the following procedure does not lead to a good result.

However, it is possible and even likely, that an observed AC signal is merely a "softly" induced hum that holds no sway when it meets any clamping introduced by our analog input. With this in mind, it may be best to defer even taking AC reading until after the DC oriented methods have proven unsuccessful.

With the main focus being the DC voltage readings, we are looking at some point on the loop that is much less than eight volts DC away from ground, and that is where the Verbatim input should be relocated in the loop. Chances are good that the Verbatim had previously been placed at a point on the loop well away from ground potential and that the relocation will end the problem.

An added step that may be useful in addition to the two sets of voltage readings (AC and DC), especially if the voltage readings seem to be erratic, is to have the customer use a jumper wire to temporarily connect some candidate point in the loop to electrical ground, and observe whether the loop is disturbed by this temporary grounding. If it is not, that is a good place to locate our input in the loop. In fact, this approach can be used without taking voltage readings at all. But if it does not work, then we do want the voltage readings in order to best understand what is going on.

Occasionally, something in the loop will cause there to be no available point in the loop that is close to ground potential. In such cases, if this cannot be changed, then the customer will need to install an optical isolator between the loop and our inputs. The customer may be referred to: Action Instruments, San Diego, CA, (619) 279-5726. Isolators cost \$300 per loop.

2

1

# C

## Remote Supervisory Control Output

### C.1

### Remote Supervisory Control (VRSC) Output Installation and Operation Instructions

This option allows you to turn connected equipment on and off from any remote Touch Tone telephone, or from a non-Touch Tone telephone with the use of a portable tone generator. Option VRSC-4 provides 4 outputs, VRSC-8 provides 8 outputs. The unit's voice guides and confirms your operations. Advanced features such as programmable length momentary activations are included. Control operations may also be performed from the unit's keyboard.

Connections are normally made by means of optically isolated solid state relays housed in a separate Output Relay Enclosure which requires its own 120 VAC power connection. In some situations, the user may choose to make connections directly to the transition outputs within the main unit.

If your unit was not originally equipped with this option, refer to the separate instructions for adding this option.

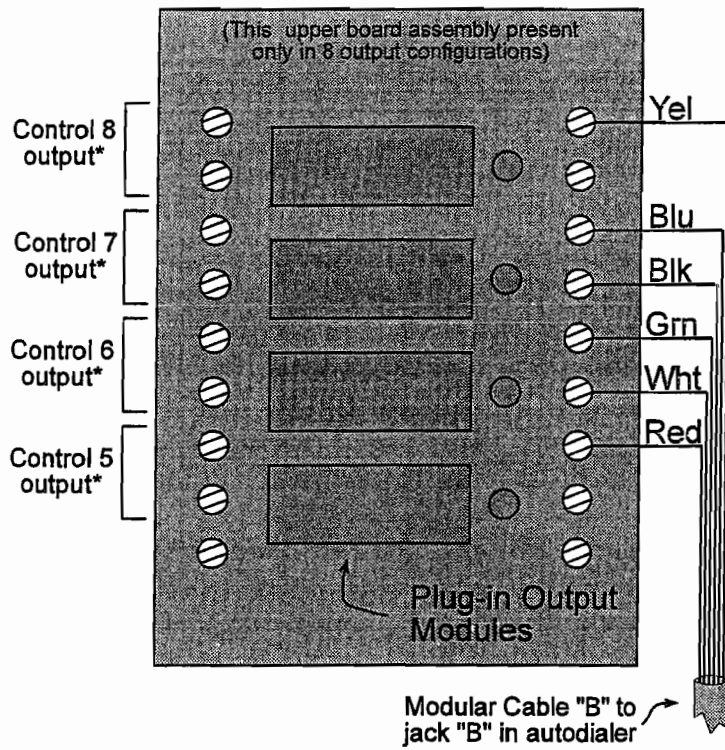
### C.1.1

### Mounting and Wiring Connections for Remote Supervisor Control

If you are using the separate Output Relay Enclosure normally supplied with this option, mount the enclosure within 3 feet of the Verbatim Autodialer, and make your output connections to the left hand row of terminal strip points within the separate enclosure, as shown in the diagram of the VRSC Output Relay Enclosure. Be sure that the correct type of plug-in Opto 22 relays are in place. The available types are:

Type	Value
OAC5	12 to 140 VAC, 2 amps
OAC5A	24 to 280 VAC, 2 amps
OAC5A5	120/240 volt AC, Normally Closed
ODC5	5 to 60 VDC, 2 amps
ODC5A	5 to 200 VDC, 2 amps
ORR 5	Reed relay dry contact output

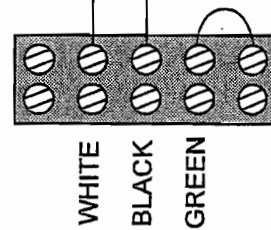
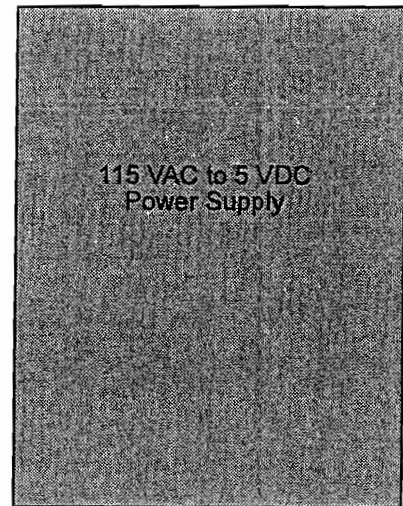
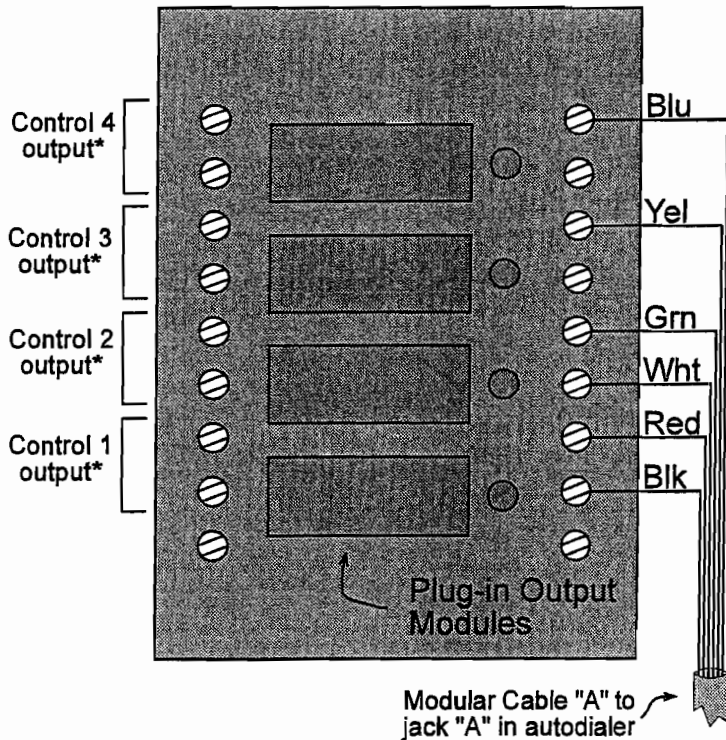
RSC Supervisory Remote Control Output Box Diagram



**OUTPUT MODULE TYPES:**

OAC5	12 to 140 VAC, 2 amps
OAC5A	24 to 280 VAC, 2 amps
ODC5	5 to 60 VDC, 2 amps
ODC5A	5 to 200 VDC, 0.67 amps
ORR5	Reed Relay Output

\* If DC output modules are used, the lower terminal is the positive terminal, for each control output.



Connect 120VAC here

Unless ordered otherwise, type OAC5 is normally provided from the factory. Connect 120 VAC power as shown on this same diagram. Route modular "Cable A" through one of the entrance holes on the bottom of the Verbatim Autodialer, and plug it into J301 (the right-hand jack on the VCP circuit card, see diagram). The 8-output VRSC-8 option also includes a second modular "Cable B", connect this to the adjacent jack J302 on the VCP circuit card. Avoid routing these cables alongside power wiring and route them so that the front panel circuit board does not pinch them when the door is closed.

### C.1.2

#### Optional Direct Connection Without Use of Output Relay Enclosure

The outputs on the VCP circuit card are NPN transistor open collectors capable of switching up to 12 volts DC at up to 500 ma, and thus these outputs may in some cases be connected directly to logic inputs of logic controllers, etc, although external pullup resistors may be required. Consult Racal for details. The color codes for VRSC cables "A" and "B" are:

Cable	Color Code
<i>Cable A</i>	
Common Return	Black
Output # 1	Red
Output # 2	Green
Output # 3	Yellow
Output # 4	Blue
<i>Cable B</i>	
Output # 5	Red
Output # 6	Green
Output # 7	Blue
Output # 8	Yellow

### C.1.3

#### Remote Supervisory Control Operation

- ◆ To check the on/off status of output # N, use program code

9 5 N ENTER

where N is a 2 DIGIT output number (e.g. 01 for output # 1).

- ◆ To turn output # N ON, use program code

9 5 N 1 ENTER

- ◆ To turn output # N OFF, use program code

9 5 N 0 ENTER

- ◆ To turn output # N on for a specific number of seconds, use code  
9 5 N 2 XXXXX ENTER  
where XXXXX is the desired number of seconds, from 1 to 99999.
- ◆ To turn output # N off for a specific number of seconds, use code  
9 5 N 3 XXXXX ENTER  
where XXXXX is the desired number of seconds, from 1 to 99999.
- ◆ To establish a default pulse time duration in seconds for a given output N (2 digits), use code  
9 5 N 9 XXXXX ENTER  
where XXXXX is 1 to 99999 seconds.
- ◆ Alternatively, to establish a default pulse time duration in minutes, for individual output N (2 digits), use code  
9 5 N 8 XXXX ENTER  
where XXXX is 1 to 1666 minutes.

Then you may use code 9 5 N 2 (or 3) without need to enter the digits. The unit will use the pre-stored value for that output's pulse length.

- ◆ To hear a report of the on/off status of ALL outputs in one operation, use program code  
9 5 0 0 ENTER
- ◆ To turn ALL outputs OFF in one operation, use code  
9 5 0 0 0 ENTER
- ◆ To turn ALL outputs ON in one operation, use code  
9 5 0 0 1 ENTER
- ◆ To establish a default pulse time duration for ALL outputs in one operation, use code  
9 5 0 0 8 XXXX (XXXX = 1 to 1666 minutes)

or

9 5 0 0 9 XXXXX (XXXXX = 1 to 99999 seconds)

**Warning:**

Because the devices under control would not normally be operational during AC power failures, the Output Relay Enclosure does not include battery backup for the output relays during AC power failures. Upon restoration of AC power, the outputs will return to the state dictated by the Verbatim Autodialer.

When the Verbatim Autodialer itself is first turned on, and at certain other times when a microprocessor reset occurs, all the outputs will be turned ON for a fraction of a second, before assuming the state dictated by the Verbatim Autodialer. In some installations this could cause problems, and in such cases external time delay relays or other measures may be required to prevent unwanted momentary activation of controlled devices.

MM are the minutes (09 for 9 minutes)

SS are the seconds. Entry of SS is optional.

- ◆ To clear the time and date back to 00:00:00 on 01/01/89.

935 7 ENTER



(1)

(2)

(3)

# D

## Printer Options

### D.1 Local Data Logger (Local Printer) Option

If your unit was not originally equipped with this option, refer to the separate instructions for installing this option. (See Section 2.3 for LDL parallel). The local printer will automatically print out each activity that occurs: alarms, acknowledgments, programming entries, inquiry calls, etc.. A time and date stamp will be included with each report. The local printer may be either serial or parallel as discussed below.

#### D.1.1 Serial Printer Interface

- If your printer was obtained through Racal, it will have been properly configured and tested at the factory...
- If it was purchased independently, refer to the printer's instruction manual to configure it for 9600 baud, 8 data bits, 1 stop bit, and no parity.
- Improper configuration settings will result in "garbage" being printed, or possibly no printing at all.
- The printer must have a "serial" input.
- Printers not specified by or purchased through Racal are not guaranteed to be compatible for this application.
- Connect the DB-25 connector end of a Racal SER-01 cable (the specific type required will depend upon the printer type) to the input connector on the back of the printer.
- Route the small "modular" plug end of this same cable through one of the holes at the bottom of the Verbatim Autodialer, and plug it into modular jack J303 located near the left side of the Verbatim Autodialer, on the vertical VCP circuit card.
- Avoid routing this cable alongside power wiring, and route it so that the front panel circuit board does not pinch it when the door is closed.

#### D.1.2 Parallel Printer Interface

Some newer models of the VSS Series autodialer have a standard Parallel Printer Interface. This interface is accessed via the parallel printer port located on the inside of the unit front panel door. This printer port is already activated. (See Section F.3)



- ◆ To activate this port, attach a RACO VPPC-1 Parallel Printer Cable (or equivalent) to the front panel port and to the parallel port on your printer.

**Caution:**

Attach the parallel printer cable to the VSS front panel port with the "red striped edge" on the right side. If you connect any other way, you may damage the parallel connection on your printer.

### D.1.3

#### Time and Date Setting

Time and date may be set or corrected with the following programming code entries:

- ◆ To check the date  
941 ENTER
- ◆ To set the date  
941 MM DD YY D ENTER

where:

MM is the month (03 for March)

DD is the date (07 for the 7th day of the month)

YY is the year (89 for 1989)

D is the day of the week (1 for Sunday, 2 for Monday, etc.). Entry of D is optional.

- ◆ To check the time  
942 ENTER
- ◆ To set the time  
942 HH MM SS ENTER

where:

HH are the hours in military time (13 for 1 PM)

MM are the minutes (09 for 9 minutes)

SS are the seconds. Entry of SS is optional.

- ◆ To clear the time and date back to 00:00:00 on 01/01/89.  
935 7 ENTER

### D.1.4

#### Printout at Regular Intervals

The unit may also be programmed to automatically log (printout) all input conditions at regular intervals, by entering code:

943 XXX.X ENTER

XXX.X is the desired printing interval in hours, from 0.1 to 999.9.

The first such printout will occur when the period elapses, rather than immediately upon programming.

- ◆ To check programmed printing interval  
943 ENTER
- ◆ To turn off regular interval printing function  
943 0 ENTER
- ◆ To printout All User-Entered Programming  
944 ENTER

1  
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# E

## Data Acquisition/Central Data Logging

The following section describes commands used to configure features of the Data Acquisition/Central Data Logging options. The software is called SCADA.

### E.1

## Return To Normal (RTN) Calling

You may program the unit to place calls upon an input returning to its normal state. This applies only to channels which have become acknowledged alarms. Return to Normal (RTN) calls may be placed to people, to a SCADA Central Station or to a Central Data Logger (CDL) printer.

- ◆ There are three modes of calling for RTN calls:

Mode 0 = Data only

Mode 1 = Voice only

Mode 2 = Data and Voice

Return-to-normal (RTN) calls on units NOT configured for SCADA or CDL will always be mode 1, Voice only. RTN calls on SCADA or CDL configured units may be mode 0, mode 1 or mode 2. If mode 1 is set on SCADA/CDL units then data calls to the SCADA Central Computer or CDL printer will be skipped. (See Appendix K for a discussion of the Return-to-Normal modes of operation.)

- ◆ To program Return to Normal Calls, press:

981 V

Where V is one of the following:

- 0 = OFF - No return-to-normal calls will be made (Default is OFF)
- 1 = ON - Return-to-normal calls will be made for channels in the ALARM, ACKNOWLEDGED state whose input returns to normal (non-violation).
- 2 = used to manually reset all return to normal channel status - does not affect the return-to-normal calling ON/OFF state above or the calling modes below.
- 3 = Sets return-to-normal mode to mode 0 - makes return to normal calls only in data mode to the SCADA Central Computer or to Central Data Logger Printer Entering this parameter does not affect the RTN ON/OFF state.

- 4 = Sets return-to-normal mode to mode 1 - makes return to normal calls only in voice mode (NO data calls to the SCADA Central Computer or Central Data Logger Printer. Entering this parameter does not affect the RTN ON/OFF state.
- 5 = Sets return-to-normal mode to mode 2 - makes both data and voice calls upon return to normal. Entering this parameter does not affect the RTN ON/OFF state.

## E.2

### Quick Intercall Delay & SCADA Units Connected to Cellular Phones

This section discusses two different but sometimes interrelating topics regarding SCADA configured autodialer/RTU units. One topic is the different ways in which the intercall delay operates in SCADA units. The other is the ability to interface SCADA units over cellular phones.

Units configured for SCADA operation may place and receive calls via cellular telephones instead of standard dial-up telephone lines. If purchased from RACO, the combination of autodialer/RTU, dial-up adaptor and cellular transceiver is called the CELLULARM™ package.

CELLULARM™ autodialers/RTUs may be used in cases where land lines are not available but cellular service is available in a particular area. CELLULARM™ units function nearly identically to land line based dial-up interfaced units.



#### *Exceptions*

The *intercall delay* (time between calls) functions somewhat differently on SCADA units than on non-SCADA units. On SCADA units a shortened intercall delay takes effect under certain circumstances. These circumstances are:

- 1) There is a fixed, non-adjustable intercall delay of 35 seconds between:
  - a) multiple attempts at data calls to the SCADA Central Computer.
  - b) the last personnel (voice) number and "wrapping around" to the data number again.
- 2) There is also a special adjustable quick intercall delay taken only between the progression from data calls to the first personnel (voice) call.

The quick intercall delay is set to 35 seconds by default. The usual intercall delay taken between one personnel number and the next personnel number is 2.0 minutes by default.







The purpose of the quick intercall delay is for more expedient in transitioning from data calls to voice calls. However, in certain cases the quick intercall delay may actually interfere with attempts to call the autodialer/RTU for acknowledgement. This is especially true for cellular interfaced units.

Cellular phone calls often take substantially more time to connect to the called party. Therefore, on cellular interfaced units you may need to lengthen the quick intercall delay to allow a longer time "window" for acknowledgement calls from the SCADA Central Computer.

- ◆ To set the quick intercall time, press:

919 V

Where V is 35 to 999 secs.

Default is 60 secs.



**Note:**

Available ONLY on units with firmware revision between V1.36 to V1.99. Applies only when the autodialer/RTU is advancing to the first voice number. Does NOT apply to data call retries, calls between successive voice numbers or wrap-around from last voice number to data calls again.

## E.3

### Acknowledgment Calls To The SCADA Central Station

Units configured for SCADA operation may be programmed to make calls to the SCADA Central Computer to report alarms which were acknowledged by personnel. Alarm Acknowledgement which occurs during calls to personnel or when personnel call the unit will prompt a sequence of Acknowledgement calls made to the SCADA Central Computer. The purpose of Acknowledgement calls is simply to log the event of alarms being acknowledged by personnel.

- ◆ To program the unit for Acknowledgement Calls, press:

982 V

Where V is one of the following:

- 0= OFF - (Default)
- 1= ON - Make Acknowledgment calls
- 2= resets all alarm acknowledgement call status - inhibits all further attempts for this alarm acknowledgement occurrence.

## E.4

### Modem Automatic Speed Select for SCADA units

Automatic speed selection of 1200 baud or 300 baud may be programmed ON or OFF. When programmed ON, the unit will attempt to make data calls at 1200 baud first. If 1200 baud cannot be automatically negotiated with the SCADA Central Computer's modem, fallback to 300 baud will occur. When programmed OFF, the modem speed will be determined by the 984 command (below).



#### *Exception*

In some cases, 1200 baud may not provide reliable data communications due to phone line noise, etc. If necessary, use this command to force the unit's modem to use one specific speed only.

- ◆ To program the Automatic Speed Selection, press:

983 N

Where N is 1 (ON) or 0 (OFF)

Default is 1



#### *Note:*

This command is not applicable to Central Data Logger units.

## E.5

### Modem High Speed or Low Speed Selection

When the unit is programmed with Automatic Speed Select OFF use this command to fix the modem speed at either 1200 or 300 baud.

- ◆ To program the (non-Automatically selected) Modem Speed, press:

984 N

Where N is 1 (1200) or 0 (300)



#### *Note:*

When Automatic Speed Select is set to ON (command 983) this command has no effect on modem speed.

**E.6****Number of Data Call Attempts Before Tripping a Communications Alarm**

The autodialer can make multiple attempts to communicate in data mode to the SCADA Central Computer or to the Central Data Logger (CDL) printer. When all attempts to establish data communications have failed a Communications Failure Alarm will be tripped. If the unit is able to make voice calls (i.e. more than just the 1st phone number programmed) the Communications Alarm will be announced to personnel along with the usual alarm and status report messages. When a calling sequence is ended, for example by alarms getting acknowledged, the Communications Alarm is cleared.

If the Communications Alarm persists and successful data communications to the SCADA Computer or CDL printer is eventually established a Communications Alarm message will be logged and/or printed. After a Communications Alarm is logged and/or printed it will be cleared.

- ◆ To set the number of attempts before tripping a Communications Failure Alarm, press:

985 N

Where N is 1 to 10

Default is 3

**Note:**

If Automatic Speed Select is set ON the unit will actually make twice the programmed number of attempts before tripping a Communications Alarm; N attempts at 1200 baud and N attempts at 300 baud.

**E.7****Answer Mode - VOICE ONLY or DATA-TO-VOICE**

Most calls made to an autodialer/RTU will be polling calls from the SCADA Central Computer. By default the autodialer/RTU will be expecting a data call and answer with a modem answer tone. This is called DATA-to-VOICE answer mode. Personnel wishing to call an autodialer/RTU to get voice reports can just wait through the modem answer tone for a few seconds for the unit to fall back to voice mode and begin speaking.

The autodialer/RTU may also be programmed for VOICE ONLY answer mode. In VOICE ONLY mode the unit will never answer with a modem answer tone and voice annunciation will begin immediately upon answering.

Programming an autodialer/RTU for VOICE ONLY defeats polling calls from the SCADA Central Computer since the unit will only answer by voice and not assert a modem answer tone. However, VOICE ONLY answer mode does not affect data calls made FROM the RTU to the SCADA Central Computer or CDL Printer.

If your SCADA Central Computer is not operational you may wish to program the answer mode to VOICE ONLY. Customers who purchase the SCADA option for their autodialer/RTUs in advance of installing their SCADA Central Computer should use this programming command to make the unit function as a non-SCADA networked autodialer. In addition to programming the answer mode to VOICE ONLY make sure there is no 1st phone number programmed. (The 1st phone number does data only calls to the SCADA Computer.)

- ◆ To program the Answer Mode, press:

986 N

Where N is 0 (default) for DATA-to-VOICE or 1 for VOICE ONLY



**Note:**

Does not apply to Central Data Logger (CDL) units. CDL units never receive polling calls and always answer in VOICE ONLY mode. The 1st phone number must be programmed to call the CDL printer.

## E.8

### **DATA/VOICE Autocall Calls for SCADA & Central Data Logger**

Autocall calls may function substantially the same in SCADA and Central Data Logger (CDL) units as in standard, non-SCADA units. However, different operating modes of Autocall may be programmed in addition to the usual Autocall functionality.



**Exceptions:**

- Autocall calls may be restricted to only calling the SCADA Central Computer or CDL printer. Also, Autocall calls may be restricted to calling just the personnel numbers programmed into the unit (i.e. no calls to SCADA Computer or CDL printer). And finally, Autocalls may call both personnel numbers and SCADA Computer or CDL printer numbers.
- Autocall calls made to the SCADA Central Computer or CDL printer result in logging and printing of the Autocall session. No acknowledgement is required or is possible.
- Autocalls calls made to personnel numbers will be standard voice annunciation sessions.





- ◆ To program the DATA/VOICE Autocall mode, press:

987 N

Where N is 0 to 2

- 0 = (default) Autocall Calls made to SCADA Central Station only
- 1 = Autocall Calls made to personnel numbers only
- 2 = autocall Calls made to all numbers





# F

## MODBUS Interface

This section covers the PLC specific functions of the Verbatim autodialer. It is assumed the reader is already familiar with the basic operation of the Verbatim autodialer. If this is not the case, please take the time now to review the previous sections of this manual.

In the discussion that follows, there are many technical terms specific to PLC operation which may be unfamiliar to those not experienced with PLCs. Please refer to the Glossary section for definition of these terms.

### F.1

#### Overview

The Verbatim autodialer allows direct connection to Programmable Logic Controllers (PLCs) via a serial interface or other network connection. No direct connections from PLC output points to the Verbatim input points are required in order to monitor or annunciate for the PLC. Also, in most cases, no changes in the PLC's ladder logic program are required.

In addition, the autodialer allows connection to any non-PLC equipment compatible with supported PLC network protocols. An example of this application is a SCADA or DCS system running software configured with a PLC network protocol driver module. The autodialer does not care if the devices are a real PLC network or a computer mimicking a PLC network. However, master/slave protocols will require the autodialer to assume the role of master.

The Verbatim autodialer may read or write any data register within the PLC network. The data registers accessed by the autodialer may be in a single PLC or may be arbitrarily spread over a number of PLCs on the network.

Obviously, the number of data table locations in even a single PLC may number into the thousands. To relieve the user of having to deal with a huge number of precisely notated data table addresses, the autodialer uses the artifice of Remote Channels (RCs). Simply stated, RCs are nothing more than a kind of speed-dial number like you might set up on your telephone. Once the full number sequence has been entered into memory, a shorter sequence of numbers may be used as an abbreviation for the long sequence stored in memory.

Through the Verbatim autodialer, the user associates the address of a PLC data register to a RC. Thereafter, the RC becomes a shorthand designation for that data register's address. Any register, whether digital, analog, or other miscellaneous type, may be associated with an RC.

Data registers may actually be spread over a network of PLCs. The autodialer does not care if RC #2 is associated with a data register in a different PLC from the data register associated with RC #1. Therefore, when programming the autodialer to associate a PLC data register with a RC, the node number of the PLC may be included in the description for the location of the data register.

Additionally, the amount of User Recorded Speech Memory is increased appropriately for each Remote Channel configuration. These different quantities of memory yield total message recording times consistent with each of the available RC configuration options.

## F.2 General Operation

This section describes configuring the Verbatim autodialer to continuously monitor any data register on the PLC network. Additionally, under user command, the autodialer may read and write to any PLC data register. The autodialer will only perform these functions after it has been properly installed, connected to the PLC network, and programmed.

### F.2.1 Associating a Remote Channel with a PLC Data Register

In order for the Verbatim autodialer to read, write or continuously monitor a PLC data register the address of the data register must be associated with a Remote Channel (RC). After a data register address has been associated with a RC the Verbatim autodialer then knows where to direct queries for the contents of a data register on the PLC network.

The data register's complete address description is called the *net address*. See section F.4.2 for information about net address formats.

Once a data register's net address has been associated with a RC, the alarm criteria may then be programmed. Only after an alarm criteria is entered will the PLC data register be scanned continuously by the Verbatim autodialer. When the content of the data register changes to match the alarm criteria, the RC associated with the data register goes into the alarm state.

RCs in the alarm state behave in exactly the same way as Verbatim autodialer internal or "physical" channels.

The Verbatim autodialer may be called at any time to receive an annunciation of the status of channels monitored. PLC registers associated to RCs may be read and written over-the-phone. Additionally, programming activities may be performed via the buttons on the user's phone.

When an operator calls the autodialer, the status of RCs will be reported and the user may reprogram parameters of RCs over-the-phone. When accessing the autodialer over-the-phone, all user functions that could result in the alteration of ANY data register can be made subject to correct entry of an access code.

Alarm criteria, trip delays and alarm call groupings are established in a fashion similar to normal physical channels. RCs associated with PLC discrete data registers support the normally open or closed criteria. RCs associated with PLC analog or integer data registers support high and low set points.

Associating a net address to a RC implicitly establishes the channel as digital or analog. For RCs, the default alarm criteria for both digital and analog channels is 'disarmed'. Attempts to set analog criteria on digital channels, and vice versa will cause an error announcement. If the net address for an RC already configured is re-programmed so that the type (analog or discrete) of data changes, the criteria will automatically be set to 'no alarm'. There is no run-time or totalizer capability for any of the RCs.

At the front panel, the LED channel status display shows all Remote and Physical Channels. Since the count of total Physical and Remote channels is greater than the usual 32 status LEDs, channels are combined into groups so that the status of all channels may be observed.

## F.3

### Connecting to the PLC Network

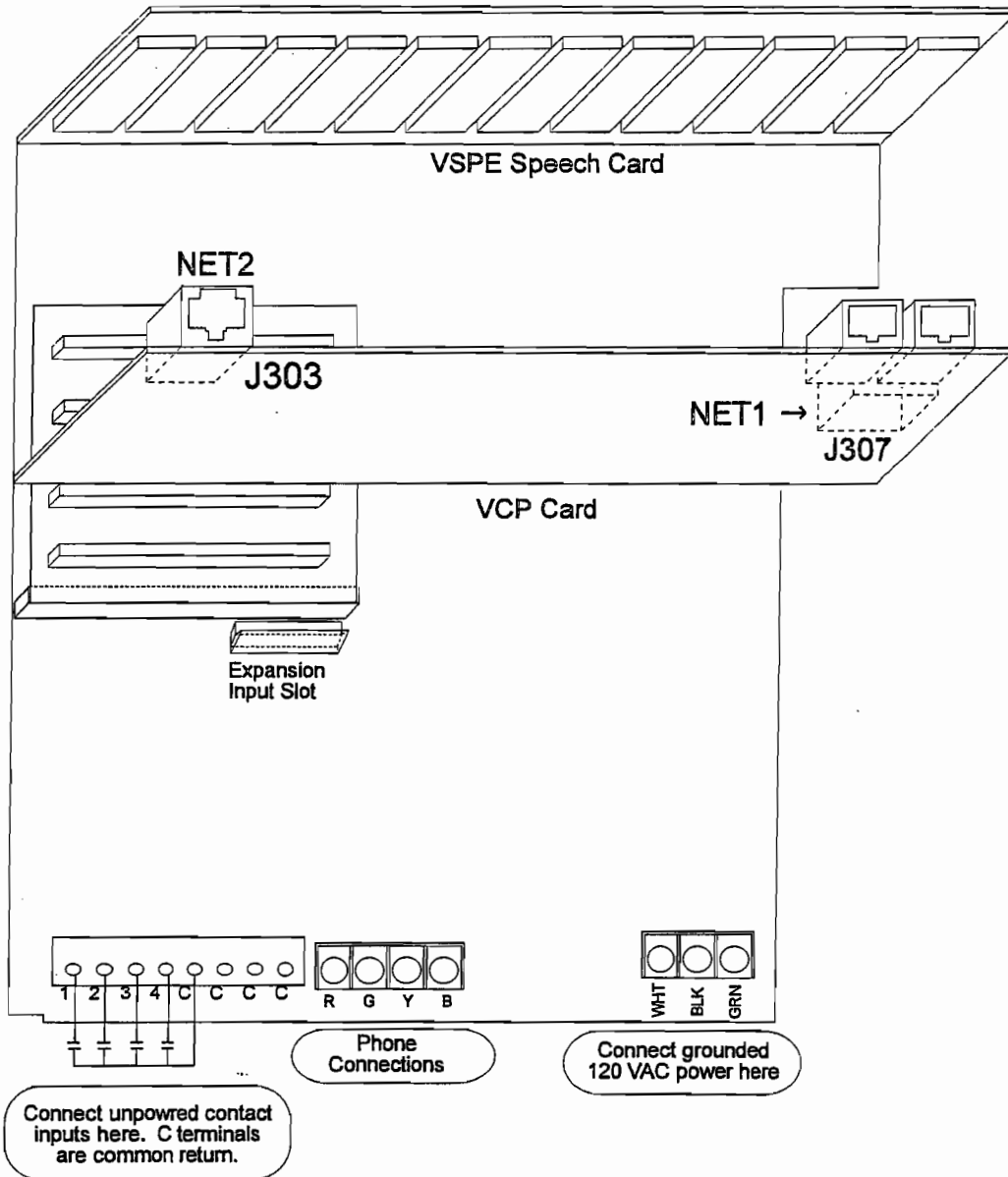
In most cases, the cable supplied by RACO will already be connected at the Verbatim autodialer end to a modular jack inside the unit. If this is not the case, please refer to the drawings in appendix H.



#### **Note:**

Refer to the cable drawings in the appendices to identify your type of PLC network connection.

*Electrical Connection Diagram for PLC Network Connection*



Cable connections for various PLC network protocols	
NET1	NET2
Modbus	NONE
Modbus	Serial LDL

**F.3.1****Before Calling Technical Service Assistance**

Programmable Logic Controllers have been used for several decades for process control applications. There is a large body of knowledge germane to using PLCs. RACO assumes that the user needing to monitor a PLC network with the Verbatim autodialer is already familiar with the PLCs being used for the application. It may also be assumed that the user has access to a PLC expert to help accurately identify the addresses of a PLC data register.

Before consulting the RACO Customer Service Department or your local RACO Representative for assistance in installation and configuration, please insure that the PLC details described in the next paragraph are readily available.

The user must have access to the PLC ladder logic program listing and know the location and properties of all data table locations which will be monitored by the Verbatim autodialer. Also the user must be able to determine the basic operating parameters of the PLC communications channel. This means being able to configure the PLC's parameters such as the node address, baud rate, data bits, parity and stop bits. Setting these parameters at the PLC may require the use of a PLC Hand Held Terminal, or a Personal Computer running PLC programming software available from the PLC's manufacturer.

The MODBUS communications protocol is a Verbatim autodialer firmware option and must have been properly configured at the factory. Parameters concerning link, frame and packet-level interfaces are configurable in the field.

**F.4****Programming for Remote Channels****F.4.1****Remote Channel Programming Overview**

The Remote Channels (RCs) behave fundamentally the same as their physical channel (PC) counterparts. Procedures for programming and recording messages for remote channels are very similar to the procedures described in the previous sections of this manual. There are some differences, however. These differences will be discussed in this section.

In general, all Verbatim autodialer commands that operate on remote channels will begin with the digit '4'. Commands that perform functions similar to non-Remote Channel specific commands use the same key sequence, preceded by the digit '4'.

- ◆ For example: to interrogate the alarm status for Physical Channel number 1 1, enter the command:

```
0 1 1 then <ENTER>
```

- ◆ To interrogate the alarm status for Remote Channel number 1 1 enter the command:

4 0 1 1 <ENTER>

The existing commands that apply globally to all channels will apply uniformly to the RCs as well. Specifically, these codes are: 900, 902, 904, 917N, 923N, 927N, 930, 935N, 966N, 9403, 9404. The 'CHECK STATUS' function, either from the front panel or over-the-phone, reports channel status for all channels both physical or remote.

The sub-sections that follow itemize all programming key sequences available to the user. A short description of each function is provided, together with longer notes when necessary. If a programming key sequence is not recognized by the Verbatim autodialer, or any parameter is invalid, the Verbatim autodialer simply says "Enter program code".

All commands that use a full network address may omit the network ID and/or the node address, in which case the default values (codes 4910, 4911) will be used. The user should then also omit the '\*' delimiter associated with the omitted component. If the user does omit a field then all preceding fields must also be omitted. (See Section F.4.2 for more information on net address formats.)

The RCs on any specific network may be globally inactivated without erasing any of their configuration. An individual RC may be inactivated without erasing the network address by setting the no alarm or disarmed criterion. In this case, it will be necessary to reprogram the criterion in order to re-activate the channel.

## F.4.2



### Associating a Net Address with a Remote Channel

*Note:*

Remember that \* = POINT when referenced in this manual.

The most important operation in configuring your Verbatim autodialer is associating a data register's net address to a RC. The net address is actually part of the complete command sequence entered by the user when programming the association of a RC and a data register. Consider the following example. Suppose the Verbatim's NET 1 is configured for the Modbus protocol and node 2 on that net is a PLC. To associate RC #01 with the 16 bit data register whose address is 40001 you would enter the following command sequence:

4 5 0 1 \* 1 \* 2 \* 40001 \* then ENTER.

The first 4 digits from the above example are the programming command for RC association or RC alarm criteria. Thus, the sequence 4 5 0 1 refers to programming for RC #01. The net address portion of this command sequence is the remaining digits plus the '\*' used for delimiting. The 16 bit data register has the address of 40001. The PLC's node number is 2 and the Verbatim's NET is 1.

The general net address syntax has the following form:

\* NET \* node \* address \*

where:

*NET* is NET Number - 0, 1, or 2

Net 0 is Physical Channels

Net 1 is Modbus

Net 2 is serial printer

*node* is PLC's Node Number

Modbus - 1 to 256

*address* is Data Register Address - may be numbers. Syntax for the register address is very specific to the PLC brand.

In the previous example, certain simplifications were made. Simplifications in the net address may be made by using programmed defaults. The usual default for the Verbatim's NET number is 1. The default node number may be set to any value allowed by protocol. Therefore, in the previous example, the entry may be simplified further to the following:

4 5 0 1 \* 40001 \* <ENTER>

## F.5

### General MODBUS Requirements

This appendix provides information specific to Modicon's Modbus network. There are sections on PLC data table addressing, net address format, and global data. The paragraphs here describe general requirements and hints.

*Modicon PLCs:* Be sure that the DEF/MEM switch on compact 984 PLCs is set to 'MEM'. Otherwise, it will be impossible to change network communications parameters from the defaults.

*Modbus Networks:* All nodes on a Modbus network must use RTU protocol. There can be only one master on the network. The master must be the Verbatim Autodialer.

Use the link-level timer (command 4908) to insert a delay between query/response cycles. This will only be necessary if talking to a slow device.



## F.6

### PLC Address Format

The table below shows how to address specific objects in Modicon PLCs. 'x' represents a digit in the range 0-9. The Verbatim autodialer User Interface will accept any values for 'xxxx'. If a value is out of range for a particular PLC, that PLC will issue an error diagnostic, which will be passed on to the user. This is to say, the remote PLCs enforce the validity of PLC addresses on their own.

#### Notes:

- ◆ Extended memory access is not currently implemented.
- ◆ Inputs may be written by the Verbatim autodialer, but will most likely be overwritten immediately by the PLC when it does its next scan of the ladder logic.
- ◆ The PLC memory protect switch will prevent a coil or register from being written.

#### Addressing Modicon PLC Objects

<i>Address</i>	<i>Description</i>
0xxxx	Coil (1-bit Output) number xxxx
1xxxx	Input point (1-bit) number xxxx
3xxxx	Input register (16-bit) number xxxx
4xxxx	Output (holding) register (16-bit) number xxxx

## F.7

### Potential Effects of Network Communications Failures

Physical channels only go into alarm state when their input matches programmed alarm criteria. Remote channels also support these criteria-based alarms.

It must be remembered however, that the channel data compared against the criteria must first be received from the network being monitored. Since the remote channel's data is being transferred over a network, alarming may be affected by various network failures.

If such a failure occurs, and the data cannot be received, it is no longer possible to reliably compare the channel against the alarm criteria. As a result, the remote channels will enter the alarm state even though their channel data may not have changed. The term "COMALARM" is used to distinguish this sort of alarm scenario from the criteria based alarms.

More precisely, an RC will register a COMALARM whenever the following two conditions are met:

1. The RC is configured with alarmable criteria.
2. All attempts to poll the RC have failed for the COMALARM trip delay period (code 4907).

For status reports, alarm calls, LED indicators and acknowledgments, the COMALARMS are treated in the same way as criteria alarms. They are annunciated in the following manner:

1. The COMALARM message will override any criteria alarm message.
2. The COMALARM message is not user recordable. It always consists of "Remote Channel Number ZZ Communication Failure Code XXX."

The failure code annunciated by the Verbatim autodialer serves as an aid in troubleshooting the network problem causing the failure. They are listed in section F.17.

To further assist in network troubleshooting several diagnostic commands are provided. It is possible to:

1. Perform a complete network self-test.
2. Read the communications status for any RC.
3. Read and reset the COMALARM count for any RC.
4. Read a list of the last 10 COMALARM codes on the network.
5. List all RCs currently in the COMALARM state.
6. List the nodes (PLCs) on the net that have all of their RCs in the COMALARM state.

The Verbatim autodialer provides several other features to help the user with the inevitable complexities of a networked environment. One is the ability to suspend/resume all queries initiated by the Verbatim autodialer without altering any RC programming. The status reports will inform the user when a network is globally disabled in this fashion.

Another diagnostic tool is the front panel Network Status Indicator LED for each network. Each LED is like a channel which monitors the overall health of each network. This is accomplished by accumulating all the COMALARM codes into a single value. The value is compared against a threshold. See code 492 in Section F.16 for details.

If the threshold is exceeded, then the LED will blink and status reports will annunciate the current value of the network status code. If the network has been globally disabled the LED is off. Otherwise the LED is steadily ON, indicating the network is operating within programmed parameters. See Section F.17.

The Verbatim autodialer keeps a count of the threshold violations. Programming commands are available to announce and reset these counts. It is also possible to announce the current value of the status code and set the threshold to any severity level. See section F.16 for details.

## F.7.1

### Abbreviations and Typographic Conventions

In the following sub-sections, the verbal response expected from the Verbatim autodialer will be given following the program code that the user is to enter for each programmable function. This verbal response will be differentiated by being in italics in the following way: *Remote Channel Number TEN, Alarm, Acknowledged*. The following table describes the abbreviations used in the code listings and elsewhere in this document:

Code Listing Abbreviations	
Code	Description
ZZ	Any two-digit remote channel number, from 01 to 96, depending on the hardware configuration.
yy	Same as above
N	An integer from 0 to 65535, or as specifically noted.
net	The network ID: 1 to 5
node	The node address, as appropriate for a given network.
addr	The PLC address, as appropriate for the given PLC. (Details on specific PLCs and protocols are found in the appendices.)
DN	A two-digit code indicating a specific phone number.
V	An arbitrary floating point number of the form: 1.23. If 3 or more digits to the right of the decimal point, V is truncated to the nearest .005.
*	Same as 'point' key
#	Same as 'minus' key

## F.8

### Remote Channel Status, Reading, and Writing

4 0 ZZ

Function      Read alarm status of Remote Channel ZZ. (See code 49402 for Network Alarm Status)  
 Response      *remote channel <ZZ> <alarm status>*

*If ZZ=00 in the following two commands, then the command applies to the net address specified by the most recent 4500\* command. In that case, the "remote channel ZZ" responses are replaced with the explicit net address.*

4 0 ZZ \*

Function      directly read PLC address associated with Channel ZZ

Response *remote channel <ZZ> is <N> or  
remote channel <ZZ> communications error <code>*

4 0 ZZ \* N

Function write value N to PLC address associated with channel ZZ  
Response *remote channel <ZZ> set to <N> or  
remote channel <ZZ> communications error <code>*



**Notes:**

- ◆ This command will execute without any “are you sure?” checking. Users must make sure the address and value being written will not create an unsafe condition.
- ◆ Writing a value greater than 1 to a digital or net address will result in the value 1 being written.

**F.9**

**Remote Channel Message Recording and Reviewing**

4 1 00 net

Function Record network ID message for specified net. Append a ‘\*’ to the command to return to default network ID message.  
Response whatever was recorded or the default message: *NET <net>*



**Notes:**

- ◆ For the following 2 commands, N is optional. If present, it must be in range 1-4 and sets the recording rate for that particular message. User Messages for the remote channels are used in the same way as user messages for the physical channels.
- ◆ For analog channels, the alarm message is always the default: “<high> <low> set-point exceeded”. The user messages form a preamble and epilogue for the data value recitation during alarm messages. The default epilogue for remote channels is null.

4 1 ZZ N

Function Record channel ZZ alarm/preamble message. N, if present, specifies the recording rate to use. If N is not present, the default recording rate is used. Append command with a ‘\*’ or ‘0’ to return to default alarm message  
Response whatever was recorded or the default message: *remote channel <ZZ> alarm*

4 2 ZZ N

Function Record channel ZZ normal/epilogue message. N, if present, specifies the recording rate to use. If N is not present, the default recording rate is used. Append command with a ‘\*’ or ‘0’ to return to default normal message.

Response whatever was recorded.  
 The default message for discrete channels is: *remote channel <ZZ> normal*. The default message for analog channels is silence (no epilogue).

4 3 ZZ

Function Review both messages for channel ZZ. If ZZ is 00 then all network ID messages are reviewed.  
 Response whatever was recorded or the default messages.

## F.10 Remote Channel Configuration

Commands in the series "4 5 ZZ," are used for Remote Channels as follows:

- ◆ Associate a PLC net address to a Verbatim Remote Channel. This step tells the Verbatim autodialer where on the PLC network to look for the point to be monitored.
- ◆ Establish the alarm criteria for a Remote Channel. This step tells the Verbatim autodialer what constitutes an alarm condition in the monitored PLC point.
- ◆ Link a Remote Channel to a phone number or group of phone numbers. When an alarm occurs in the monitored PLC point only the phone numbers linked to the Remote Channel will be called. (By default, all phone numbers will be called.)

Note that you must first assign a net address to a Remote Channel before any alarm criteria may be configured.

### F.10.1 Assigning PLC Net Addresses to Remote Channels

Command "45ZZ" associates a remote channel with a network address and, as such, is essential for activating an RC. When issued, this command will cause the Verbatim autodialer to immediately access the specified network address. Any communications errors at this point will generate the message: *communication error code <diagnostic>*. Any command in this section will support ZZ=00.

If the data type (analog, discrete) of the new address is incompatible with the existing alarm criteria, then the NOALARM criteria will replace them. Otherwise, the existing criteria are untouched. The Verbatim will announce this action. Any links to other RCs are always preserved.



#### Notes:

See section F.4.2 for an overview of net addresses.

<b>4 5 ZZ *</b>	Function	Read the network address which is currently associated with RC number ZZ.
	Response	<i>remote channel &lt;ZZ&gt; NET &lt;net&gt; NODE &lt;node&gt; ADDRESS &lt;addr&gt; or communication error code &lt;diagnostic&gt;</i>
<b>4 5 ZZ *net *node *addr *</b>	Function	Associate RC <ZZ> with specified network address. Does not alter any other parameters.
	Response	<i>remote channel &lt;ZZ&gt; NET &lt;net&gt; NODE &lt;node&gt; ADDRESS &lt;addr&gt; or communication error code &lt;diagnostic&gt;</i>

## F.10.2

### Remote Channel Alarm Criteria

<b>4 5 00</b>	Function	The criteria for all "eligible" RCs are set so that the channel is normal in its current state. An RC is NOT eligible if any of the following conditions apply: <ul style="list-style-type: none"> <li>Channel's net address type is analog or floating point</li> <li>Channel has NOALARM criteria already configured</li> <li>Channel is already the destination channel in a linked pair</li> </ul>
	Response	<i>present input condition is programmed to be normal for all remote channels</i>
<b>4 5 ZZ</b>	Function	Read alarm criteria for channel ZZ
	Response	<i>remote channel &lt;ZZ&gt; &lt;criteria&gt; or remote channel &lt;ZZ&gt; no net address programmed</i>
<b>4 5 ZZ 0</b>	Function	Disarms <ZZ> (i.e. eliminates all status reporting for the channel). All other configuration information is preserved.
	Response	<i>remote channel &lt;ZZ&gt; disarmed</i>
<b>4 5 ZZ 1</b>	Function	Set channel number ZZ alarm criteria to normally 1.
	Response	<i>remote channel &lt;ZZ&gt; normally 1</i>
<b>4 5 ZZ 2</b>	Function	Set channel number ZZ alarm criteria to normally 0.
	Response	<i>remote channel &lt;ZZ&gt; normally 0</i>
<b>4 5 ZZ 3</b>	Function	Set channel number ZZ alarm criteria to no alarm. The channel is still listed in all status reports.
	Response	<i>no alarm condition for remote channel &lt;ZZ&gt;</i>
<b>4 5 ZZ 4</b>	Function	Set channel number ZZ to NETERR mode — alarm if and only if a communications alarm occurs.
	Response	<i>remote channel &lt;ZZ&gt; alarm on communication failure.</i>

4 5 ZZ 5 N

Function Set channel number ZZ analog low alarm set point to N. Use N = -0 to clear. Omit N to read current set point value.  
 Response *remote channel <ZZ> low set point is <N>*

4 5 ZZ 6 N

Function Set channel number ZZ analog high alarm set point to N. Use N = -0 to clear. Omit N to read current set point value.  
 Response *remote channel <ZZ> high set point is <N>*

**F.10.3**

**Linking Remote Channels to Phone Numbers**

4 5 ZZ 9

Function Read RC number ZZ alarm call grouping linkage.  
 Response *remote channel <ZZ> calls <list>*

4 5 ZZ 9 DN

Function Link RC number ZZ to phone number list DN  
 Response *remote channel <ZZ> calls <list>*

4 5 ZZ 9 \*

Function Clear all RC number ZZ phone number linkages  
 Response *remote channel <ZZ> calls all phone numbers*



**Note:**

Linking Remote Channels to phone numbers is different than linking one Remote Channel to another Remote Channel. The latter is discussed in section F.12.

**F.11**

**Alarm Trip Delays**

The alarm trip delay commands here apply only to criteria violations. See code 4907 for the COMALARM trip delay. See codes 4921 and 4922 for network alarming.

4 6 ZZ

Function Reads channel number ZZ alarm trip delay.  
 Response *remote channel <ZZ> alarm trip delay is <v> seconds*

4 6 ZZ \*

Function Sets channel number ZZ alarm trip delay to 2.0 seconds.  
 Response *remote channel <ZZ> alarm trip delay is 2.0 seconds*

4 6 ZZ V

Function Sets RCZZ individual alarm trip delay to V.  
 Response *remote channel <ZZ> alarm trip delay is <V> seconds*

## F.12 RC Linking/Network Bridging

The commands detailed in this section allow data to be passed between any two remote channels. Applications include passing data between nodes on compatible and incompatible networks, updating status registers in DCS systems, or exporting the Verbatim physical I/O to remote nodes. One channel acts as a data “source” and the second as a data “destination”. Data is read from the source channel’s net address and then written to the destination channel’s net address once per scan loop. The destination and source are said to be “linked”.

### F.12.1 Linking Modes

The linking functions can work in one of two modes. In Data Link mode, the data read from the source is written directly to the destination. In the absence of communication problems, each destination channel is updated with a frequency equal to the Verbatim scan time. If there is a communications problem reading data from the source, then nothing is written to the destination.

In Alarm Link mode, the source channel data is first interpreted against the configured alarm criteria. If any alarm condition exists at the SRC channel, then a 1 is written to the DST. Otherwise, 0 is written. Any communications problem reading from the source will be reflected.

For both modes, the reads and writes are attempted once per scan loop. Any required protocol conversions are handled automatically. Any problems getting data for or writing data to the destination will appear as communications errors on the source or destination RCs. The data read or written is subject to RC initialization and the worst-case scan loop latencies. See Section F.7 for details.

### F.12.2 Commands & Limitations

The commands below establish the channel linkage configurations. There are several rules and restrictions as follows:

1. Both the source and destination RCs must already be configured with net addresses. If this is not the case, then an error message is given. The net address for either channel in a linked pair may be reconfigured at any time, without altering the link.
2. If the RC specified as source is already configured as destination for any other linked pair, then an error message is given. Similarly, if the RC specified as destination is already configured as source for any other linked pair, an error message is given. This prevents “chaining” of linked pairs.



3. If the RC specified as destination is already configured as the destination for another source, then the new configuration supersedes the old one. No error message is given. This prevents the configuration of multiple sources for a single destination. The user must take care that distinct destination channels do not have identical net addresses. Multiple destinations for a single source are allowed.
4. If either the source or destination RC are "DISARMED", then its criteria will be reset to "NETERR". This alteration will be announced. All other existing criteria are accepted without alteration. Once a link is configured, any attempt to DISARM either the source or destination results in an error message. All other criteria modifications are allowed. Note however that it rarely makes sense to have destination criteria of anything other than "NETERR" or "NOALARM".
5. The linking of channels with different data types is allowed. For example, it is OK to have a discrete source linked to an analog destination. Special data conversion rules apply and are presented in the table below.

<b>Conversion Rules</b>		
<i>Source</i>	<i>Dest.</i>	<i>Destination Value</i>
16 or 32 bit	1 bit	0 if source is 0, otherwise 1
1 bit	16 bit	0 if source is 0, otherwise 1
1 bit	32 bit	0.0 if source is 0, otherwise 1.0
16 bit	32 bit	floating point number with integer value equal to the source value
32 bit	16 bit	garbage: least significant 16 bits of the source value, however encoded

6. If the destination channel is read-only (i.e. a PLC input register) then a COMALARM will result.

**4 7 ZZ \* YY**

**Function** Establishes an alarm mode link with RC ZZ as the source channel and YY as the destination channel. Channel ZZ's alarm status will be written to YY's net address once per scan loop. A 1 is written if any alarm exists, otherwise zero.

**Response** *remote channel ZZ alarm link to remote channel YY* or, *remote channel (ZZ,YY) not programmed*, if no net address, or, *remote channel (ZZ,YY) already linked*, if multiple sources, or link chain would result.

**4 7 ZZ \* YY \***

**Function** Establishes a data mode link with RC ZZ as the source channel and YY as the destination. The value from ZZ's net address is written to YY's net address once per scan loop.

Response *remote channel ZZ data link to remote channel YY or, remote channel (ZZ,YY) not programmed, if no net address, or, remote channel (ZZ,YY) already linked, if a link chain would result.*

The commands listed below report or clear existing link configurations. When a link is cleared, the net address and criteria for both channels are untouched. Operation of the source channel is unchanged. In fact, the only change is that the destination channel will no longer write any data to the remote address. Rather, it begins to read the remote address and will alarm according to the existing criteria, just like the source or any other remote channel.

**4 7 ZZ**

Function Reports all linked channel pairs using ZZ as either source or destination channel. If ZZ is 00, then the set of all linked channel pairs is listed.

Response *remote channel <ZZ,XX> <data,alarm> link to remote channel <YY,ZZ>*

**4 7 ZZ-0**

Function Clears all linked channel pairs using ZZ as either source or destination channel. If ZZ is 00, then the set of all linked channel pairs is cleared.

Response *remote channel ZZ link to remote channel YY is cleared or, remote channel ZZ is not linked, if no such link existed, or, all remote channel links cleared, if ZZ is 00.*

**4 7 ZZ \* YY-0**

Function Clear specific link using ZZ as source and YY as destination.

Response *remote channel ZZ <data,alarm> link to remote channel YY is cleared. or, no link, if such a link does not exist.*

## F.13 Communications Parameters

All commands in this section allow the 'net' parameter to be omitted, in which case the default network is used. If either 'net' or the default net (see code 4910) is 0, the command has no effect. If the '\*' is omitted, then the current setting is spoken. If '\*' is present and 'N' omitted, then the parameter is set to it's default. If 'N' is present, then '\*' must precede it.

If the protocol currently configured on any specific net forbids alteration of a parameter, then the command is ignored and the "Enter program code" message is announced. The defaults for each parameter are also network dependent.

**4 9 00 net**

Function Announces the current setting of all applicable parameters.

Response See all codes below

*4 9 00 net \**

Function Resets all applicable parameters to their factory default.  
 Response See all codes below

**F.13.1**

**Serial Port Parameters**

*4 9 01 net \* N*

Function Read/set baud rate for net to N. If present, N must be: 50, 75, 110, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 14400, 19200, 28800, 57600. Any other values are ignored.  
 Response *<net ID message> baud rate is <N> .*

*4 9 02 net \* N*

Function Read/set data bits for net to N. If present, N must be one of: 5, 6, 7, or 8. Any other values will be ignored.  
 Response *<net ID message> data bits are <N>*

*4 9 03 net \* N*

Function Read/set stop bits for net to N. N must be 1 or 2. Any other values will be ignored.  
 Response *<net ID message> stop bit is <N>*

*4 9 04 net \* N*

Function Read/set parity for net. If present, N=0 is NO parity, N=1 sets ODD parity and N=2 sets EVEN parity for net, N=3 for SPACE parity, N=4 for MARK parity. Any other values will be ignored.  
 Response *<net ID message> parity is <even, odd, space, mark>*

**F.13.2**

**Network Parameters**

*4 9 05 net \* N*

Function Read/set local node address for net to N. The allowable range for N is protocol dependent. Illegal values are ignored.  
 Response *<net ID message> node number is <N>*

*4 9 06 net*

Function Read protocol for network.  
 Response *<net ID> protocol is <current protocol>*

**F.13.3**

**Timing Parameters**

*4 9 07 net \* V*

Function Reads/sets communications alarm trip delay. Communications errors for all RCs on net must persist continuously for V seconds before a COMALARM violation is registered.  
 Response *<net ID> communication alarm trip delay is <V> seconds*

4 9 08 net \* N

Function Reads/sets link-level timer. Units are milliseconds. Usage of this timer is protocol dependent and described in the appendices. In general, this parameter is the maximum time the Verbatim will wait for the response from a communications co-processor or interface module.

Response <net ID> link limit time is <N> mseconds

4 9 09 net \* N

Function Reads/sets application-level timer. Units are milliseconds. This value is the maximum amount of time the Verbatim will wait for another node to respond to any command.

Response <net ID> message limit time is <N> mseconds

## F.14

### Miscellaneous

4 9 \*

Function Repeats the previous command which began with a '4'. It is possible to add key strokes after the \* and before enter, subject to limit of 65 total keystrokes. The added key strokes are not concatenated for subsequent 49\* commands.

Response appropriate to actual command resulting

In the following, N may be omitted, in which case the current value is only announced, not altered. The values apply to all commands expecting a net or node value to be specified. They allow fewer keystrokes to be used when programming net addresses and other commands.

4 9 10 N

Function Read/set default net number to N. N must be 0-5, consistent with the hardware options.

Response Default net address network is N

4 9 11 N

Function Read/set default node number to N. Allowable values for N are protocol dependent.

Response Default net address node is <N>

## F.15

### Clear-Out Operations

4 9 3 \* net

Function Globally disables/enables RC polling on the specified network. Acts as a toggle, so two consecutive entries cancel each other out. No RC programming is erased.

Response <net ID> communication is (off, on)

4 9 35 4

Function Clears all RC user recorded messages.

	Response	<i>All remote Channel messages cleared</i>
4 9 35 5	Function	Clears all RC configuration data: network addresses, criteria, links.
	Response	<i>All remote channels reset</i>
4 9 35 8	Function	Clears out all communications failure codes and counts.
	Response	<i>Communication error count overall reset</i>
4 9 35 9	Function	Does all the 4935 functions. NOTE, ONLY the RC configuration is affected.
	Response	<i>Verbatim RC programming requires Firmware Revision</i>

## F.16 Diagnostic Readouts

In the following, N may be omitted, in which case the current value is only announced, not altered.


4 9 2 <net>	Function	Reads current value for Network Failure threshold. The LED indicator will blink and a Network Failure Alarm will register when this value is exceeded.
	Response	<i>&lt;net ID&gt; network status alert setpoint is &lt;N&gt;</i>
4 9 2 <net> <*<N>>	Function	Sets current value for Network Failure threshold. Use N=200 to disable the network failure indicator.
	Range for N	0-200
	Default	0
	Response	<i>&lt;net ID&gt; network status alert setpoint is &lt;N&gt;</i>
4 9 30 * net	Function	Perform a diagnostic self-test on specified network. Depending on protocol and LDL configuration, diagnostic counters may be printed and/or reset.
	Response	<i>&lt;net ID&gt; communication test is &lt;normal, errcode&gt;</i>
4 9 40	Function	Read all 4940x diagnostic info for all networks.
	Response	See error/diagnostic code list in section F.17.



### Note:

In the following, 'net' may be omitted, in which case the information for the default network is annunciated.

4 9 40 * net	Function	Read all 4940 diagnostic info for <net>
	Response	see commands below

<i>4 9 40 1</i>	Function	Read time to complete RC table scan
	Response	<i>scan time is &lt;time&gt; seconds</i>
<i>4 9 40 2 net</i>	Function	Read network status code for specified network
	Response	<i>&lt;net ID &gt; network status code is &lt;code&gt;</i>
<i>4 9 40 3 net</i>	Function	Read network alert count.
	Response	<i>&lt;net ID &gt; network alert count is &lt;count&gt;</i>
<i>4 9 40 4 net</i>	Function	List all the node addresses whose RCs are currently experiencing communication failure.
	Response	<i>&lt;net ID &gt; communication failure at node(s) &lt;list&gt;</i>
<i>4 9 40 5 net</i>	Function	List all RCs on net currently having communications failure.
	Response	<i>&lt;net ID &gt; remote channel(s) now in communication alarm are &lt;list&gt;</i>
 <b>Note:</b>		
49405 does not report criteria-tripped alarms. The check status command (4 0 ZZ) checks all alarm conditions, communication or otherwise.		
<i>4 9 40 6 net</i>	Function	Read diagnostic codes for last 10 network problems.
	Response	Append -0 to clear the history stack. <i>recorded error numbers are code &lt;n&gt;...</i>
<i>4 9 41 ZZ</i>	Function	Read current communications status for channel number ZZ. Status reported is result of latest scan loop poll, not the communications alarm status (see 40zz)..
	Response	<i>remote channel &lt;ZZ&gt; communication alarm code is &lt;diag code&gt;</i>
<i>4 9 41 ZZ *</i>	Function	Read count of communication alarms for RC ZZ (add -0 to clear)
	Response	<i>remote channel &lt;ZZ&gt; communication alarm count is &lt;count&gt;</i>
<i>4 9 42 net</i>	Function	Read list of disarmed (see code 45ZZ0) RCs
	Response	<i>&lt;net ID&gt; remote channels now disarmed are &lt;list&gt;</i>
<i>4 9 43</i>	Function	Read list of uninitialized RCs.
	Response	<i>remote channel(s) not programmed are &lt;list&gt;</i>

Continued on next page . . .

4 9 44

Function Read list of all RCs not using the default criterion.  
 Response *remote channels armed are <list>*

4 9 45 ZZ

Function Reports net address, criterion, setpoints, links, and alarm status for channel number ZZ.  
 Response See commands 45zz\*, 45zz, 47zz\*, 4941zz

## F.17 Status, Diagnostic & Error Code Listing

This section lists all network status, diagnostic and communications error codes likely to be of use for customer troubleshooting. Other codes may be reported in rare instances, and information about their interpretation may be obtained from RACO customer support.

### F.17.1 Network Status Codes

The Network Status code reflects the overall health of all devices connected to a specific net. The values for these codes are used both for programming the alert threshold and in reporting the current status. Whenever a specific network's status code exceeds the alert threshold the network status LED will blink and an alert message is included in all reports. There is a distinct LED and status code and threshold for each net.

The table below lists the values and interpretation for the Network Status codes and thresholds.

0	No error. All RCs and scanned nodes are operating within scan timing parameters.
1-96	Some RCs are in communications failure and have not been successfully scanned for the COMALARM trip delay period. The number of such failed RCs is equal to the code value.
101-196	Some nodes on the net have quit responding to scanning. The number of such failed nodes is computed by subtracting 100 from the code. All RCs on those nodes are in COMALARM.
200	The scan of all nodes on the network is failing.

## F.17.2 Diagnostic & Communications Error Codes

The diagnostic and communications error codes are registered whenever the scan for a particular RC fails. When such an event occurs, the code is pushed onto the diagnostic history stack (see code 49406) and copied into the RC status word (see code 4941zz). These may be interrogated at any time.

If the problem occurs during selftesting or configuration, the code is reported immediately. During normal scanning, the problem must continue for the COMALARM trip delay period before a communications alarm for that RC is triggered. The report for that alarm will then mention the code. The network status code is then updated appropriately. See table on next page.

The table below lists the values and interpretations for the most common error situations. Note that some codes are derived directly from standard error codes supported by specific protocols. The documentation for those products is then necessary for interpretation.

0	no error condition detected
352	specified net is invalid
354	protocol doesn't support the net address format
356	request timed out with no feedback
357	node address is invalid for selected protocol
359	node/driver incompatible with address mode
360	miscellaneous error parsing address string
361	some field was duplicated in address string
362	file type specifier in address string not supported
363	couldn't parse file number field in address string
364	couldn't map the I/O slot specified in address string
365	couldn't parse element field in address string
366	couldn't parse subelement field in address string
367	couldn't parse bit field in address string
368	too many routing nodes specified in address string
369	some routing node has illegal syntax
370	transaction aborted at user request
390	source channel data not available for RC link
410	no traffic received from the net
430	timeout with no recognizable response
431	timeout with no response at all
501	transaction took too long to transmit
601- 608	AEG/MODICON exception codes.

That code can be determined by subtracting 600 from this code. Refer to F.5, "General Modbus Reaquirements," for details.

Continued on next page . . .



700	device has not been opened
705	DUART not present
710	net not configured with PLC-type protocol
715	bad serial io configuration parameter
725	background noise on network substrate
730	another modbus master already active
731	mbplus peer in monitor-on-line state
732	mbplus peer never getting token
735	diagnostic loopback test failed
750	a remote node has same node address
755	could not find any nodes on network
1540	NAK count limit exceeded for transmit msg
1541	ENQ count limit exceeded for transmit msg
1561	timeout waiting for response to command
2278	RAM allocation failed
2279	hardware failed self-test at warmstart
2280	cannot access net hardware

## PLC Programming Code Table (Page 1 of 4)

Code	Description	Default	Range	Section
<b>Remote Channel Status, Reading and Writing to PLC Data Register</b>				
40ZZ	Read alarm status of Remote Channel ZZ		ZZ=0 to 96	F.8
40ZZ*	Read data register associated with RC ZZ		ZZ=0 to 96	F.8
40ZZ*N	Write value N to data register associated with RC ZZ		ZZ=0 to 96, N=0 to 65535	F.8
<b>Remote Channel Message Recording and Reviewing</b>				
4100 net	Record network ID message		net=1 to 5	F.9
41ZZ N	Record Remote Channel ZZ ALARM/PREAMBLE message at recording rate N (N is optional)	See Code 913	ZZ=1 to 96, N=1 to 4	F.9
42ZZ N	Record Remote Channel ZZ NORMAL/EPILOGUE message at recording rate N (N is optional)	See Code 913	ZZ=1 to 96, N=1 to 4	F.9
43ZZ	Review both Remote Channel ZZ messages (ZZ=0 for network ID messages)		ZZ=1 to 96	F.9
<b>Remote Channel Programming (Configuration)</b>				
4500	Sets current status as NORMAL for all RCs			F.10.2
45ZZ	Reads alarm criteria for RC ZZ		ZZ=1 to 96	F.10.2
45ZZ * net *node *addr *	Associate RC ZZ with specified network address		ZZ=1 to 96	F.10.1
45ZZ *	Read back the net address (net/node/addr) assoc. with RC ZZ		ZZ=1 to 96	F.10.1
45ZZ0	Disables Remote Channel ZZ		ZZ=1 to 96	F.10.2
45ZZ1	Sets alarm criteria to NORMALLY 1		ZZ=1 to 96	F.10.2
45ZZ2	Sets alarm criteria to NORMALLY 0		ZZ=1 to 96	F.10.2
45ZZ3	Sets alarm criteria to NO ALARM Status reporting only		ZZ=1 to 96	F.10.2
45ZZ4	Sets alarm criteria to NETERR mode		ZZ=1 to 96	F.10.2
45ZZ5 N	Sets analog low setpoint to N		ZZ=1 to 96, N=0 to 65535	F.10.2
45ZZ6 N	Sets analog high setpoint to N		ZZ=1 to 96, N=0 to 65535	F.10.2

PLC Programming Code Table (Page 2 of 4)

Code	Description	Default	Range	Section
<b>Alarm Call Grouping</b>				
45ZZ 9	Reads RC ZZ alarm call grouping linkage			F.10.3
45ZZ 9 DN	Links RC ZZ to phone numbers DN			F.10.3
45ZZ 9 *	Clears all RC ZZ alarm call linkages.			F.10.3
<b>Alarm Trip Delays</b>				
46ZZ	Reads Remote Channel ZZ alarm trip delay			F.11
46ZZ V	Set RC ZZ individual alarm trip delay to V	none	.1 - 9999.9 sec	F.11
46ZZ *	Resets RC ZZ individual alarm trip delay back to default of 2.0 sec.			
<b>Remote Channel Linking/Network Bridging</b>				
47ZZ * YY	Establish Alarm Link. ZZ source, YY destination			F.12
47ZZ * YY *	Establish Data Link. ZZ source, YY destination			F.12
47ZZ	Report all linked channel pairs using ZZ as source or destination. If ZZ=0 reports all linked channel pairs.			F.12
47ZZ -0	Clears all linked pairs using ZZ as source or destination. If ZZ=0 clears all linked channel pairs.			F.12
47ZZ * YY -0	Clear Specific Link using ZZ as source and YY as dest.			F.12
<b>Serial Communications Parameters</b>				
<b>Note: See Code 4910 for default value for "net" in all of the following</b>				
4900 net	Announces the current settings of all serial parameters for "net"			F.13
4900 net *	Resets all serial parameters for "net" to their factory defaults		See Below	F.13
4901 net *N	Read/Set baud rate for net to N	9600	50-57600	F.13.1
4902 net *N	Read/Set data bits for net to N	8	7 or 8	F.13.1
4903 net *N	Read/Set stop bits for net to N	1	1 or 2	F.13.1

## PLC Programming Code Table (Page 3 of 4)

Code	Description	Default	Range	Section
<b>Serial Communications Parameters . . . Continued from p. F-26</b>				
<b>Note: See Code 4910 for default value for "net" in all of the following</b>				
4904 net *N	Read/Set parity for net	protocol dependent	odd, even, none	F.13.1
4905 net *N	Read/Set local node address for net to N	1	1-256	F.13.2
4906 net	Read protocol type for net N	Factory Configured	Not user settable	F.13.2
4907 net *N	Read/Set COMALARM Trip Delay	30 sec.	N=0.1-999.9 sec.	F.13.3
4908 net * V	Read/Set link-level timer.	Protocol Specific	V is in msec.	F.13.3
4909 net * V	Read/Set applications-level Timer	Protocol Specific	V is in msec.	F.13.3
49 50	Reads/Sets all protocol	varies	See applicable notes	F.13.4,

**Miscellaneous**

49 *	Repeat the previous command which began with a '4'			F.14
4910 N	Read/Set default net to N	1	1 to 5	F.14
4911 N	Read/Set default node to N	1	protocol dependent	F.14

**Clearout Operations**

493 *net	Globally disables/enables network communications		Acts as toggle	F.15
4935 4	Clears all RC user recorded speed messages			F.15
4935 5	Clears all RC net addresses and criteria			F.15
4935 8	Clears out all communications failure codes and counts			F.15

**Diagnostic Readouts**

**Note: See Code 4910 for default value for "net" in all of the following**

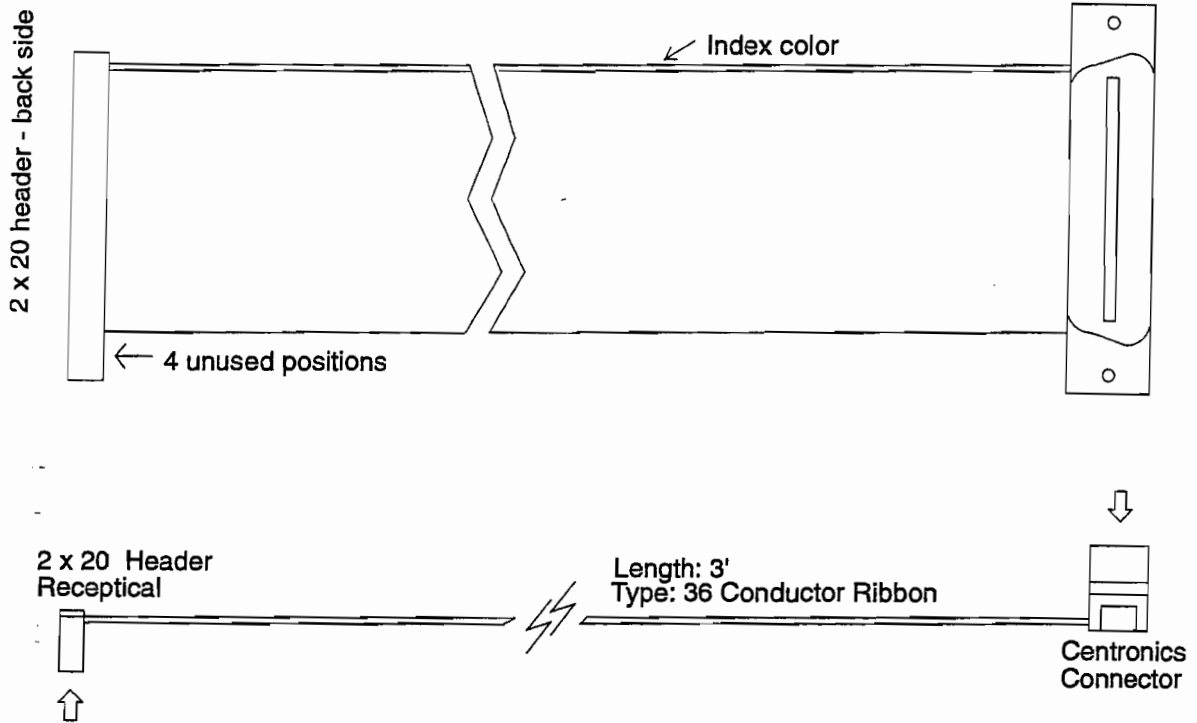
49 2 net	Reads current Network Failure threshold for net			F.16
49 2 net *N	Set Network Failure threshold to N		0 - 200	F.16
49 30 *net	Perform diagnostic self-test on specified net			F.16
49 40	Reads all 4940 X diagnostic for all networks			F.16
49 40 *net	Reads all diagnostic information for net			F.16

PLC Programming Code Table (Page 4 of 4)

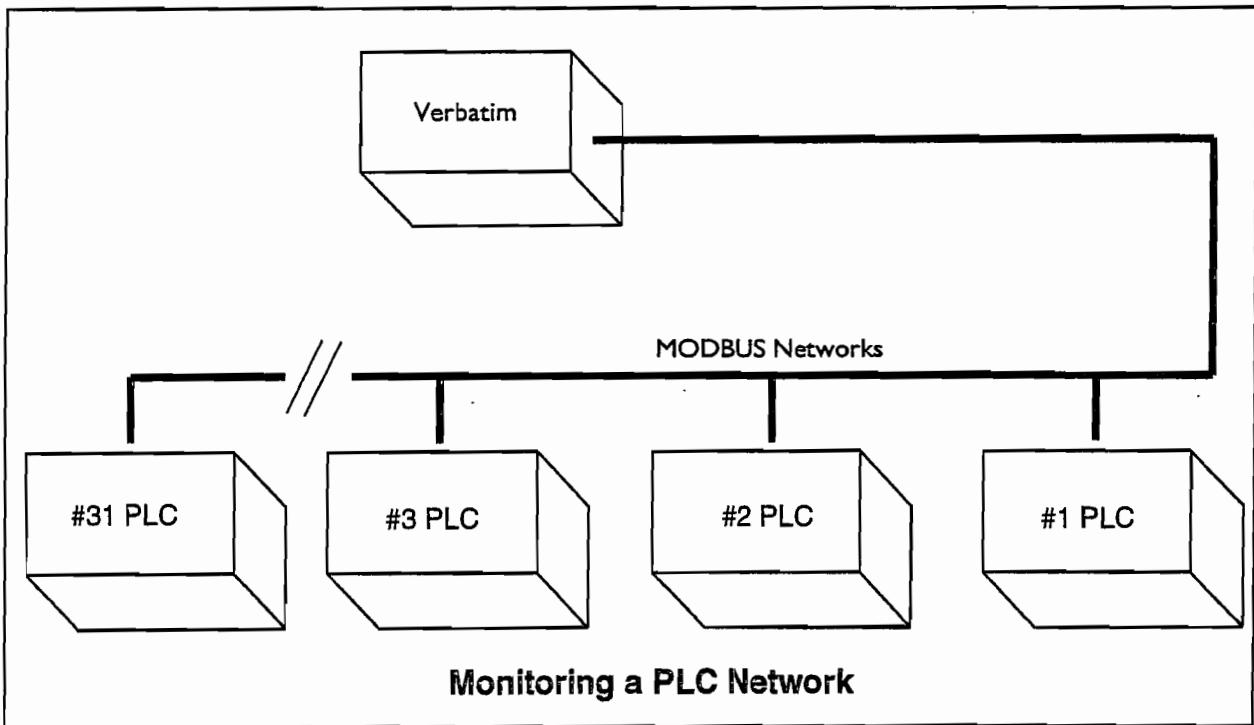
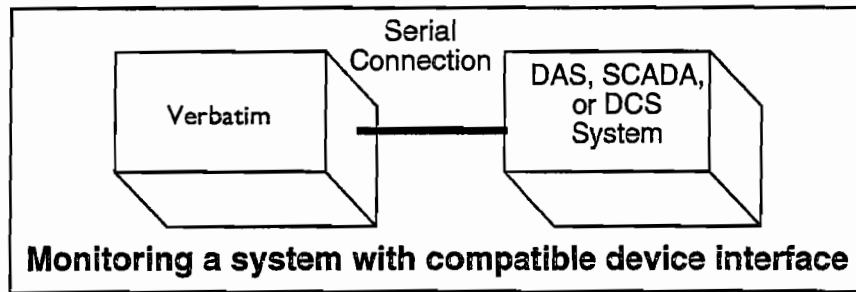
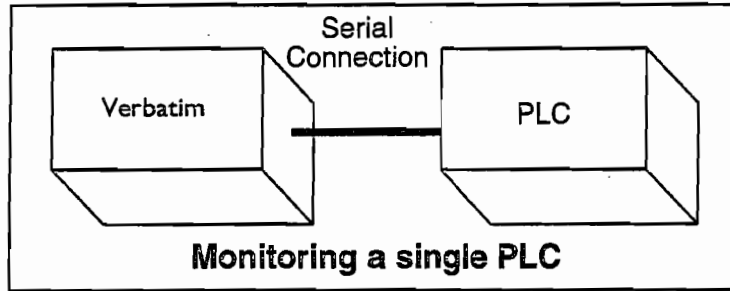
Code	Description	Default	Range	Section
<b>Diagnostic Readouts . . . Continued from p. F-27</b>				
<b>Note: See Code 4910 for default value for "net" in all of the following</b>				
49 40 1	Reads time to complete RC table scan			F.16
49 40 2 net	Reads communications alert status for net			F.16
49 40 3 net	Reads communications alert count for net (Append with 0 to clear count)			F.16
49 40 4 net	Reads all node address whose RCs have current communications failure			F.16
49 40 5 net	Reads all RCs on net currently having communications failure			F.16
49 40 6 net	Reads diagnostic codes for last 10 network problems			F.16
49 41 ZZ	Reads communications status for RC ZZ			F.16
49 41 ZZ*	Reads count of COMALARMS for RC ZZ			F.16
49 42 net	Reads list of disarmed (code 45ZZ0) RCs			F.16
49 43	Reads list of uninitialized RCs			F.16
49 44	Reads list of all RCs not using the default alarm criteria			F.16
49 45 ZZ	Reports net address, alarm criteria, setpoints, links and alarm status for RC ZZ			F.16

## G.2 RACO VPPC-1 Parallel Cable Connection Diagram

Used for LDL parallel printer option



### G.3 Verbatim PLC Network Connections Diagram



# G

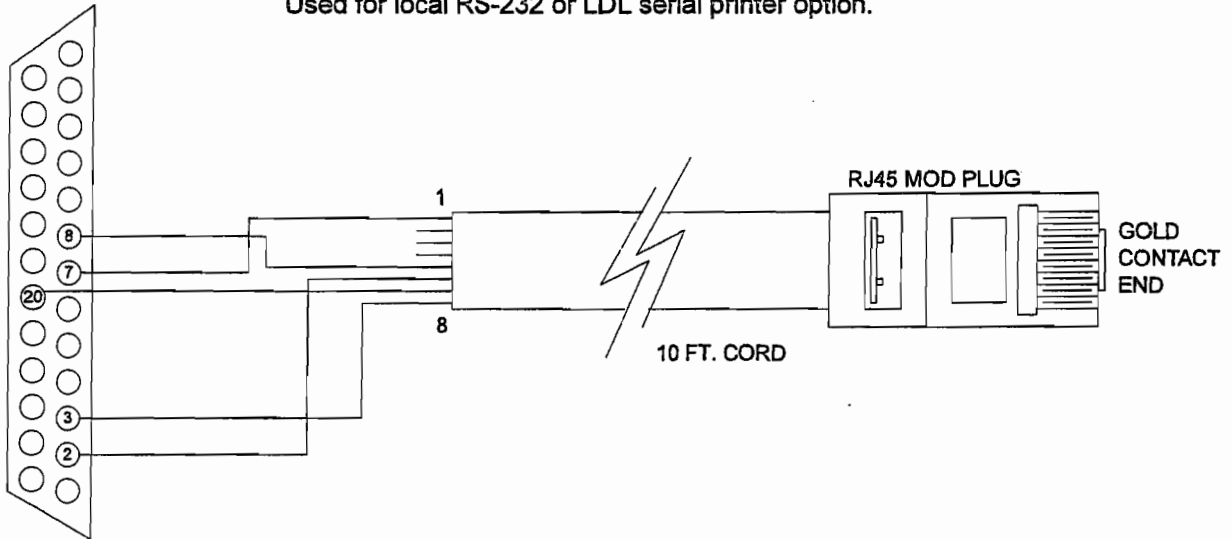
## Cabling Diagrams



# G.1 RACO VSER-01 Serial Cable Connection Diagram

REAR (SOLDER SIDE) OF DB25P (MALE) CONNECTOR

Used for local RS-232 or LDL serial printer option.



25 Pin Connector Pin-Out		
2	RXD	Data to VB
3	TXD	Data from VB
7	SGND	Signal Ground
8	DCD	Carrier Detect - Handshake Out (not used)
20	DTR	Data Terminal Ready - Handshake In (not used)

# G.4 RACO VMB-2 Serial Cable Connection Diagram

for use with Modicon PLC's using Modbus Protocol

9 PIN MALE  
RS232 CONNECTOR

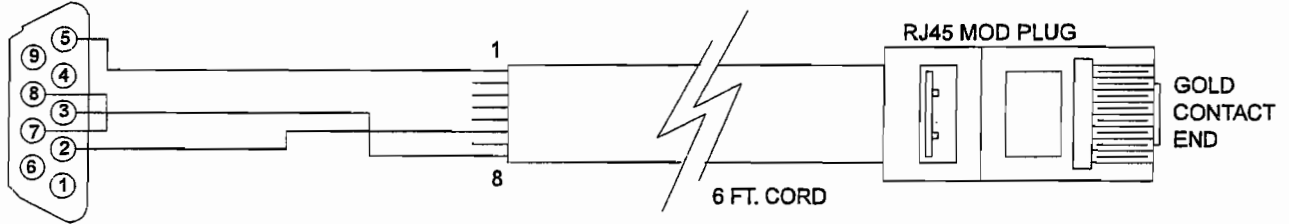


9 Pin Connector Pin-Out		
2	TXD	Data from Verbatim
3	RXD	Data to Verbatim
4	DSR	Data Set Ready - Jumpered to DTR at 9 pin conn. only
5	SGND	Signal Ground
6	DTR	Data Terminal Ready - Jumpered to DSR at 9 pin conn. only
7	RTS	Request to Send - Jumpered to CTS at 9 pin conn. only
8	CTS	Clear To Send - Jumpered to RTS at 9 pin conn. only

# G.5 RACO VMBM-1 Serial Cable Connection Diagram

9 PIN MALE  
RS232 CONNECTOR

for use with Modicon Micro PLC's using Modbus Protocol



9 Pin Connector Pin-Out		
2	RXD	Data to Verbatim
3	TXD	Data from Verbatim
5	SGND	Signal Ground
7	RTS	Request to Send - Jumpered to CTS at 9 pin conn. only
8	CTS	Clear To Send - Jumpered to RTS at 9 pin conn. only

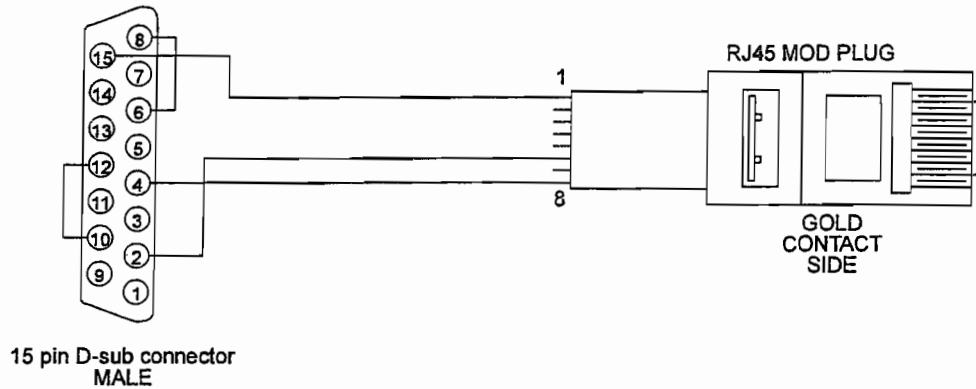


**Note:**

Connection to Modicon Micro PLC requires use of Modicon Cable Part Number 110XCA28201, 110XCA28202, or 110XCA28203 plus adaptor 110XCA20300. This combination of cable plus adaptor mates with above RACO cable. The Modicon cable is a flat, eight wire cable with RJ-45 male connectors on each end. The Modicon adaptor is an RJ-45 female to D-sub 9 Pin female adaptor.

# G.6 RACO VBB-1 Serial Cable Connection Diagram

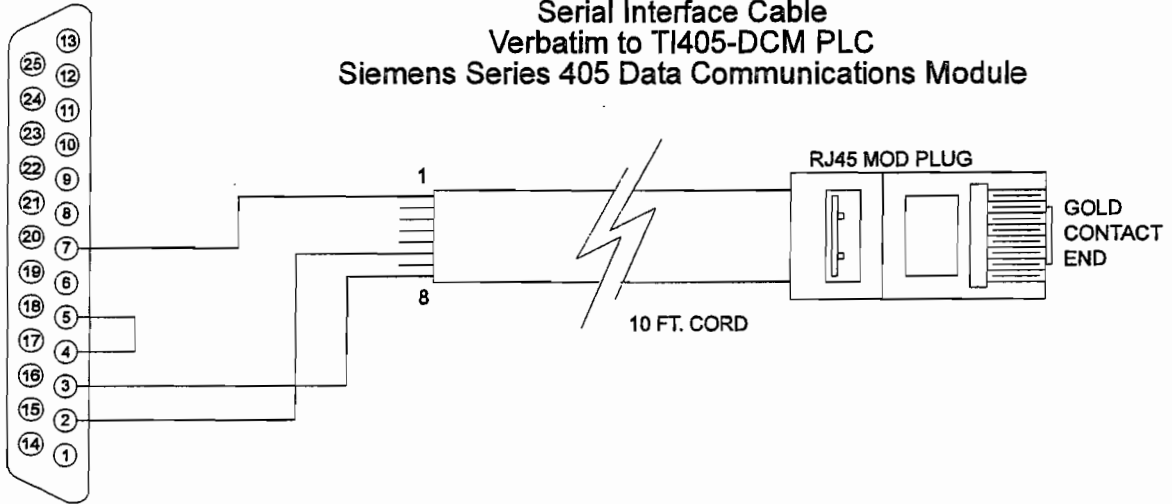
for use with Bristol Babcock DPC 3330 or 3335



15 Pin Connector Pin-Out		
2	RXD	Data to Verbatim
4	TXD	Data from Verbatim
6	JUMP	Jumpered to pin 8
8	JUMP	Jumpered to pin 6
10	JUMP	Jumpered to pin 12
12	JUMP	Jumpered to pin 10
15	SGND	Signal Ground

# G.7 VTI 405/505-DCM Serial Cable Connection Diagram

REAR (SOLDER SIDE) OF DB25P (MALE) CONNECTOR



25 Pin Connector Pin-Out		
2	RXD	Data to VB
3	TXD	Data from VB
7	SGND	Signal Ground

# H

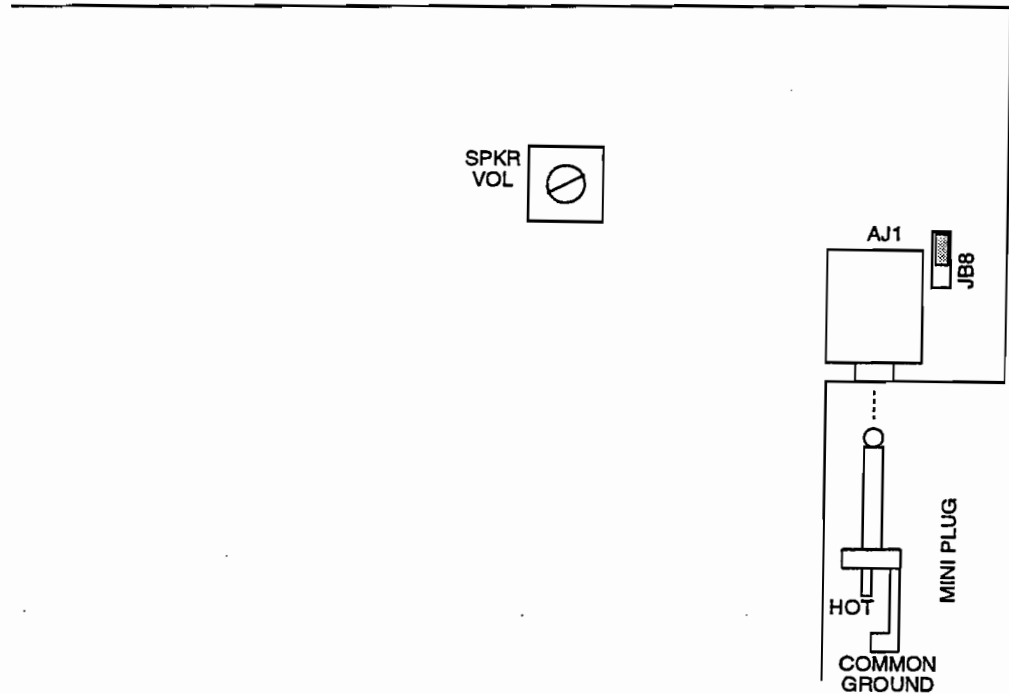
## Verbatim Floobydust

### H.1

### Adjusting Internal Speaker Volume

Speaker volume may be adjusted via the trimpot marked SPKR VOL located in the upper right hand area of the main circuit board.

This trimpot also adjusts the level of the audio signal that can be obtained via jack AJ1. However, sensitive audio systems may require an additional signal level attenuator in order to prevent overloading.



## H.2 External Speaker Connections

An audio output suitable for driving an external speaker of 4 to 16 ohms impedance, headphones, or other audio system, is available via jack AJ1, located in the upper right hand area of the main circuit board. This jack must be configured to deliver audio signal output by placing a jumper shunt across the upper pair of pins on the three-pin header JB8, located next to AJ1.

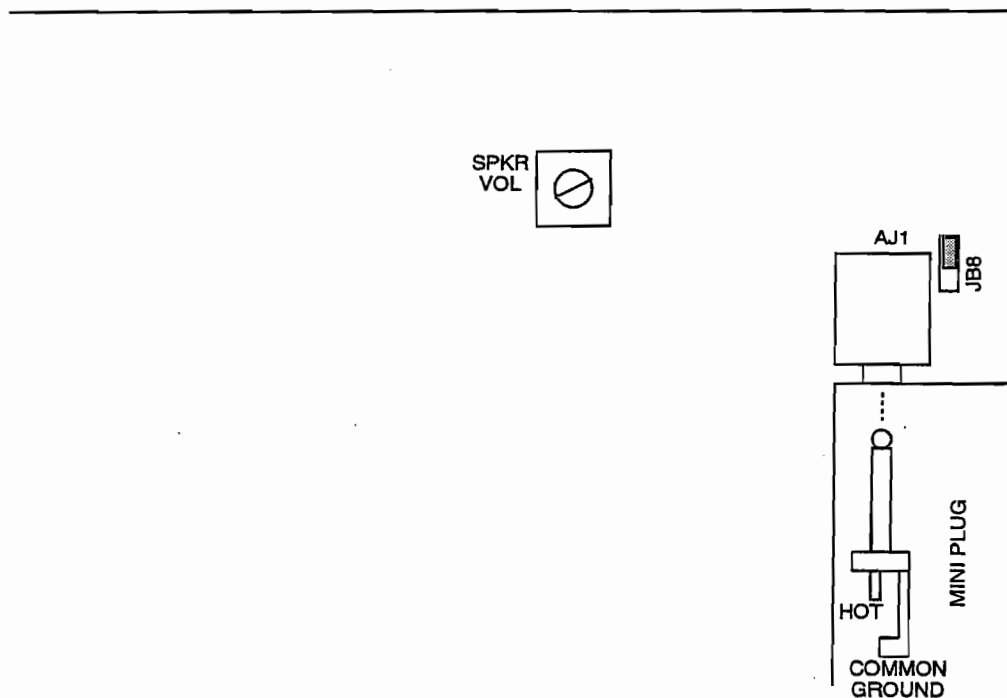
Note that AJ1 is a dual purpose jack which may be used either for audio output or DC power input, but not for both simultaneously.

To make connection with AJ1, use a standard single-circuit "MINT" plug. The tip end will be the audio signal; the shell will be ground.

The output signal has a nominal impedance of 8 ohms and a nominal average amplitude of 1 volt RMS, when the audio level trimpot, described below, is set to full clockwise position.

### H.2.1 Specifications for Audio Output from Jack AJ1

Nominal output impedance	8 ohms
Nominal average output amplitude with 8 ohm load	1 VRMS



## H.3

### Alternative Power Sources

As an alternative to the 120 VAC input, an external DC power source can be used. The DC power source should have a current capacity of at least 500 ma DC and a voltage from 8 to 14 VDC. Actual current consumption will be approximately 250 ma standby and 375 ma while phoning and speaking, plus whatever current is required to charge the internal 6 volt, 4 AH gel-cell battery. This supplemental charging current will be roughly 25 ma when the battery is already fully charged, and up to 200 ma if the battery is being recharged after a discharge. Option cards such as analog, remote supervisory control etc. will also moderately increase the current being drawn.

DC power should be connected via a standard single-circuit "MINI" plug, inserted into jack AJ1 located in the upper right hand corner of the main circuit board. This jack must be configured to accept DC power input by placing a jumper shunt across the lower pair of pins on the three-pin header JB8, located next to AJ1. **The positive (plus) side of the power source must go to the end "tip" of the plug; reversing this polarity can damage the product.**

#### Note:

Note that AJ1 is a dual purpose jack which may be used either for audio output or DC power input, but not for both simultaneously. Note also that the AC power fuse FU1 is bypassed with this configuration. It should be removed to avoid confusion.

The front panel ON/OFF control will operate as with standard 120 VAC power input. If the external power source is interrupted, the unit will switch to gel cell battery power and go into power failure alarm.

The Verbatim autodialer is capable of being powered by other types of power source, including 240 VAC, on special order. Contact factory for details.

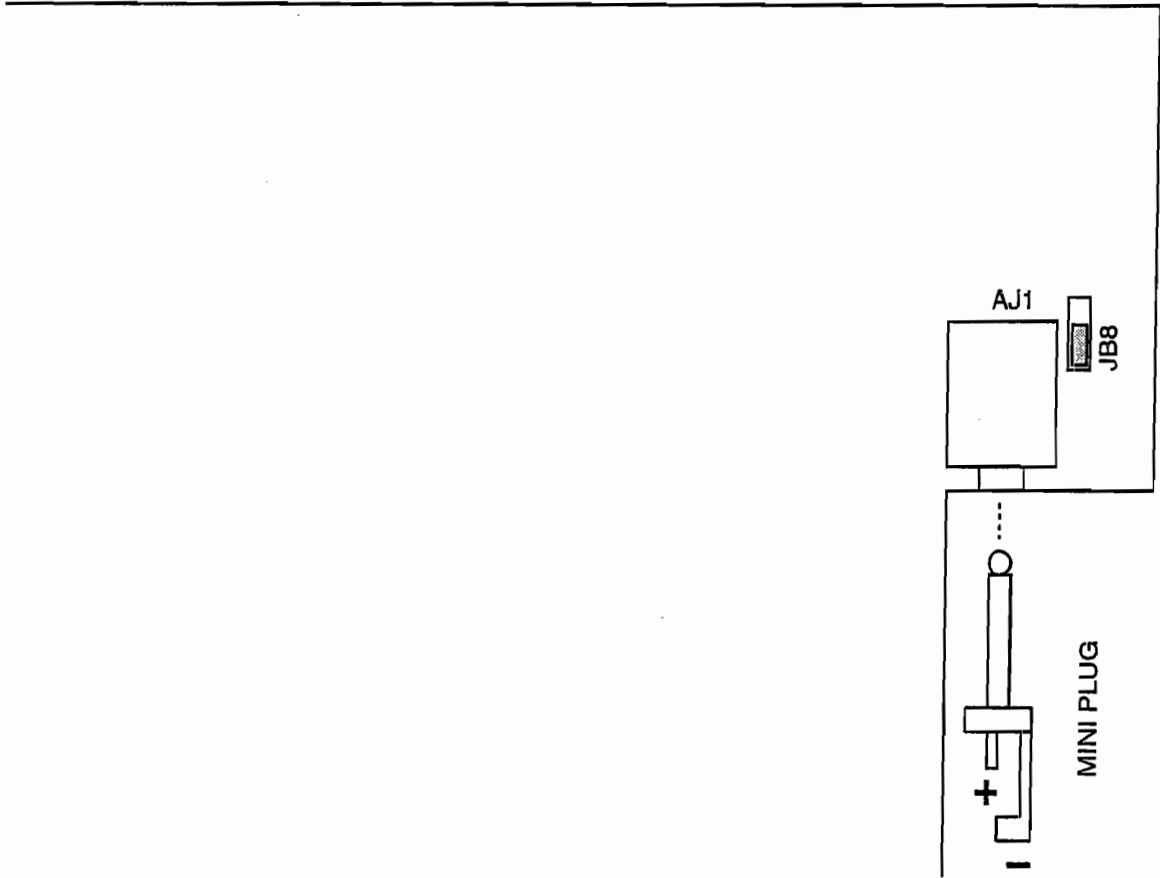
#### H.3.1

#### Standard DC Power Power Specifications

Input voltage range	8-14 VDC
Recommended minimum current capacity	500 ma DC
VSS-4C-32 current drawn, less battery, standby	275 ma
VSS-4C-32, less battery, phoning/talking	400 ma
Added current to maintain charged battery	25 ma
Added current to charge discharged battery	200 ma



*DC Power Connection Diagram*



## H.4

### Speech Recording Times

The following is a table of available speech recording times on Verbatim autodialer.

To find the available amount of speech recording time, first determine the total number of channels on the unit, then find the corresponding row indicating the number of seconds of speech recording time at the various recording rates.

Example: A VSS-4C-32, has a total of 36 channels (4 contact and 32 plc channels). Therefore the available recording times are 130, 200, 270 or 399 seconds, depending upon which recording rate is selected by the user.

Total# OF Channels	# OF RAM CHIPS	# OF Seconds @ Rate1	# OF Seconds @ Rate2	# OF Seconds @ Rate3	# OF Seconds @ Rate4
1-8	1	26	40	54	79
9-16	2	52	80	108	159
17-24	3	78	120	162	237
25-32	4	104	160	216	318
33-40	5	130	200	270	399
41-48	6	156	240	324	476
49-56	7	182	280	378	555
57 UP	8	208	320	432	624

The above table indicates the recording times that are shipped standard. However on special order, the available recording time can be increased to correspond with any row in the table.

## H.5

### **PBX Support**

Interfacing the Verbatim to PBX or PABX phone systems can occasionally present problems. Some PBXs have a non-standard dialtone. Additionally, in many PBXs, you must first press a special key, like a '9' to get an outside line. After pressing the '9' there may be a short delay followed by the dialtone for the outside line.

By turning OFF Phone Fault Detection you can avoid problems with non-standard dialtones from your PBX system. Then Phone Fault Detect will not falsely indicate a telephone line interruption.

Even with Phone Fault Detect OFF you can still accomplish dialtone detection on outside lines. Simply add the Tone Detect key sequence to the phone number string after the '9' or other digit to request an outside line.

### H.5.1

#### **Cautionary Notes About Interfacing to PBXs**

##### **Must Be an Analog Line**

Some PBX systems are either partially or entirely digital. That is, voice and signaling information is converted to a digital representation. Voice information arriving at the PBX from the outside is converted from analog to digital. Voice information leaving the PBX to the outside is converted from digital to analog. Phone sets within a digital system may be interfaced by digital signals only. In such systems it may be difficult, but usually not impossible, to obtain a "standard" analog phone line to use in interfacing devices such as a Verbatim . It may be necessary to contact the vendor of your PBX system for information on addition of analog lines.



##### **Lines Can Cause Damage**

Caution is advised. Some telephone lines within digital PBXs present voltages which can be dangerous to RACO's equipment. If you are attempting to interface a Verbatim inside of a PBX it would be a good practice to have the phone line you intend to use checked for "unusual" voltages and signals.

With few exceptions, if you can get a standard telephone set to work on a PBX line then you will be able to make the Verbatim work as well.

## H.6

### Local Alarm Relay Option

The Verbatim provides a 5 volt output that is turned on whenever the unit goes into alarm. This is available at JB4, located at the top center of the main board. Use a molex style 2 pin connector to plug onto the JB4 pins. This output can activate a sensitive (500 ohm +) relay such as a Potter & Brumfield KHU-17D11-6). Connect a 150 ohm, 1/4 watt resistor across the relay coil. The Potter & Brumfield relay plugs into a socket (#27E166) which is shown in the accompanying figures. Note that it has four separate circuits in SPDT form. This relay may be used for local alarm, line seizure, or both.

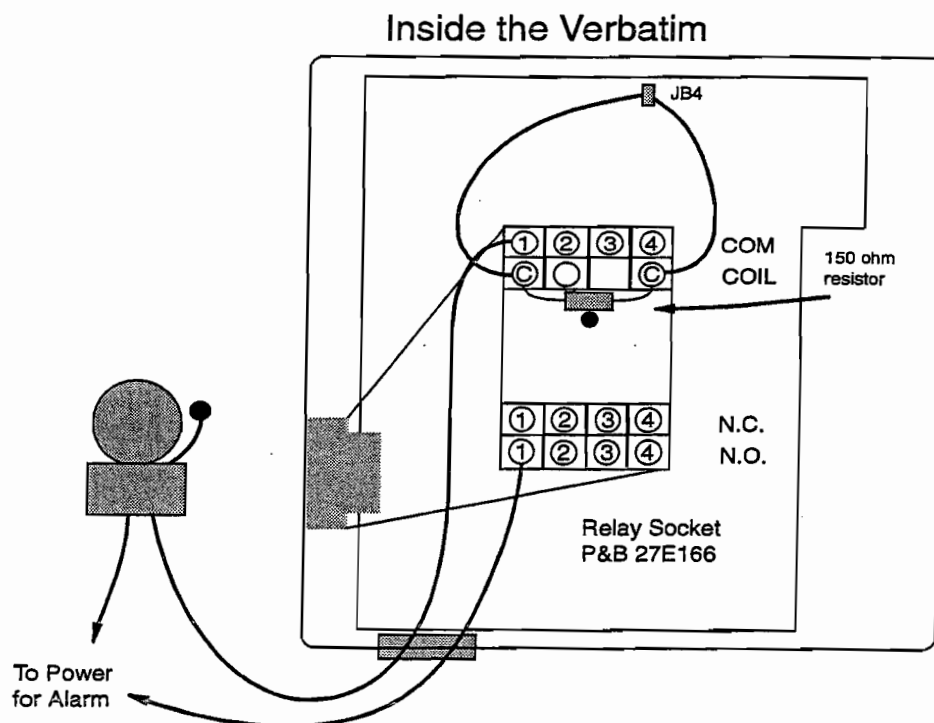
#### H.6.1

### Local Alarm Relay Configuration

1. Wire the relay coil as described in the introduction.
2. Wire the local alarm to one of the four circuits of the relay. In the illustration, the numbers refer to the four separate circuits, and C refers to the coil terminals.
3. Note that the Verbatim does not provide the power for the alarm, it functions only as a switch.
4. The program code for Local Alarm Relay configuration is  

```
960 00 ENTER
```

which is the factory default.



## H.7

### Line Seizure Option

Line Seizure is a feature that ensures that the dialer will seize the phone line when it goes into alarm, cutting off any phones, FAX, or answering machines that may be on line at the time (these are called the *downstream* phones, as they are *downstream* from the Verbatim ). The unit waits two seconds to allow a dial tone to come up, then dials out. These phones will remain cut off until the alarm is acknowledged.

The Verbatim provides a 5 volt output that is turned on whenever the unit goes into alarm. This is available at JB4, located at the top center of the main board. Use a molex style 2 pin connector to plug onto the JB4 pins. This output can activate a sensitive (500 ohm +) relay such as a Potter & Brumfield KHU-17D11-6. Connect a 150 ohm, 1/4 watt resistor across the relay coil. The Potter & Brumfield relay plugs into a socket (#27E166) which is shown in the accompanying figures. Note that it has four separate circuits in SPDT form. This relay may be used for local alarm, line seizure, or both.

The phone jack must be an RJ-31X, which is available from the phone company or a phone supply outlet. In operation, the Verbatim plugs into the RJ-31X jack and makes contact with the middle four pins, which are the standard red, green, yellow and black wires.

Note that you may combine the Local Alarm Relay with Line Seizure feature simply by using one of the spare circuits (3 or 4) for the local alarm. It breaks the downstream connections, thereby seizing the line, then waits two seconds to allow a dial tone to come up, then dials out.

## H.7.1

**Line Seizure Installation**

1. Wire the relay coil as described in the introduction.
2. Wire the four terminals of the telephone input terminal strip to the relay as follows (please refer to accompanying figures):

<b>Terminal Strip</b>	<b>Relay</b>
R	COM circuit #2
G	COM circuit #1
Y	N.C. circuit #1
B	N.C. circuit #2

3. Wire the special RJ-31X line seizure jack as follows (refer to the accompanying figures):

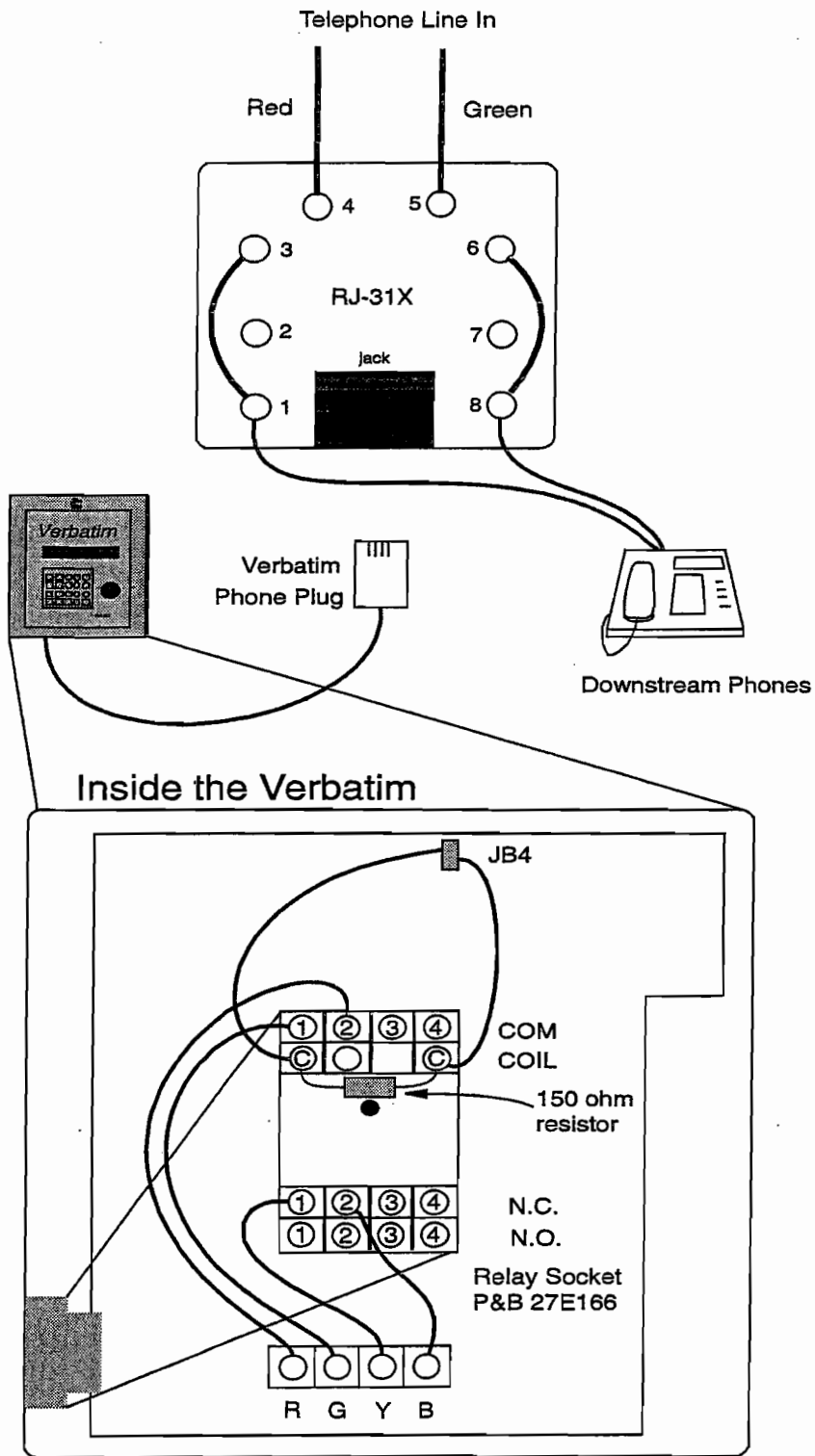
Connect a jumper wire from terminals 1 to 3 and a second jumper wire from terminals 6 to 8.

Connect the incoming telephone line red wire to terminal 4 and the green wire to terminal 5.

Connect the downstream extension phones to terminals 1 and 8.

4. Plug the Verbatim into the RJ-31X socket.
5. Program the Verbatim with code:  
960 01 ENTER  
This is the code for Line Seizure configuration of the Local Alarm Relay.

*Wiring the RJ-31X Line Seizure Jack Diagram*



**H.8****Heater / Thermostat Option**

The heater/thermostat option is intended to provide warming of the product when it is exposed to particularly cold ambient temperatures.

The thermostat applies 120 VAC power to two chassis-mounted resistors, when it senses temperatures below approximately 40 degrees F. The resistors dissipate a combined 75 watts of power. The amount of temperature elevation above ambient temperature that this provides depends on the thermal insulation of the enclosure and "heat sinking" into the surface which the unit is mounted to. The unit's aluminum enclosure provides relatively little thermal insulation by itself. However if RACO's fiberglass NEMA 4X enclosure option is used, a temperature elevation of about 75 degrees is provided.

If the unit is to be powered by something other than 120 VAC and you need a heater/thermostat, consult factory.

---

**Heater/Thermostat Option**

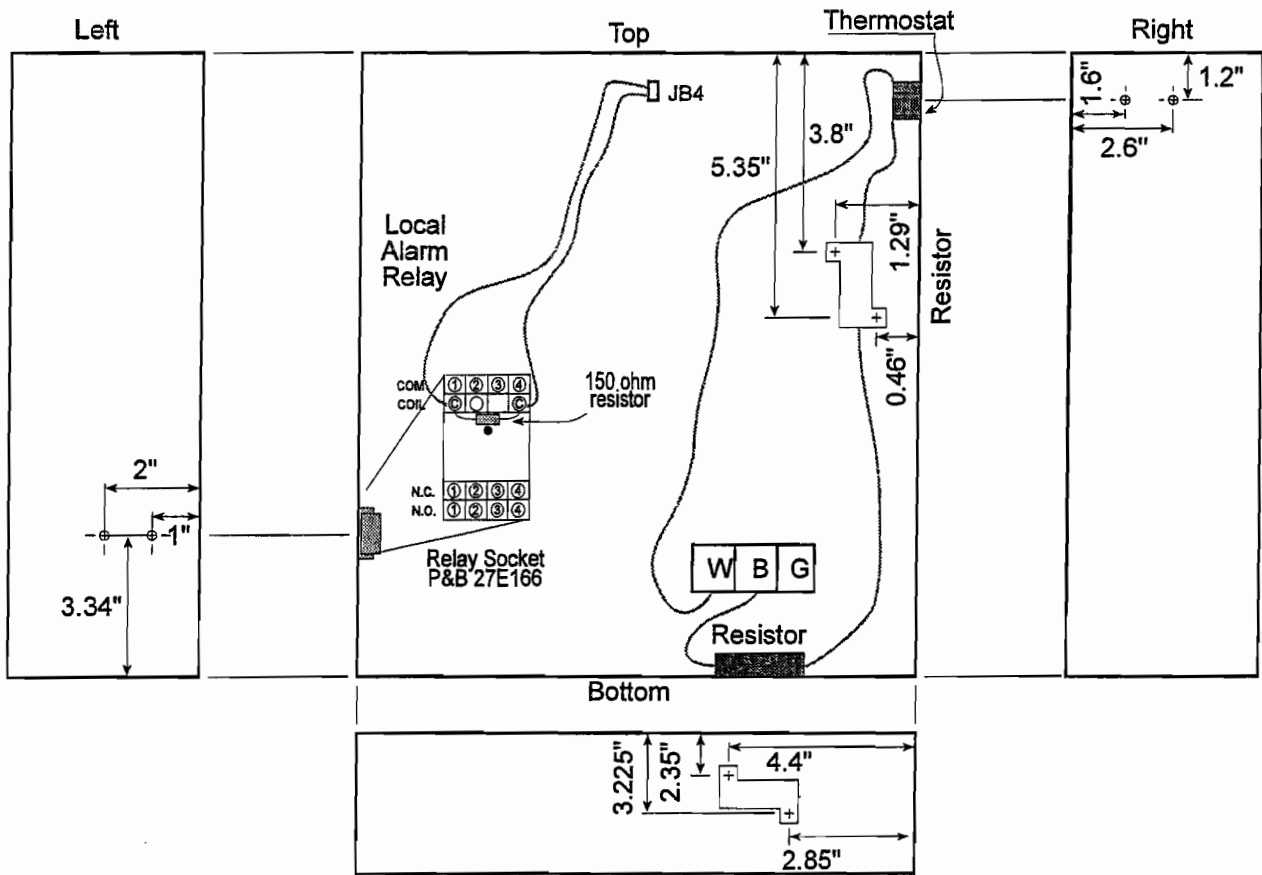

---

Power source required	120 VAC
Power dissipated when activated	75 watts
Nominal activation temperature	40 deg F
Nominal heat rise in fiberglass NEMA 4X enclosure	75 deg F

---



### Heater/Thermostat Mounting and Wiring Diagram



## H.9

### Connecting to a Radio Transmitter

If you have a radio transmitter that can provide for external connection of an audio signal input and also for connection of an external contact closure to key on the transmitter, you may connect it to the Verbatim autodialer. However you should also consider the alternative of using RACO's CELLULARM cellular phone system, which provides a superior means of signalling where regular land line phone service is not available.

Note that the radio operation described below is not compatible with installation of the Telephone Line Seizure option.

To obtain the contact closure used to key on the transmitter, it is necessary to solder some special connections on the back of the main circuit board. **This step is not necessary if your unit has been supplied from the factory with the RF Interface option.**

First, disconnect the gel cell battery and remove all AC power connections. Remove any option cards. Then carefully remove the speech card located at the top of the unit, via its two mounting screws. Be careful to retain the plastic spacers located behind these screws, for use when replacing this speech card. Flex the card slightly to clear the two mounting pegs and pull the card straight outward.

Remove the main circuit board by removing the six 6-32 mounting screws. You may also wish to unplug the contact input terminal strips and the ribbon cable which leads to the front panel. Solder a pair of jumper wires to the back of the board as indicated in the Jumper Wires for RF Link Diagram. This step connects the auxiliary contacts of off-hook relay K1, to the Y and B terminals of telephone terminal strip TS2.

Re-assemble the unit and restore any connections which were removed. Be sure that the ribbon cable's connector is accurately and firmly seated.

Connect the Y and B terminals on TS2, to the external keying input of your transmitter. The transmitter will now be keyed on whenever the off-hook relay is activated.

The method of audio connection depends on whether the product is to be connected to a regular phone line in addition to the radio transmitter. If a sensitive microphone input is used, additional attenuation may be required to avoid overloading the audio input.

**If phone line operation is required** in addition to radio operation, establish the audio connection into the transmitter via jack AJ1, as described in the section on EXTERNAL SPEAKER CONNECTIONS.

**If no phone line operation is required**, you may instead remove the phone cord and obtain an isolated 600 ohm, line-level audio signal at the TIP and RING terminals of TS2.

In operation, the transmitter will be keyed on whenever the off-hook relay is activated -- i.e. whenever the product is attempting to place or answer a phone call. Thus, if an ordinary phone line is also used, all phone activity will also be transmitted.

**If no phone line is used**, it will still be necessary to program a "dummy" phone number consisting of a single digit "1", using program code 7 0 1 1. Also, program for touch tone dialing using program code 9 0 1 1. When the unit goes into alarm, it will activate the off-hook relay and therefore the transmitter. Then it will issue the single digit tone, and a few seconds later it will begin the speech message, continuing as it would for a regular phone call. The number of message repeats may be altered if desired, using program code 907.

**If a phone line is also used**, program the appropriate phone numbers as you would ordinarily do. All phone calls will also be transmitted by radio. If you desire to have selected "calls" go out only over the air and not to any real phone number, program the single "dummy" phone number as described above. This single digit will silence the dial tone which would otherwise be broadcast along with the speech message.

Alarm calls will continue until acknowledged, unless the unit is programmed to cease calling when the alarm violation ceases, using program code 9 2 3 2.

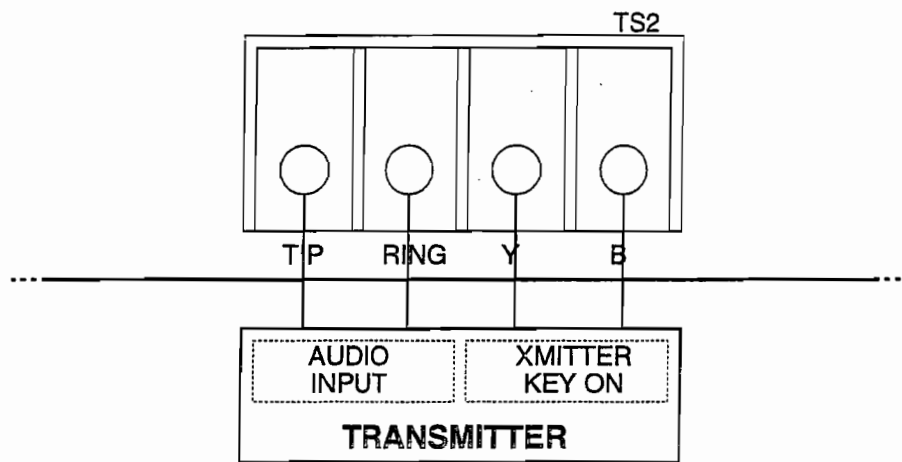
In order to acknowledge alarms, it will be necessary to phone the unit back (if a phone line connection is also being used), or else press one of the keys on the front panel.

If a two-way transceiver is available which includes some kind of tone signalling and detection feature that results in momentary closure of a local relay contact at the autodialer locations, this contact may be used to place inquiry calls to the unit and also to acknowledge alarms, by radio. Contact factory for details.

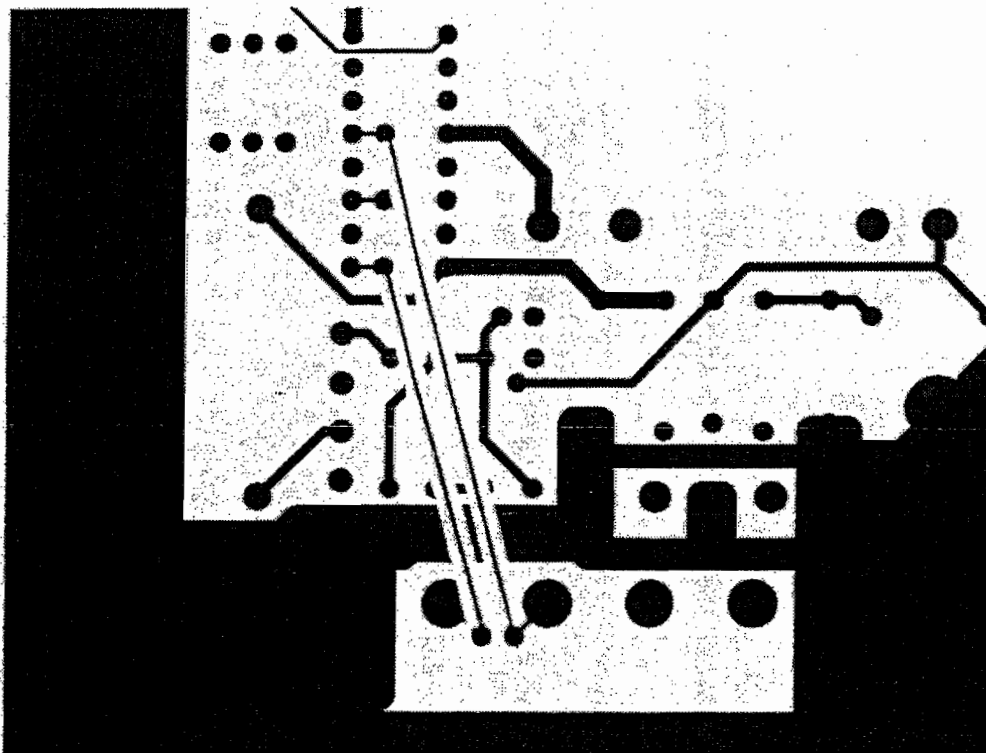
Note that it will not be possible to perform remote programming of the unit with these radio connections.

A CELLULARM cellular system eliminates all such constraints.

*TS2 Connection Diagram*



*Jumper Wires For RF Link Diagram*



## H.10

# Calling a Pager

### H.10.1

## Introduction

It has become fairly common to have the autodialer call a pager system with an alarm call. The dialer is well equipped to handle many of the current pager protocols, and an overall understanding of the sequence of events will make the required programming go smoother.

Typically, a call to the pager is placed. After a short period (usually 5-12 seconds), the pager answers then gives a beep or a short burst of beeps. This is the signal to begin entering the number you want to be received and displayed by the beeper. When the information is complete, the pager terminal will hang up.



### *Note:*

RACO strongly recommends that you program other personnel phone numbers at the appropriate place in the dialing list. This is to insure that if for some reason the pager system cannot be activated, you will get a timely warning from your autodialer.

### H.10.2

## General Programming Considerations

In most cases, the entire pager calling sequence is handled within the dialing string of the Verbatim. That is, it is all part of the phone number. The unit will handle up to 60 digits, including any timing delays you insert. The dialer must be programmed for touch tone dialing (program code 9011), as a pager terminal will not recognize pulse dialing.

### Numeric Pager Support

Support for Numeric Pagers is comprised of a number of Verbatim autodialer features:

- Ability to add delays into a phone number string  
Often needed to pause after dialing the pager system's digits and emitting the caller's ID digits in the phone string.
- Ability to add DTMF # (or DTMF\*) into a phone number string  
Often needed as a terminator character to inform the paging system that the last digit has been entered.
- Ability to add a pause for tone detect anywhere in the phone number string  
Sometimes used to detect the paging system's beep(s) heard after it answers.

- Ability to defeat voice annunciation for a specific phone number  
Often just dialing the pager system and emitting a DTMF ID sequence is sufficient for that phone call. Voice reports only delay the calling of subsequent numbers.
- Ability to add DTMF A, B, C, and D tones to phone number string  
These DTMF characters don't appear on standard telephones and may be used to differentiate automation equipment from humans calling the paging system.

Except for simple delays, entry of these additional digits into a phone number string requires a two key sequence. For example, to enter a '#' character into a phone number string, either at the front panel or over the phone, press the '\*' key followed by the 8 key. This two key sequence will enter the single '#' character into phone number string.

The complete list of special digits is as follows:

Desired Result	User Enters	Voice Speaks
DTMF 'A' in phone string	*1	A
DTMF 'B' in phone string	*2	B
DTMF 'C' in phone string	*3	C
DTMF 'D' in phone string	*4	D
No voice annunciation for this number	*5	PHONE
Pause for tone detect	*6	TONE
DTMF '*' in phone string	*7	STAR
DTMF '#' in phone string	*8	POUND

### Case 1: Simplest Case Pager

The simplest case is when you only have to call the pager and can hang up as soon as it answers, with no information being passed to the pager except that someone called. If you have only one dialer (and no one else uses the number!) you assume that any call from the pager is a Verbatim alarm call, and proceed from there. Of course, if you had two possible callers, you wouldn't know which one had called.

#### *Example:*

Set the first phone number to call the pager, the second phone number to call the plant foreman. Program 701 9 \*6 1 713 235 3456 ENTER. (here, 701 signifies the first phone number, 9 to get an outside line, \*6 to get an outside line dial tone, 1 713 235 3456 our hypothetical long distance call to a pager, and ENTER to complete the phone number). Program 702 9 \*6 548 7632 ENTER (this is the second phone number, to call the foreman in case the pager call doesn't get through).

## Case 2: Passing a Phone Number to a Pager

Some pager systems will allow the caller to enter a phone number (or other ID number), which is then relayed on to the beeper. When the person with the beeper gets the call, he will know immediately from the number which dialer has called. This is a good system if you are using multiple dialers, or have other pager calls in addition to autodialers.

### *Example:*

Consider the following example of initiating a call to a paging system. We will assume here we don't have to dial 9 to get an outside line for this example. The paging terminal phone number is entered, followed by a CPM wait \*6 to wait for the pager to beep. After that, an ID number is entered. Often the ID number is simply the phone number at the Verbatim autodialer site.

A # terminator \*8 is inserted. Finally, the characters \*5 are added to designate this phone session as a pager call and not a voice announcement. Entry of additional delay digits may be required for proper timing of the pager call session.

The phone number string for this example with the first phone number calling a pager, is:

701 2352456 \*6 5481234 \*8 \*5

Program 702 548 7632 ENTER (this is the second phone number, to call the foreman in case the pager call doesn't get through).



### *Exception:*

With some pager systems, Call Progress Monitoring (CPM) on may cause a delay that will not allow the pager message to be transmitted in the time allowed. If this is the case with your paging system, either have CPM in the default off state or, if you want CPM on, time delays can be used in the place of \*6 pause for tone detect. The critical task here is to time the delay from the last digit dialed until the pager beeps. The delay time needed can be determined by using a stopwatch or a clock with a second hand. You want to time this delay to the nearest second, then add 1 second to be sure. Consult the diagram on page H-20 to see the time line of events, then program the dialer.

### *Example 1:*

Delays are added by pressing the MINUS # key on the front panel. Each delay is normally 1 second, but can be programmed (using 928 N) to be any length from 1 to 10 seconds.



We made each delay 2 seconds long by programming code 928 to be 2 seconds for each delay used: program 928 2 ENTER. We then called the pager, and determined the delay between the last digit dialed and the pager beep was 6 seconds.

We programmed our pager phone number: 701 6586713 ### 18007226999 \*8 \*5, where # are delays inserted.

*Example 2:*

In this example we will enter an ID number before entering a phone number into the pager. The pager phone number is 1 713 2352456. The ID number is 7711. The dialer is at 5481234. Calling the pager by hand from the dialer site, we find the following:

- dial pager
- wait for pager to answer (6 seconds)
- pager beep
- enter ID (7711)
- wait for new pager prompt (2 seconds)
- enter dialer phone number (5481234)
- hang up

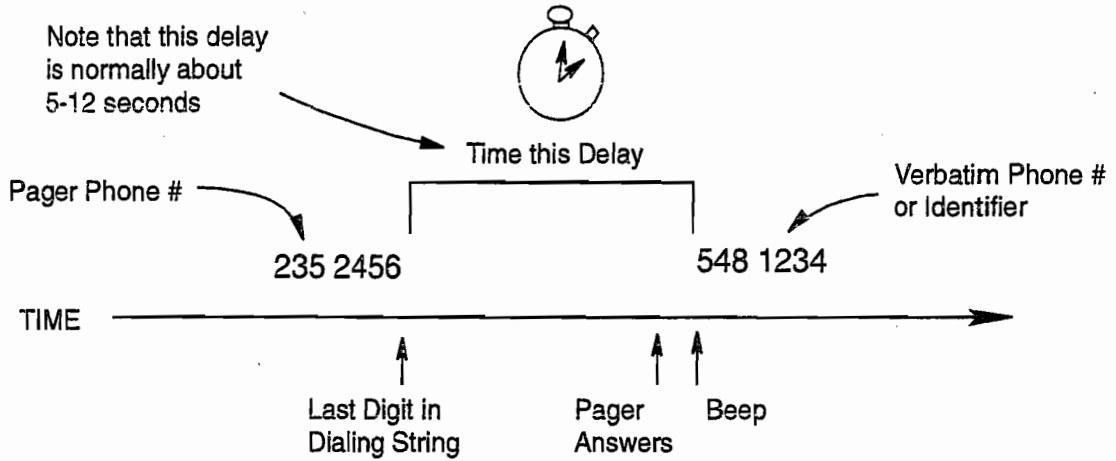
The phone number to enter will look something like:

1 713 235 2456 (delay 1) 7711 (delay 2) 548 1234

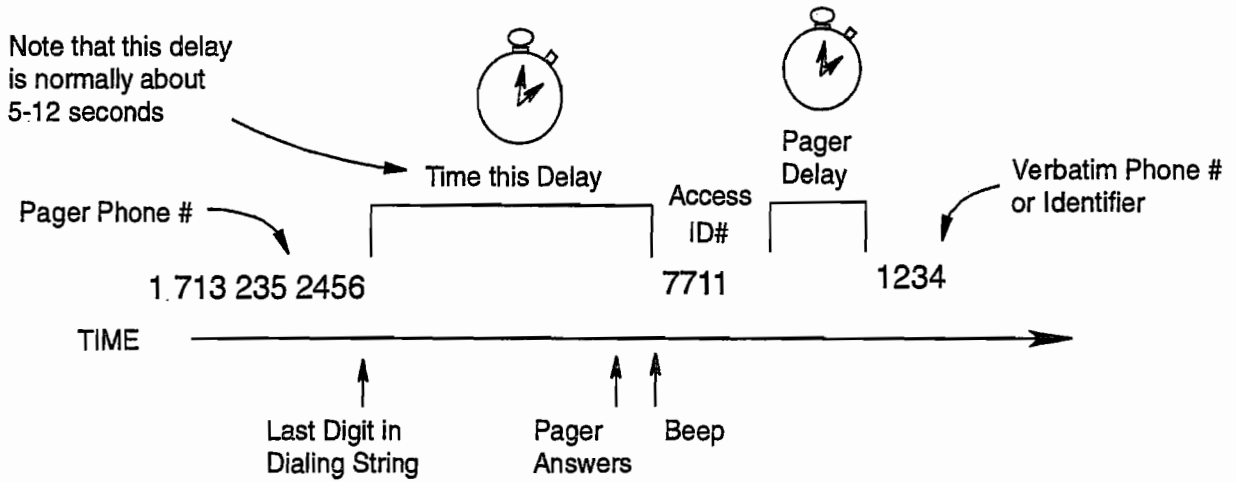
- In our example we programmed Phone #1:  
701 1 713 235 2456 ### 7711 # 548 1234 ENTER  
(Remember that each # represents a 3 second delay).
- and Phone #2:  
702 548 7632 ENTER (our foreman again)



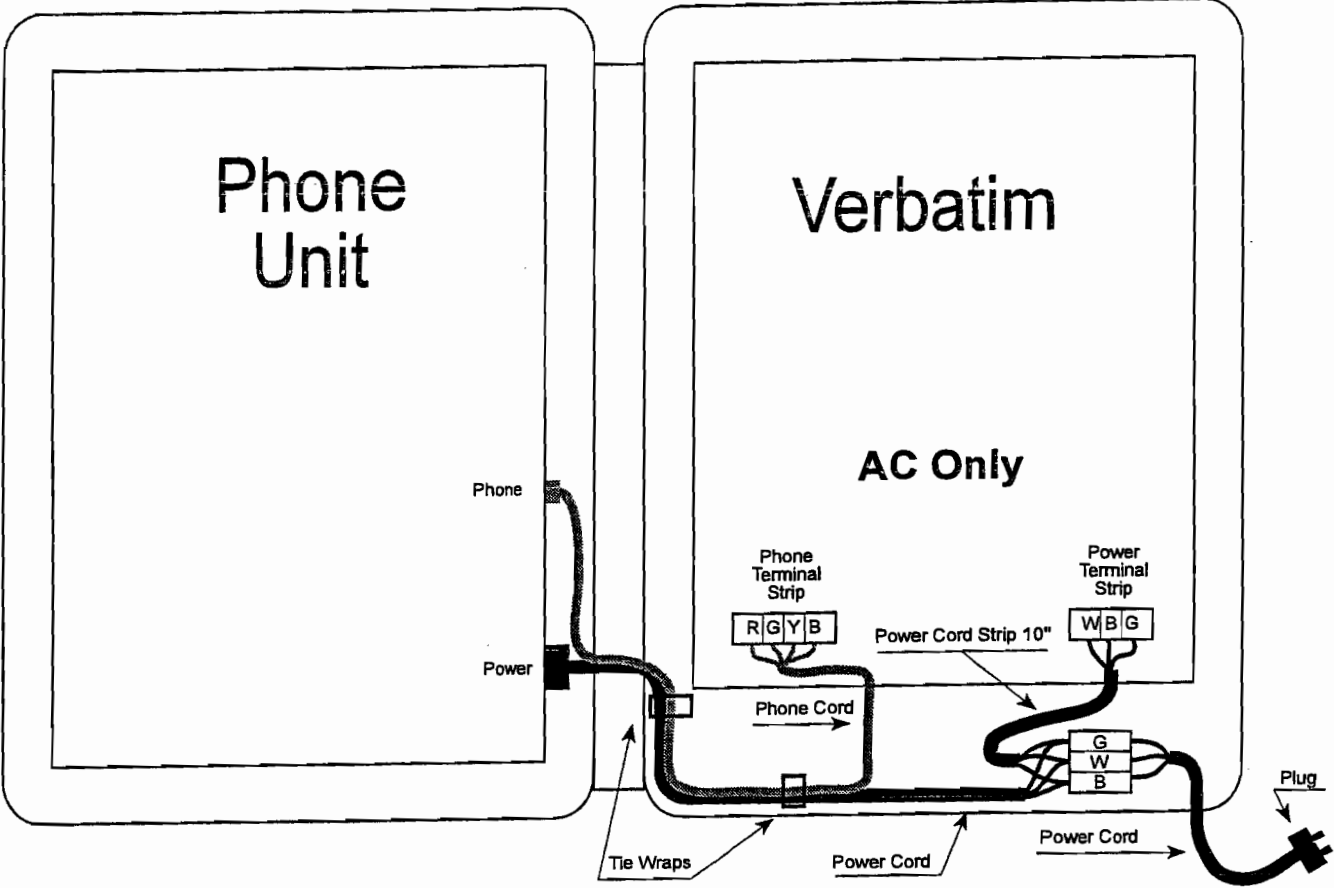
*Case 2: Pager Calling Sequence Using Delays (Example 1)*



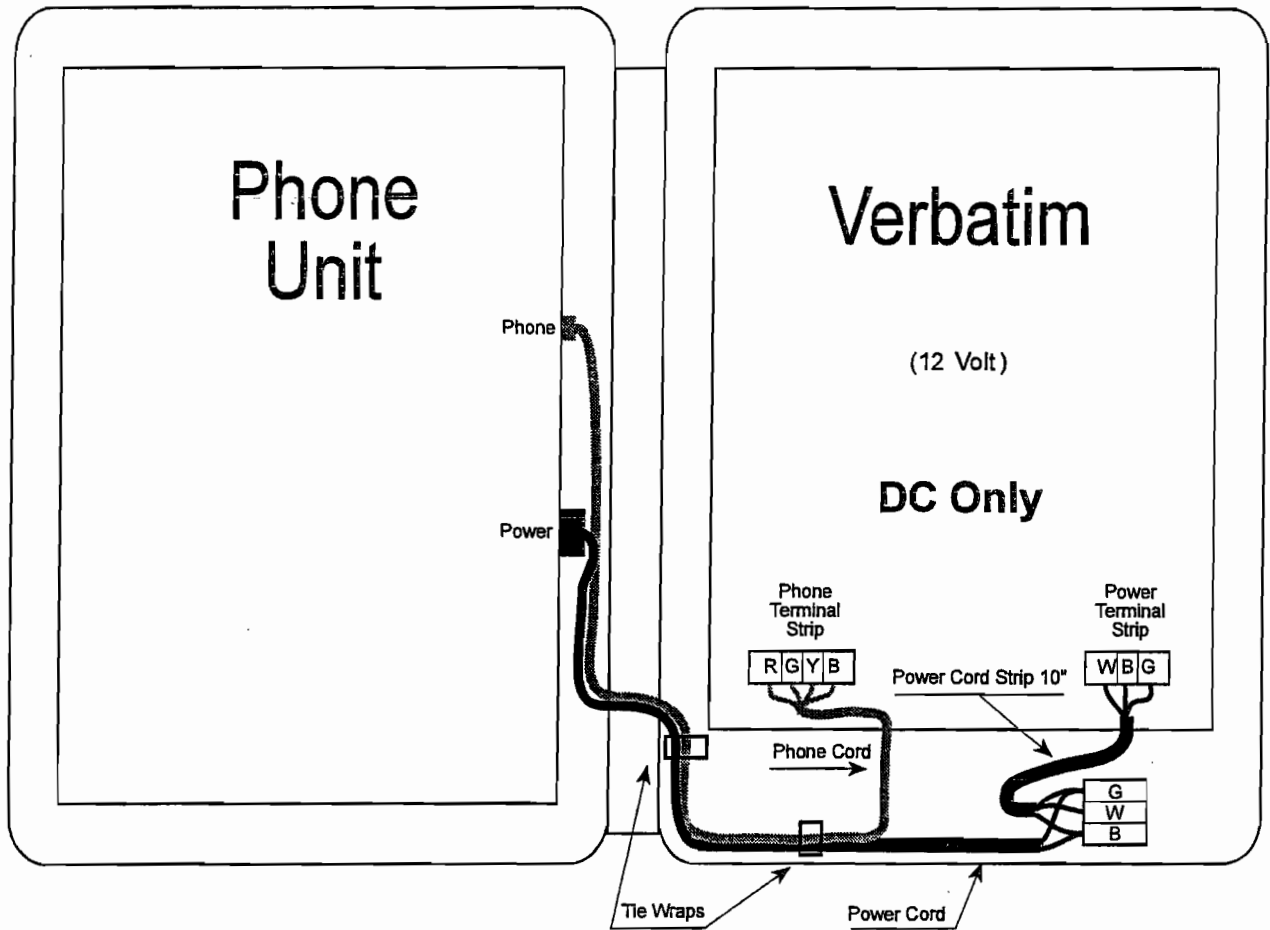
*Case 2: Pager Calling Sequence Using Delays (Example 2)*



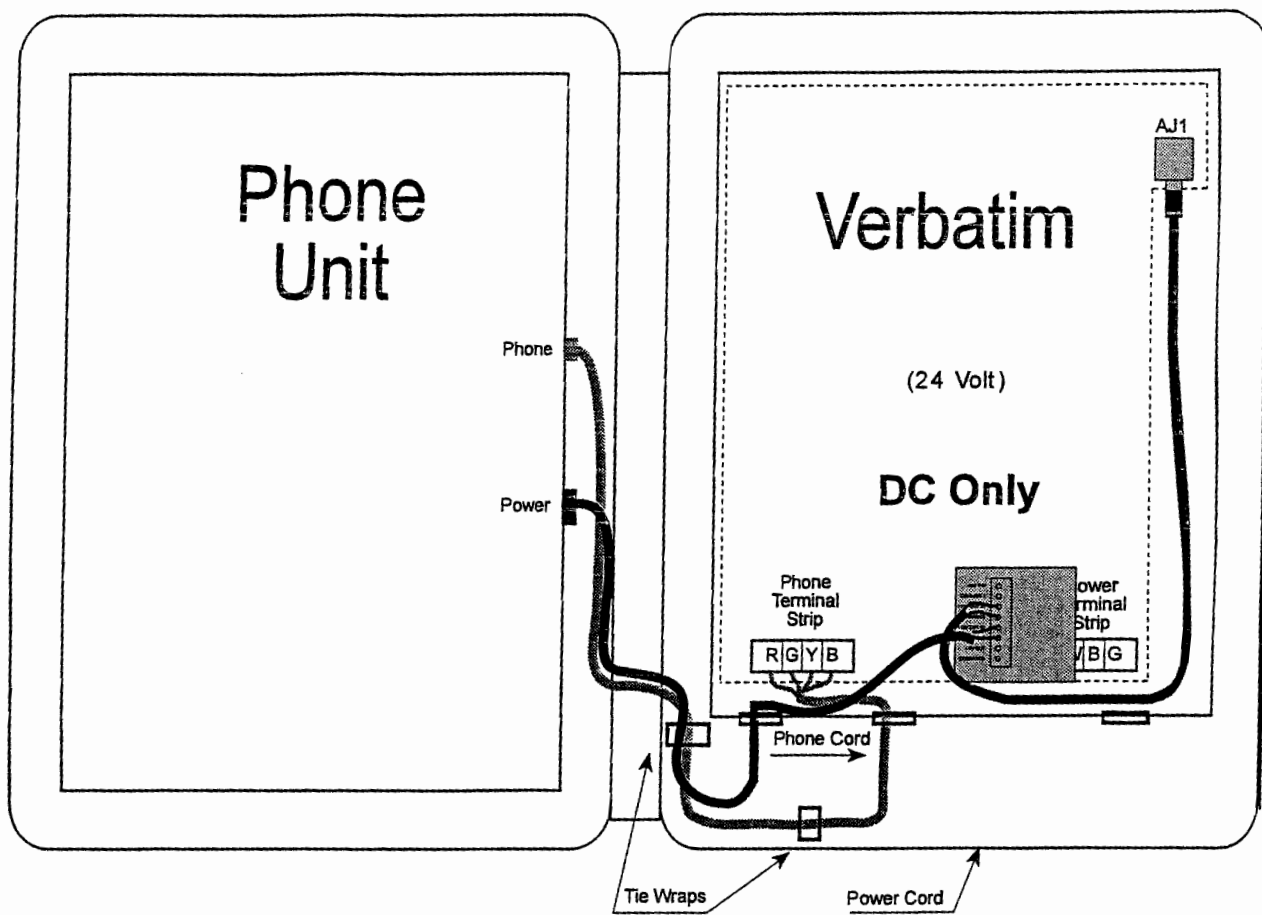
Cellularm Cellular Communications Diagram (AC Only)



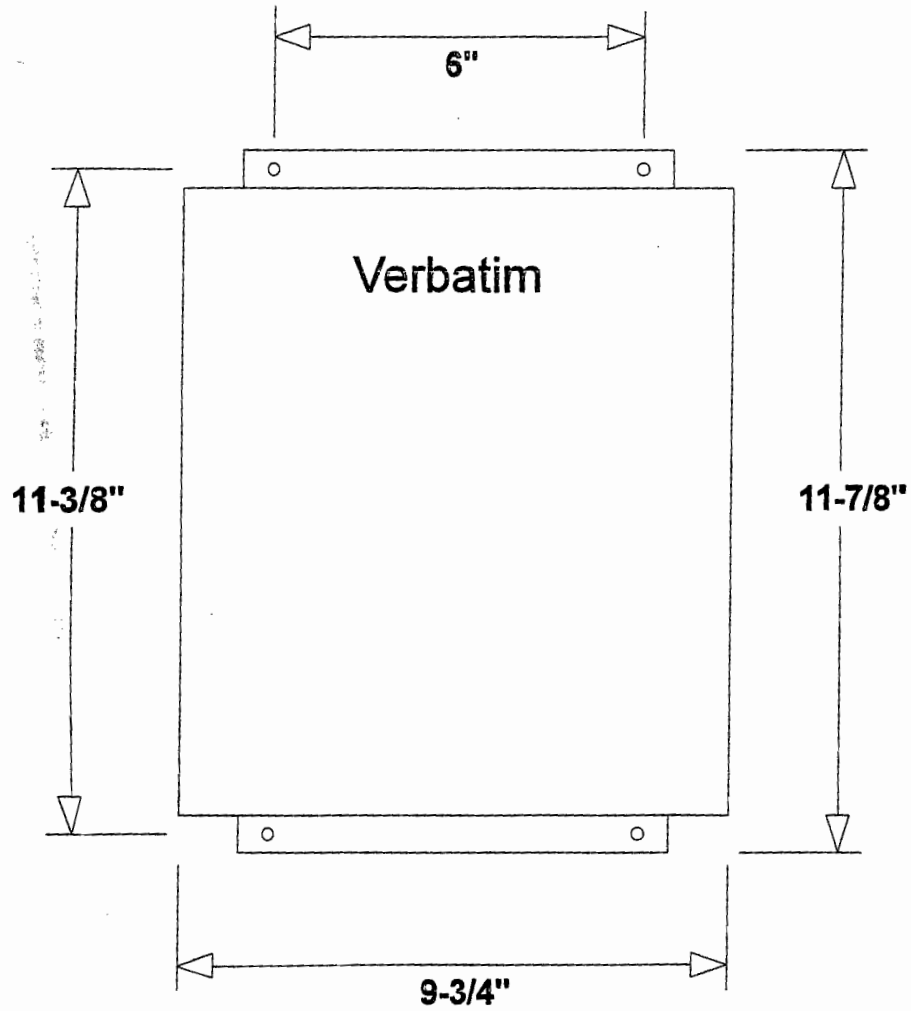
*Cellularm Cellular Communications Diagram (12V DC Only)*



*Cellularm Cellular Communications Diagram (24V DC Only)*

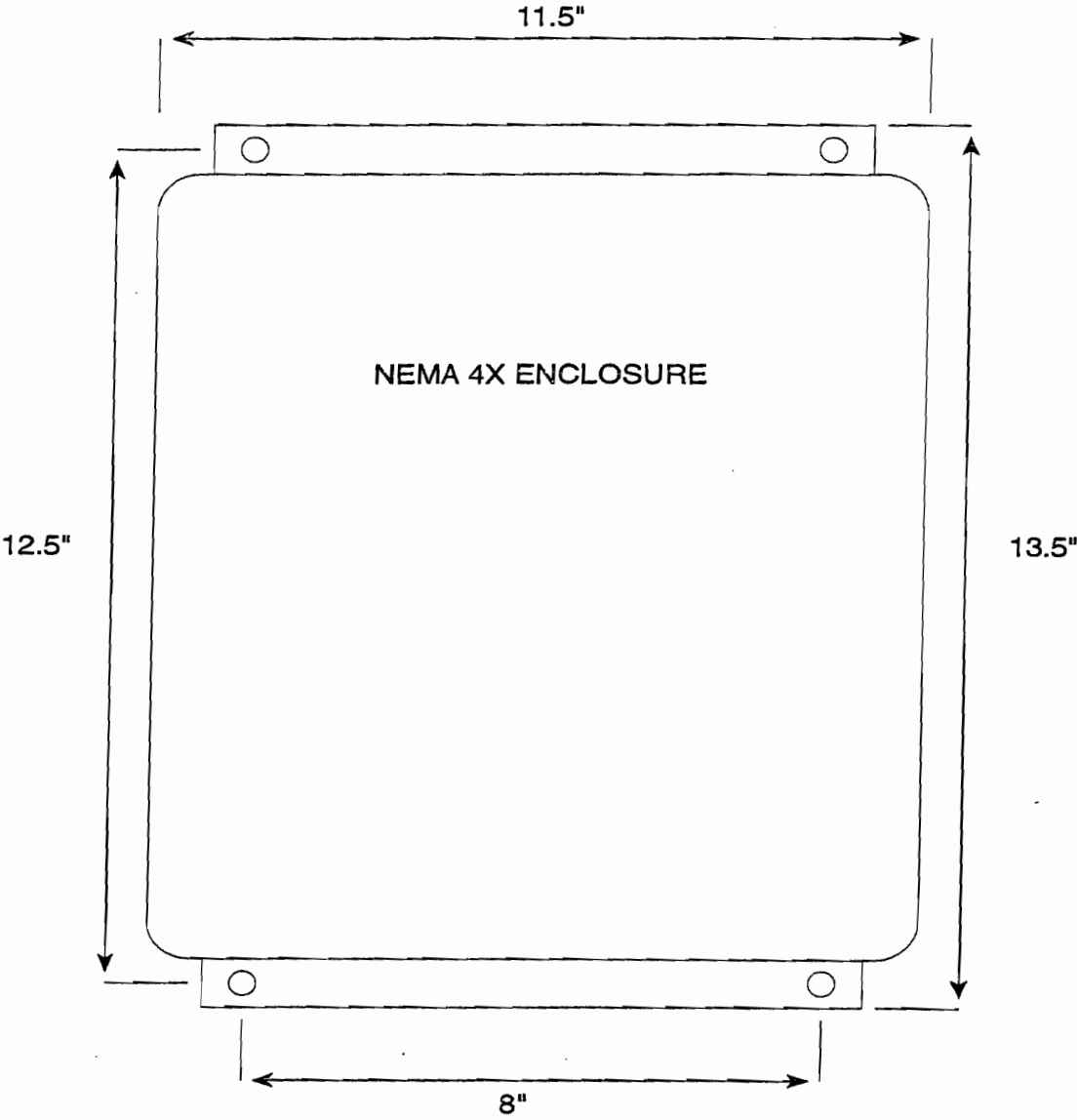


*Verbatim Enclosure Diagram*



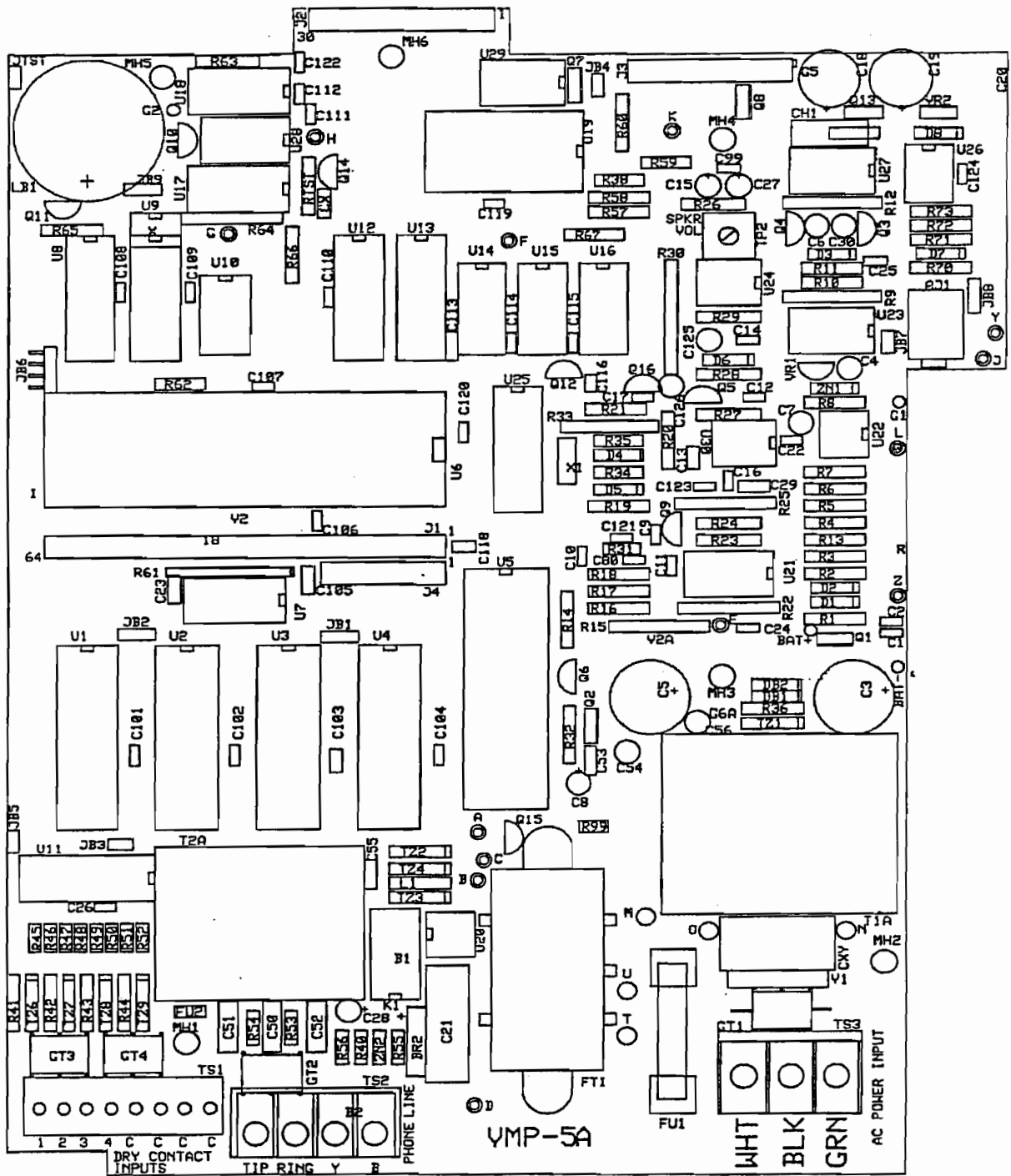
RECTANGULAR MOUNTING CENTERS: 6" W x 11-3/8" H  
OVERALL DIMENSIONS: 9-3/4" W x 11 7/8" H x 5" D

*NEMA 4X Enclosure Diagram*

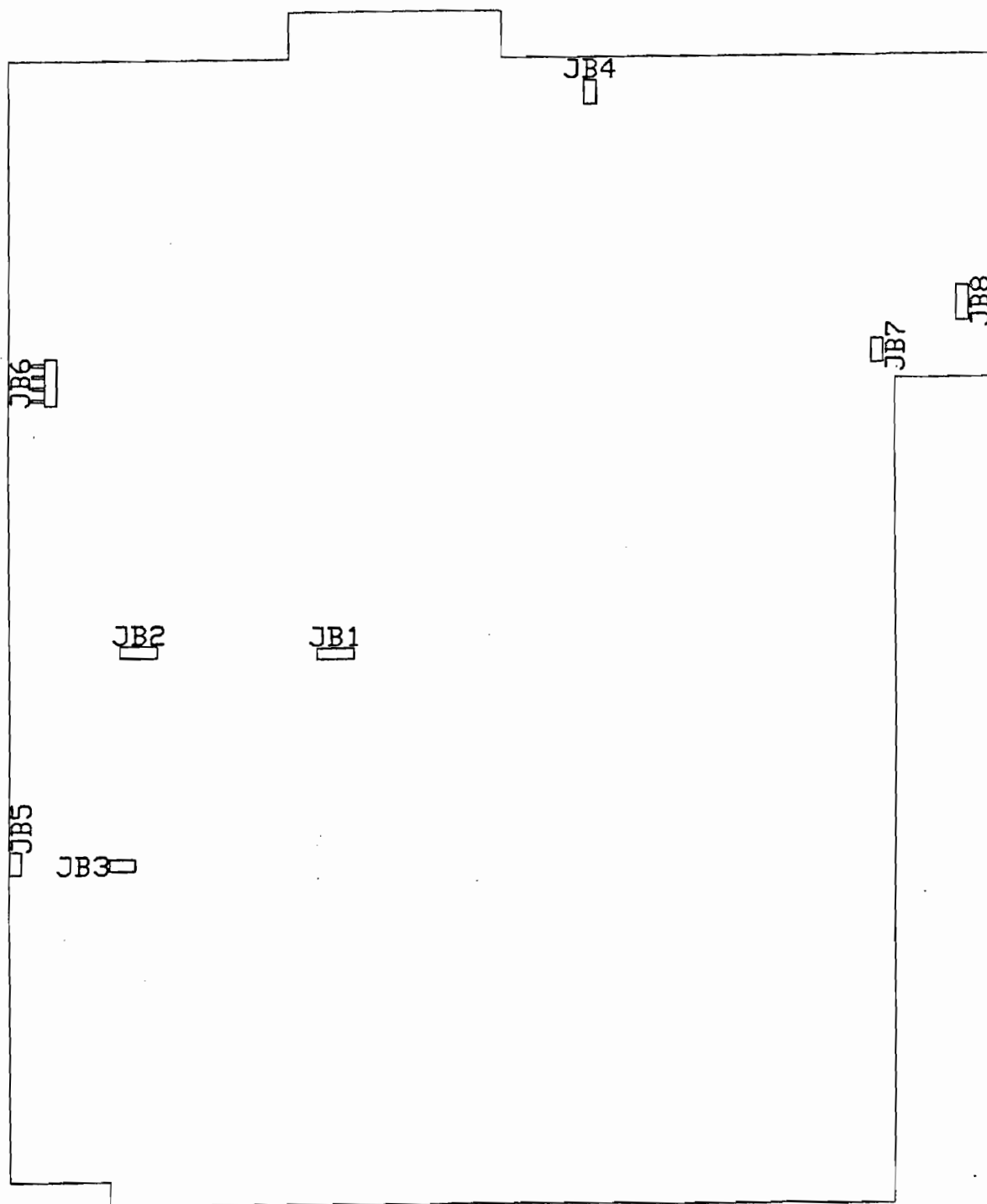


RECTANGULAR MOUNTING CENTERS: 8" W x 12.5" H  
OVERALL DIMENSIONS 11.5" W x 13.5" H x 5.5" D

Motherboard Component Diagram



*Jumper Block Diagram*





## H.11

# Jumper Configurations

### Main Board VMP-5A

- ◆ JB1 - configures sockets U3 and U4 for the size of EPROM chip used.

Placement of shorting block:

- left hand two pins- 2 meg EPROMs (for future use)
- right hand two pins- 1meg and 512k EPROMs (factory default)

- ◆ JB2 - configures sockets U1 and U2 for the size of RAM chip used.

Placement of shorting block:

- left hand two pins- 1 meg or 256k RAMs (factory default)
- right hand two pins- 2 meg RAMs (for future use)

- ◆ JB3 - RESET. Short these two pins together for about 2 seconds (a screwdriver works fine) to clear the programming back to factory defaults.

- ◆ JB4 - Local Alarm Relay/ Line Seizure Relay output. Upper pin is ground, lower pin supplies 5vdc on alarm to activate the relay.

- ◆ JB5 - SYSTEM RESET. Short these two pins together for about two seconds to reset the system hardware.

- ◆ JB6 - factory use only

- ◆ JB7 - factory use only

- ◆ JB8 - configures jack AJ-1 to be either an audio output jack or a 12vdc power input jack.

Placement of shorting block:

- upper two pins makes AJ-1 an audio output jack, for using an external speaker or connecting to another audio system.
- lower two pins makes AJ-1 a 12vdc power input jack for powering the unit from an external source.

- ◆ JB9 - factory use only

## Speech Board VSPE-2

- ◆ JB101 - position of jumper varies with the firmware version

Placement of shorting block:

- left hand two pins if the firmware version is 2.00 or higher. Speech RAM is to be placed in the board beginning with U103 then U104 and so on up to 8 RAM chips.
- right hand two pins if the firmware version is 1.36 or below. A maximum of two speech RAM may be used. If using just one RAM chip, it goes in socket U104. A second one if used can go in U105 (U103 is skipped).

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# **Verbatim™ Series VSS Autodialer Specification**

## **I.1 Description & Phone Number Dialing**

The autodialer shall be a solid state component capable of dialing up to 16 phone numbers, each up to 60 digits in length. Phone numbers and Standard pulse dialing or Touch Tone DTMF dialing are user programmable via the system's keyboard or Touch Tone phone. Further, the autodialer shall be capable of connecting, via a single serial interface cable, to a variety of Programmable Logic Controllers (PLCs), Distributed Control Systems (DCSs) & SCADA systems. Serial interfacing methods shall incorporate commonly used standard industrial network protocols such as Modicon, Inc. Modbus RTU

## **I.2 Solid State Voice Message Recording and Playback**

The unit shall have two different categories of speech message capability, all implemented with permanent non-volatile solid state circuitry with no mechanical tape mechanisms. The unit shall allow for message recording from a remote telephone as well as from the front panel.

### **I.2.1 User Field Recorded Messages**

The user may record and re-record his own voice messages, for each input channel and for the Station ID.

1. *There shall be no limit on the length of any particular message, within the overall available message recording time, which shall be 409 seconds for 36 total channel units and 624 seconds for 57 total or more channel units.*
2. *The unit shall allow selective recording of both Normal and Alarm advisory messages for each input channel.*
3. *The unit shall provide for automatic setting of the optimum speech memory usage rate for the total set of messages recorded, in order to achieve optimum recording sound quality.*
4. *Circuit board switches or jumper straps shall not be acceptable means of manipulating message length or recording rates.*

**I.2.2****Permanent Resident Non-Recorded Messages**

Permanent built-in messages shall be included to support user programming operations, to provide supplemental warning messages such as advising that the alarms have been disabled, and to allow the unit to be fully functional even when the installer has not recorded any messages of his own.

**I.3****Local & Remote Programming Capabilities**

The user may optionally elect to alter the following parameters from their standard normal default values via keyboard entry or remotely from any Touch Tone phone.

Capability	Setting/Description
Alarm Call Grouping	On alarm, system shall selectively call the correct phone numbers according to the current alarm(s).
Alarm response delay	.1 to 9999.9 seconds.
Delay between alarm call outs	.1 to 99.9 minutes.
Alarm reset time:	0.1 to 99 hours or "NO RESET".
Incoming ring response (answer) delay	1 to 20 rings.
Input alarm criteria	Each channel shall be independently configured for "Normally Closed," "Normally Open," "No Alarm," or "Disabled."
Autocall Test	When enabled, the unit shall place a single round of test calls, both at the time this function is enabled and also at regular subsequent intervals until this function is disabled at the keyboard.
Run Time Meter	Selected physical channel inputs shall accumulate and report the number of hours that its input contacts have been closed.
Remote system microphone activation. Remote and local arming and disarming of system.	
Pulse Totalizer Function.	Selected physical input channels shall be capable of counting pulses of up to 100Hz. at 50% duty cycle.

## **I.4 Nonvolatile Program Memory Retention**

User-entered programming and voice messages shall be kept intact even during power failures or when all power is removed for up to ten years.

## **I.5 Acknowledgment**

Acknowledgment of an alarm phone call is to be accomplished by pressing a Touch Tone® "9" as the alarm call is being received, and/or by returning a phone call to the unit after having received an alarm call.

## **I.6 Remote (PLC) Channel Monitoring Function**

The unit shall continuously scan all properly configured Remote Channels. The unit shall monitor remote channels which physically reside in other industrial equipment interfaced to the Verbatim via the serial interface. The unit shall be capable of interfacing to at least two PLC networks simultaneously. The unit shall be capable of monitoring any PLC data register regardless of register type, whether digital, analog, input, output or status point. Alarm criteria shall be settable according data register type. For digital remote channels, alarm criteria shall be settable for normally '0' or normally '1'. For analog remote channels, both a high setpoint and a low setpoint alarm criteria shall be settable.

Violation of alarm criteria at any remote channel shall cause the unit to go into alarm state and begin dial-outs. All remote channel alarm criteria shall be settable either at the front panel of the unit or over the telephone using touch-tone commands. The unit shall be capable of writing data to any PLC data register to which writing data is a legal operation. The unit shall monitor any failure of the active serial communications channels. Upon failure of any communications channel the unit shall enter the alarm state and begin dial-outs. The unit shall be capable of transferring data between one remote channel on one serial communications network and another remote channel on a second serial communications network. The unit shall also be capable of transferring data between remote channels on a serial communications network and physical channels within the unit. The unit shall be optionally upgradable to incorporate provision for 32, 64 or 96 total remote channels.

## I.7

### **Input Monitoring Function**

The unit shall continuously monitor the presence of AC power and the status of four contact closure inputs. Unit shall optionally be field upgradeable to incorporate a total of 8, 16, 24, or 32 dry contact inputs. AC power failure, or violation of the alarm criteria at any input, shall cause the unit to go into alarm status and begin dial-outs. Unit shall, upon a single program entry, automatically accept all input states as the normal non-alarm state, eliminating possible confusion about Normally Open versus Normally Closed inputs. Further, as a diagnostic aid, unit shall have the capability of directly announcing the state of any given input as currently "Open Circuit" or "Closed Circuit," without disturbing any message programming. Each input channel shall also be independently programmable, *without need to manipulate circuit board switches or jumpers*, as Normally Open or Normally Closed, or for No Alarm (Status Only), or for Pulse Totalizing, or for Run Time Metering.

## I.8

### **Run Time Meter Inputs**

Any dry contact input can be programmed to accumulate and report the number of hours their respective input circuits have been closed. Any such channels will never cause an alarm, but on inquiry will recite the channel's message according to the status of the input and then report the closed circuit time to the tenth of an hour. The input will accumulate and report in tenths of hours up to a total accumulated running time of 99,999.9 hours. The initial value of the Run Time Meter shall be programmable in order to agree with existing electromechanical Run Time Meters. Up to a total of 8 Run Time Meters may be programmed.

## I.9

### **Pulse Totalizer Inputs**

Any dry contact input can be programmed to accumulate the number of pulses (momentary contact closures) occurring at the input. The maximum input pulse rate must not exceed 100 pulses per second, and if the rate is over 50 pulses per second, the pulses must have a 50% duty cycle. The user shall be able to program an initial starting value and a scale factor for each pulse totalizer input. The pulse totalizer input shall cause an alarm call upon reaching a user defined alarm setpoint.

## I.10

### **Alarm Message**

Upon initiating an alarm phone call, the system is to "speak" only those channels that are currently in "alarm status".

## **I.11      Communications Protocol**

The unit shall interface to standard networks commonly used in industrial installations. The unit shall be capable of network communications using the Modbus RTU protocol.

## **I.12      Diagnostics**

The unit shall include user commands to execute diagnostics of the PLC network to determine the health of the network. The unit shall inform the user of the length of scan time for the set of all configured remote channels. The unit shall provide a complete verbal report of all programmable functions and their programmed values on command from any remote Touch Tone phone.

## **I.13      Speakerphone**

The unit shall be capable of dialing any phone number on command and function as a speakerphone.

## **I.14      Inquiry Message and Function**

Inquiry phone calls can be made directly to the unit at any time from any telephone, locally or long distance, for a complete status report of all variables being monitored, including power status.

## **I.15      Power Battery Backup**

Normal power shall be 105-135 VAC, 15 watts nominal. The product is to contain its own gel cell rechargeable battery which is automatically kept charged when AC power is present. The system shall operate on battery power for a minimum of 13 continuous hours in the event of AC power failure. A shorter backup time shall not be acceptable. The built-in charger shall be precision voltage controlled, not a "trickle charger," in order to minimize recharge time and maximize battery life available.

## **I.16      Phone Line**

The autodialer is to use a standard rotary pulse or Touch Tone "dial-up" phone line (direct leased line not to be required) and is to be F.C.C. approved. Connection to the telephone is through a 4-pin modular jack (RJ-11).



the main circuit board shall not be an acceptable substitute. The installer shall provide a good electrical ground connection point near the unit to maximize the effectiveness of the surge protection.

## **I.17 Local Data Logging**

The system shall include a parallel printer interface for local data logging. The local printer will automatically print out, with date and time stamp, each activity that occurs; alarms, acknowledgements, programming entries, inquiry calls, etc.. For the purpose of easy program review the user shall be able to printout on demand all user entered programming.

## **I.18 Public Address Broadcast**

The standard dialer shall provide a mini phone jack for optional connection to a local public address system. If connected to the PA system the dialer shall broadcast all alarm messages over the PA system and the telephone simultaneously.

## **I.19 Integral Surge Protection**

*All power, phone line, dry contact, and analog signal inputs shall be protected at the circuit board to IEEE Standard 587, category B (6,000 volts open circuit/ 3,000 amps closed circuit). Gas tubes followed by solid state protectors shall be integral to the circuit board for each such line. Protectors mounted external to the main circuit board shall not be an acceptable substitute. The installer shall provide a good electrical ground connection point near the unit to maximize the effectiveness of the surge protection.*

## **I.20 Warranty**

The dialer shall be covered by a five (5) year warranty covering parts and labor performed at the Factory.

## **I.21 Modular Upgrades**

The system shall include expansion connectors to accommodate field upgrades for additional internal dry contact inputs, remote supervisory control outputs, and internal analog inputs, CDL, SCADA.

**I.22****Additional Features: Sealed Switches, LED Indicators, Alarm Disable Warning, TalkThrough**

All keyboard and front panel switches shall be sealed to prevent contamination. Front panel LED's shall indicate: Normal Operation, Program Mode, Phone Call in Progress, Status for each channel, AC Power Present, AC Power Failure, and Low, Discharging or Recharging Battery. On any Inquiry telephone call or On Site status check, the voice shall provide specific warning if no dialout phone numbers are entered, or if the unit is in the "alarm disable" mode, or if AC power is off or has been off since last reset. A built-in microphone shall allow anyone at a remote phone to listen to local sounds and have a two-way conversation with personnel at the dialer.

**I.23****Special Order Items**

The following options shall be available on specific order:

- a) 4, 12, 20, or 28 extra contact channels (8,16,24, or 32 respectively, total.)
- b) 32, 64, 96 remote channels
- c) 1, 4, 8, or 16 analog channels.
- d) Remote supervisory control (4 or 8 outputs).
- e) Cellular telephone communications.
- f) Radio communications interface.
- g) NEMA 4X (sealed) enclosure.
- h) Thermostatically controlled heater.

**Specifications subject to change without notice.**

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# J

## Worksheets

# Worksheet A Programming

## Part 1: Phone Number Programming

2-Digit Phone Number Designation	Use Program Code	Phone Number (Including any necessary prefixes or area codes)	Person
01 (First)	701		
02 (Second)	702		
03 (Third)	703		
04 (Fourth)	704		
05 (Fifth)	705		
06 (Sixth)	706		
07 (Seventh)	707		
08 (Eighth)	708		
09 (Ninth)	709		
10 (Tenth)	710		
11 (Eleventh)	711		
12 (Twelfth)	712		
13 (Thirteenth)	713		
14 (Fourteenth)	714		
15 (Fifteenth)	715		
16 (Sixteenth)	716		

## Part 2: Optional Programming

Record of any optional programming to alter selected parameters from their normal default values. *(Sample highlighted)*

Program Code	Parameter Description	Default Value	Write In Any Altered Values YouProgram
<i>902</i>	<i>Alarm Trip Delay</i>	<i>2 seconds</i>	<i>40 seconds</i>

## Worksheet B Alarm Call Grouping Programming

*Purpose: To "link" certain input channels to call only selected phone numbers.*

*See Section 6.2.13*

### Part 1: Group Description Naming

As an organizational step, write in a Group Description Name (Electrical, Security, etc.) for each of your phone number groups, and the two-digit designation number of the phone numbers you want included in each group. Refer to the filled-in example below. This should be done only after you have already entered your entire list of up to 16 phone numbers on Worksheet A.

*(Sample highlighted)*

Group Description (Electrical, etc.)	2-Digit Phone # Designation (Taken from Worksheet A)
<i>Maintenance</i>	<i>01, 04, 05, 06</i>
<i>Electrical</i>	<i>03, 04</i>
<i>Security</i>	<i>02, 05</i>

## Worksheet B Alarm Call Grouping Programming Cont. . .

### Part 2: Linking Channels To Groups

For each input channel that you wish to have "linked" to one of your groups, write in your chosen Group Description Name (Electrical, etc.), and the corresponding set of 2-digit Phone Number Designations which you established above. Finally, write in these same sets of 2-digit codes, without the separating commas, to the right of the printed program code (501, etc.). This establishes the complete program code to enter for each channel that you want "linked" to call only a selected group of phone numbers. (*Sample highlighted*)

The filled-in sample, below, is for an 8-channel unit. Three groups were established, and 5 of the channels were linked to a group. The remaining 3 channels were not linked to any group, and therefore, those 3 "unlinked" channels would dial the entire list of phone numbers in regular order.



**Note:**

Any channels that you do not enter such a program code for, will cause dialing of the entire list of phone numbers, when that channel goes into alarm.

Channel	Linked to Group	Corresp. Phone # Desig's Est. Above	Program Code to Enter
1	Electrical	01-02	501-0201
2	Electrical	01-02	501-0202
3	Electrical	01-02	501-0203
4	Electrical	01-02	501-0204
5	Electrical	01-02	501-0205
6			501-0206
7			501-0207
8			501-0208

*Worksheet B Alarm Call Grouping Programming Cont. . .**(Page 1 of 6)*

<b>Internal Input Channels</b>	<b>Linked to Group</b>	<b>Corresp. Phone # Desig's Est. Above</b>	<b>Program Code to Enter</b>
01			501 9
02			502 9
03			503 9
04			504 9
05			505 9
06			506 9
07			507 9
08			508 9
09			509 9
10			510 9
11			511 9
12			512 9
13			513 9
14			514 9
15			515 9
16			516 9
17			517 9
18			518 9
19			519 9
20			520 9
21			521 9
22			522 9
23			523 9
24			524 9



*Worksheet B Alarm Call Grouping Programming Cont. . .*  
 (Page 2 of 6)

<b>Internal Input Channels</b>	<b>Linked to Group</b>	<b>Corresp. Phone # Desig's Est. Above</b>	<b>Program Code to Enter</b>
25			525 9
26			526 9
27			527 9
28			528 9
29			529 9
30			530 9
31			531 9
32			532 9
33			533 9
34			534 9
35			535 9
36			536 9
37			537 9
38			538 9
39			539 9
40			540 9
41			541 9
42			542 9
43			543 9
44			544 9
45			545 9
46			546 9
47			547 9
48			548 9

*Worksheet B Alarm Call Grouping Programming Cont. . .**(Page 3 of 6)*

<b>Remote Channels</b>	<b>Linked to Group</b>	<b>Corresp. Phone # Desig's Est. Above</b>	<b>Program Code to Enter</b>
01			4501 9
02			4502 9
03			4503 9
04			4504 9
05			4505 9
06			4506 9
07			4507 9
08			4508 9
09			4509 9
10			4510 9
11			4511 9
12			4512 9
13			4513 9
14			4514 9
15			4515 9
16			4516 9
17			4517 9
18			4518 9
19			4519 9
20			4520 9
21			4521 9
22			4522 9
23			4523 9
24			4524 9

*Worksheet B Alarm Call Grouping Programming Cont. . .*  
 (Page 4 of 6)

<b>Remote Channels</b>	<b>Linked to Group</b>	<b>Corresp. Phone # Desig's Est. Above</b>	<b>Program Code to Enter</b>
25			4525 9
26			4526 9
27			4527 9
28			4528 9
29			4529 9
30			4530 9
31			4531 9
32			4532 9
33			4533 9
34			4534 9
35			4535 9
36			4536 9
37			4537 9
38			4538 9
39			4539 9
40			4540 9
41			4541 9
42			4542 9
43			4543 9
44			4544 9
45			4545 9
46			4546 9
47			4547 9
48			4548 9

*Worksheet B Alarm Call Grouping Programming Cont. . .*  
*(Page 5 of 6)*

<b>Remote Channels</b>	<b>Linked to Group</b>	<b>Corresp. Phone # Desig's Est. Above</b>	<b>Program Code to Enter</b>
49			4549 9
50			4550 9
51			4551 9
52			4552 9
53			4553 9
54			4554 9
55			4555 9
56			4556 9
57			4557 9
58			4558 9
59			4559 9
60			4560 9
61			4561 9
62			4562 9
63			4563 9
64			4564 9
65			4565 9
66			4566 9
67			4567 9
68			4568 9
69			4569 9
70			4570 9
71			4571 9
72			4572 9

*Worksheet B Alarm Call Grouping Programming Cont. . .*  
 (Page 6 of 6)

<b>Remote Channels</b>	<b>Linked to Group</b>	<b>Corresp. Phone # Desig's Est. Above</b>	<b>Program Code to Enter</b>
73			4573 9
74			4574 9
75			4575 9
76			4576 9
77			4577 9
78			4578 9
79			4579 9
80			4580 9
81			4581 9
82			4582 9
83			4583 9
84			4584 9
85			4585 9
86			4586 9
87			4587 9
88			4588 9
89			4589 9
90			4590 9
91			4591 9
92			4592 9
93			4593 9
94			4594 9
95			4595 9
96			4596 9

## Worksheet C Message Planning & Recording (Page 1 of 11)

Input Channel Message Designation	Program Code	Message Content	Approx. Length
<i>Station ID</i>	<i>100</i>		
<i>Ch 01 Alarm</i>	<i>101</i>		
<i>Ch 01 Normal</i>	<i>201</i>		
<i>Ch 02 Alarm</i>	<i>102</i>		
<i>Ch 02 Normal</i>	<i>202</i>		
<i>Ch 03 Alarm</i>	<i>103</i>		
<i>Ch 03 Normal</i>	<i>203</i>		
<i>Ch 04 Alarm</i>	<i>104</i>		
<i>Ch 04 Normal</i>	<i>204</i>		
<i>Ch 05 Alarm</i>	<i>105</i>		
<i>Ch 05 Normal</i>	<i>205</i>		
<i>Ch 06 Alarm</i>	<i>106</i>		
<i>Ch 06 Normal</i>	<i>206</i>		
<i>Ch 07 Alarm</i>	<i>107</i>		
<i>Ch 07 Normal</i>	<i>207</i>		
<i>Ch 08 Alarm</i>	<i>108</i>		
<i>Ch 08 Normal</i>	<i>208</i>		
<i>Ch 09 Alarm</i>	<i>109</i>		
<i>Ch 09 Normal</i>	<i>209</i>		
<i>Ch 10 Alarm</i>	<i>110</i>		
<i>Ch 10 Normal</i>	<i>210</i>		
<i>Ch 11 Alarm</i>	<i>111</i>		
<i>Ch 11 Normal</i>	<i>211</i>		
<i>Ch 12 Alarm</i>	<i>112</i>		
<i>Ch 12 Normal</i>	<i>212</i>		
<i>Ch 13 Alarm</i>	<i>113</i>		
<i>Ch 13 Normal</i>	<i>213</i>		
<i>Ch 14 Alarm</i>	<i>114</i>		
<i>Ch 14 Normal</i>	<i>214</i>		

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## Worksheet C Message Planning &amp; Recording (Page 2 of 11)

Input Channel Message Designation	Program Code	Message Content	Approx. Length
<i>Ch 15 Alarm</i>	<i>115</i>		
<i>Ch 15 Normal</i>	<i>215</i>		
<i>Ch 16 Alarm</i>	<i>116</i>		
<i>Ch 16 Normal</i>	<i>216</i>		
<i>Ch 17 Alarm</i>	<i>117</i>		
<i>Ch 17 Normal</i>	<i>217</i>		
<i>Ch 18 Alarm</i>	<i>118</i>		
<i>Ch 18 Normal</i>	<i>218</i>		
<i>Ch 19 Alarm</i>	<i>119</i>		
<i>Ch 19 Normal</i>	<i>219</i>		
<i>Ch 20 Alarm</i>	<i>120</i>		
<i>Ch 20 Normal</i>	<i>220</i>		
<i>Ch 21 Alarm</i>	<i>121</i>		
<i>Ch 21 Normal</i>	<i>221</i>		
<i>Ch 22 Alarm</i>	<i>122</i>		
<i>Ch 22 Normal</i>	<i>222</i>		
<i>Ch 23 Alarm</i>	<i>123</i>		
<i>Ch 23 Normal</i>	<i>223</i>		
<i>Ch 24 Alarm</i>	<i>124</i>		
<i>Ch 24 Normal</i>	<i>224</i>		
<i>Ch 25 Alarm</i>	<i>125</i>		
<i>Ch 25 Normal</i>	<i>225</i>		
<i>Ch 26 Alarm</i>	<i>126</i>		
<i>Ch 26 Normal</i>	<i>226</i>		
<i>Ch 27 Alarm</i>	<i>127</i>		
<i>Ch 27 Normal</i>	<i>227</i>		
<i>Ch 28 Alarm</i>	<i>128</i>		
<i>Ch 28 Normal</i>	<i>228</i>		

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## Worksheet C Message Planning & Recording (Page 3 of 11)

Input Channel Message Designation	Program Code	Message Content	Approx. Length
<i>Ch 29 Alarm</i>	<i>129</i>		
<i>Ch 29 Normal</i>	<i>229</i>		
<i>Ch 30 Alarm</i>	<i>130</i>		
<i>Ch 30 Normal</i>	<i>230</i>		
<i>Ch 31 Alarm</i>	<i>131</i>		
<i>Ch 31 Normal</i>	<i>231</i>		
<i>Ch 32 Alarm</i>	<i>132</i>		
<i>Ch 32 Normal</i>	<i>232</i>		
<i>Ch 33 Alarm</i>	<i>133</i>		
<i>Ch 33 Normal</i>	<i>233</i>		
<i>Ch 34 Alarm</i>	<i>134</i>		
<i>Ch 34 Normal</i>	<i>234</i>		
<i>Ch 35 Alarm</i>	<i>135</i>		
<i>Ch 35 Normal</i>	<i>235</i>		
<i>Ch 36 Alarm</i>	<i>136</i>		
<i>Ch 36 Normal</i>	<i>236</i>		
<i>Ch 37 Alarm</i>	<i>137</i>		
<i>Ch 37 Normal</i>	<i>237</i>		
<i>Ch 38 Alarm</i>	<i>138</i>		
<i>Ch 38 Normal</i>	<i>238</i>		
<i>Ch 39 Alarm</i>	<i>139</i>		
<i>Ch 39 Normal</i>	<i>239</i>		
<i>Ch 40 Alarm</i>	<i>140</i>		
<i>Ch 40 Normal</i>	<i>240</i>		
<i>Ch 41 Alarm</i>	<i>141</i>		
<i>Ch 41 Normal</i>	<i>241</i>		
<i>Ch 42 Alarm</i>	<i>142</i>		
<i>Ch 42 Normal</i>	<i>242</i>		

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## Worksheet C Message Planning &amp; Recording (Page 4 of 11)

Input Channel Message Designation	Program Code	Message Content	Approx. Length
<i>Ch 43 Alarm</i>	143		
<i>Ch 43 Normal</i>	243		
<i>Ch 44 Alarm</i>	144		
<i>Ch 44 Normal</i>	244		
<i>Ch 45 Alarm</i>	145		
<i>Ch 45 Normal</i>	245		
<i>Ch 46 Alarm</i>	146		
<i>Ch 46 Normal</i>	246		
<i>Ch 47 Alarm</i>	147		
<i>Ch 47 Normal</i>	247		
<i>Ch 48 Alarm</i>	148		
<i>Ch 48 Normal</i>	248		
Remote Channel Message Designation	Program Code	Message Content	Approx. Length
<i>NET 1 ID</i>	41001		
<i>Ch 01 Alarm</i>	4101		
<i>Ch 01 Normal</i>	4201		
<i>Ch 02 Alarm</i>	4102		
<i>Ch 02 Normal</i>	4202		
<i>Ch 03 Alarm</i>	4103		
<i>Ch 03 Normal</i>	4203		
<i>Ch 04 Alarm</i>	4104		
<i>Ch 04 Normal</i>	4204		

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## Worksheet C Message Planning &amp; Recording (Page 5 of 11)

Remote Channel Message Designation	Program Code	Message Content	Approx. Length
<b>Ch 05 Alarm</b>	<b>4105</b>		
<i>Ch 05 Normal</i>	<i>4205</i>		
<b>Ch 06 Alarm</b>	<b>4106</b>		
<i>Ch 06 Normal</i>	<i>4206</i>		
<b>Ch 07 Alarm</b>	<b>4107</b>		
<i>Ch 07 Normal</i>	<i>4207</i>		
<b>Ch 08 Alarm</b>	<b>4108</b>		
<i>Ch 08 Normal</i>	<i>4208</i>		
<b>Ch 09 Alarm</b>	<b>4109</b>		
<i>Ch 09 Normal</i>	<i>4209</i>		
<b>Ch 10 Alarm</b>	<b>4110</b>		
<i>Ch 10 Normal</i>	<i>4210</i>		
<b>Ch 11 Alarm</b>	<b>4111</b>		
<i>Ch 11 Normal</i>	<i>4211</i>		
<b>Ch 12 Alarm</b>	<b>4112</b>		
<i>Ch 12 Normal</i>	<i>4212</i>		
<b>Ch 13 Alarm</b>	<b>4113</b>		
<i>Ch 13 Normal</i>	<i>4213</i>		
<b>Ch 14 Alarm</b>	<b>4114</b>		
<i>Ch 14 Normal</i>	<i>4214</i>		
<b>Ch 15 Alarm</b>	<b>4115</b>		
<i>Ch 15 Normal</i>	<i>4215</i>		
<b>Ch 16 Alarm</b>	<b>4116</b>		
<i>Ch 16 Normal</i>	<i>4216</i>		
<b>Ch 17 Alarm</b>	<b>4117</b>		
<i>Ch 17 Normal</i>	<i>4217</i>		

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*Worksheet C Message Planning & Recording (Page 6 of 11)*

Remote Channel Message Designation	Program Code	Message Content	Approx. Length
<b>Ch 18 Alarm</b>	<b>4118</b>		
<del>Ch 18 Normal</del>	<del>4218</del>		
<b>Ch 19 Alarm</b>	<b>4119</b>		
<del>Ch 19 Normal</del>	<del>4219</del>		
<b>Ch 20 Alarm</b>	<b>4120</b>		
<del>Ch 20 Normal</del>	<del>4220</del>		
<b>Ch 21 Alarm</b>	<b>4121</b>		
<del>Ch 21 Normal</del>	<del>4221</del>		
<b>Ch 22 Alarm</b>	<b>4122</b>		
<del>Ch 22 Normal</del>	<del>4222</del>		
<b>Ch 23 Alarm</b>	<b>4123</b>		
<del>Ch 23 Normal</del>	<del>4223</del>		
<b>Ch 24 Alarm</b>	<b>4124</b>		
<del>Ch 24 Normal</del>	<del>4224</del>		
<b>Ch 25 Alarm</b>	<b>4125</b>		
<del>Ch 25 Normal</del>	<del>4225</del>		
<b>Ch 26 Alarm</b>	<b>4126</b>		
<del>Ch 26 Normal</del>	<del>4226</del>		
<b>Ch 27 Alarm</b>	<b>4127</b>		
<del>Ch 27 Normal</del>	<del>4227</del>		
<b>Ch 28 Alarm</b>	<b>4128</b>		
<del>Ch 28 Normal</del>	<del>4228</del>		
<b>Ch 29 Alarm</b>	<b>4129</b>		
<del>Ch 29 Normal</del>	<del>4229</del>		
<b>Ch 30 Alarm</b>	<b>4130</b>		
<del>Ch 30 Normal</del>	<del>4230</del>		

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## Worksheet C Message Planning &amp; Recording (Page 7 of 11)

Remote Channel Message Designation	Program Code	Message Content	Approx. Length
Ch 31 Alarm	4131		
Ch 31 Normal	4231		
Ch 32 Alarm	4132		
Ch 32 Normal	4232		
Ch 33 Alarm	4133		
Ch 33 Normal	4233		
Ch 34 Alarm	4134		
Ch 34 Normal	4234		
Ch 35 Alarm	4135		
Ch 35 Normal	4235		
Ch 36 Alarm	4136		
Ch 36 Normal	4236		
Ch 37 Alarm	4137		
Ch 37 Normal	4237		
Ch 38 Alarm	4138		
Ch 38 Normal	4238		
Ch 39 Alarm	4139		
Ch 39 Normal	4239		
Ch 40 Alarm	4140		
Ch 40 Normal	4240		
Ch 41 Alarm	4141		
Ch 41 Normal	4241		
Ch 42 Alarm	4142		
Ch 42 Normal	4242		
Ch 43 Alarm	4143		
Ch 43 Normal	4243		
Ch 44 Alarm	4144		
Ch 44 Normal	4244		
Ch 45 Alarm	4145		
Ch 45 Normal	4245		

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## Worksheet C Message Planning &amp; Recording (Page 8 of 11)

Remote Channel Message Designation	Program Code	Message Content	Approx. Length
<b>Ch 46 Alarm</b>	<b>4146</b>		
<i>Ch 46 Normal</i>	<i>4146</i>		
<b>Ch 47 Alarm</b>	<b>4147</b>		
<i>Ch 47 Normal</i>	<i>4147</i>		
<b>Ch 48 Alarm</b>	<b>4148</b>		
<i>Ch 48 Normal</i>	<i>4148</i>		
<b>Ch 49 Alarm</b>	<b>4149</b>		
<i>Ch 49 Normal</i>	<i>4149</i>		
<b>Ch 50 Alarm</b>	<b>4150</b>		
<i>Ch 50 Normal</i>	<i>4150</i>		
<b>Ch 51 Alarm</b>	<b>4151</b>		
<i>Ch 51 Normal</i>	<i>4151</i>		
<b>Ch 52 Alarm</b>	<b>4152</b>		
<i>Ch 52 Normal</i>	<i>4152</i>		
<b>Ch 53 Alarm</b>	<b>4153</b>		
<i>Ch 53 Normal</i>	<i>4153</i>		
<b>Ch 54 Alarm</b>	<b>4154</b>		
<i>Ch 54 Normal</i>	<i>4154</i>		
<b>Ch 55 Alarm</b>	<b>4155</b>		
<i>Ch 55 Normal</i>	<i>4155</i>		
<b>Ch 56 Alarm</b>	<b>4156</b>		
<i>Ch 56 Normal</i>	<i>4156</i>		
<b>Ch 57 Alarm</b>	<b>4157</b>		
<i>Ch 57 Normal</i>	<i>4157</i>		
<b>Ch 58 Alarm</b>	<b>4158</b>		
<i>Ch 58 Normal</i>	<i>4158</i>		

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*Worksheet C Message Planning & Recording (Page 9 of 11)*

Remote Channel Message Designation	Program Code	Message Content	Approx. Length
<b>Ch 59 Alarm</b>	<b>4159</b>		
<i>Ch 59 Normal</i>	<i>4259</i>		
<b>Ch 60 Alarm</b>	<b>4160</b>		
<i>Ch 60 Normal</i>	<i>4260</i>		
<b>Ch 61 Alarm</b>	<b>4161</b>		
<i>Ch 61 Normal</i>	<i>4261</i>		
<b>Ch 62 Alarm</b>	<b>4162</b>		
<i>Ch 62 Normal</i>	<i>4262</i>		
<b>Ch 63 Alarm</b>	<b>4163</b>		
<i>Ch 63 Normal</i>	<i>4263</i>		
<b>Ch 64 Alarm</b>	<b>4164</b>		
<i>Ch 64 Normal</i>	<i>4264</i>		
<b>Ch 65 Alarm</b>	<b>4165</b>		
<i>Ch 65 Normal</i>	<i>4265</i>		
<b>Ch 66 Alarm</b>	<b>4166</b>		
<i>Ch 66 Normal</i>	<i>4266</i>		
<b>Ch 67 Alarm</b>	<b>4167</b>		
<i>Ch 67 Normal</i>	<i>4267</i>		
<b>Ch 68 Alarm</b>	<b>4168</b>		
<i>Ch 68 Normal</i>	<i>4268</i>		
<b>Ch 69 Alarm</b>	<b>4169</b>		
<i>Ch 69 Normal</i>	<i>4269</i>		
<b>Ch 70 Alarm</b>	<b>4170</b>		
<i>Ch 70 Normal</i>	<i>4270</i>		
<b>Ch 71 Alarm</b>	<b>4171</b>		
<i>Ch 71 Normal</i>	<i>4271</i>		

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*Worksheet C Message Planning & Recording (Page 10 of 11)*

Remote Channel Message Designation	Program Code	Message Content	Approx. Length
<b>Ch 72 Alarm</b>	<b>4172</b>		
<i>Ch 72 Normal</i>	<i>4172</i>		
<b>Ch 73 Alarm</b>	<b>4173</b>		
<i>Ch 73 Normal</i>	<i>4173</i>		
<b>Ch 74 Alarm</b>	<b>4174</b>		
<i>Ch 74 Normal</i>	<i>4174</i>		
<b>Ch 75 Alarm</b>	<b>4175</b>		
<i>Ch 75 Normal</i>	<i>4175</i>		
<b>Ch 76 Alarm</b>	<b>4176</b>		
<i>Ch 76 Normal</i>	<i>4176</i>		
<b>Ch 77 Alarm</b>	<b>4177</b>		
<i>Ch 77 Normal</i>	<i>4177</i>		
<b>Ch 78 Alarm</b>	<b>4178</b>		
<i>Ch 78 Normal</i>	<i>4178</i>		
<b>Ch 79 Alarm</b>	<b>4179</b>		
<i>Ch 79 Normal</i>	<i>4179</i>		
<b>Ch 80 Alarm</b>	<b>4180</b>		
<i>Ch 80 Normal</i>	<i>4180</i>		
<b>Ch 81 Alarm</b>	<b>4181</b>		
<i>Ch 81 Normal</i>	<i>4181</i>		
<b>Ch 82 Alarm</b>	<b>4182</b>		
<i>Ch 82 Normal</i>	<i>4182</i>		
<b>Ch 83 Alarm</b>	<b>4183</b>		
<i>Ch 83 Normal</i>	<i>4183</i>		
<b>Ch 84 Alarm</b>	<b>4184</b>		
<i>Ch 84 Normal</i>	<i>4184</i>		

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## Worksheet C Message Planning & Recording (Page 11 of 11)

Remote Channel Message Designation	Program Code	Message Content	Approx. Length
<b>Ch 85 Alarm</b>	<b>4185</b>		
<i>Ch 85 Normal</i>	<i>4285</i>		
<b>Ch 86 Alarm</b>	<b>4186</b>		
<i>Ch 86 Normal</i>	<i>4286</i>		
<b>Ch 87 Alarm</b>	<b>4187</b>		
<i>Ch 87 Normal</i>	<i>4287</i>		
<b>Ch 88 Alarm</b>	<b>4188</b>		
<i>Ch 88 Normal</i>	<i>4288</i>		
<b>Ch 89 Alarm</b>	<b>4189</b>		
<i>Ch 89 Normal</i>	<i>4289</i>		
<b>Ch 90 Alarm</b>	<b>4190</b>		
<i>Ch 90 Normal</i>	<i>4290</i>		
<b>Ch 91 Alarm</b>	<b>4191</b>		
<i>Ch 91 Normal</i>	<i>4291</i>		
<b>Ch 92 Alarm</b>	<b>4192</b>		
<i>Ch 92 Normal</i>	<i>4292</i>		
<b>Ch 93 Alarm</b>	<b>4193</b>		
<i>Ch 93 Normal</i>	<i>4293</i>		
<b>Ch 94 Alarm</b>	<b>4194</b>		
<i>Ch 94 Normal</i>	<i>4294</i>		
<b>Ch 95 Alarm</b>	<b>4195</b>		
<i>Ch 95 Normal</i>	<i>4295</i>		
<b>Ch 96 Alarm</b>	<b>4196</b>		
<i>Ch 96 Normal</i>	<i>4296</i>		

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***See next page to complete calculations***



**Worksheet C Message Planning & Recording Calculations:**

Total estimated recorded message length in seconds, page 11 of 11 \_\_\_\_\_  
Total estimated recorded message length in seconds, page 10 of 11 \_\_\_\_\_  
Total estimated recorded message length in seconds, page 9 of 11 \_\_\_\_\_  
Total estimated recorded message length in seconds, page 8 of 11 \_\_\_\_\_  
Total estimated recorded message length in seconds, page 7 of 11 \_\_\_\_\_  
Total estimated recorded message length in seconds, page 6 of 11 \_\_\_\_\_  
Total estimated recorded message length in seconds, page 5 of 11 \_\_\_\_\_  
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Total estimated recorded message length in seconds, **all** pages \_\_\_\_\_  
See Code 912 for alternate method of timing spoken messages.



**Note:**

For any channels that you have programmed for Status Report Only or for Run Time Metering, the message to be spoken on Open Circuit input is recorded with the Program Code ordinarily used for the Alarm Message; the message to be spoken on Closed Circuit input is recorded with the program code ordinarily used for the Normal Message.

# K

## Annunciator Sequences and Options

This appendix discusses Verbatim operations in the context of the *ANSI/ISA-S18.1 Annunciator Sequences and Specifications* standard. It also describes the options available for configuring the Verbatim to support a variety of sequence models. This information will be useful for users needing calling sequences different from the one discussed in Section 5.

Note that the ANSI specification uses slightly different terminology from that used here and elsewhere in this manual. Hopefully, this won't cause much confusion.

One concept central to this discussion is that of *channel state*. At any given time every armed channel is in one of the following 5 states: *normal*, *alarm*, *acknowledged alarm*, *return to normal (RTN)*, *acknowledged RTN*. The precise meaning of these terms will be clarified later on.

The term *annunciator state* is used here to describe the actions and indications of the Verbatim. These include LED illumination, voice reporting and status logging.

An *annunciator sequence* consists of specifying how transitions between the channel states occur and how they impact the annunciator state. The Verbatim supports three distinct types of annunciator sequences. These are each discussed in the subsections below. The next several paragraphs discuss the properties they all share in common.

The normal, alarm and RTN states are determined by comparing the channel's value with the criteria settings. A transition into these states requires that the condition persist for a time period referred to as the *alarm trip delay*. This provides hysteresis, or debouncing between the real-world signals and the channel state.

The two acknowledged states are determined by operator actions. Unacknowledged alarms and RTNs transit to the acknowledged states by pressing keys on the front panel or entering DTMF tones over the phone.

The Verbatim gives visual indications for the state of each channel or group of channels. If normal, the LED is OFF. When alarmed, the LED is blinking. When acknowledged the LED is steady ON. The visual indications for the RTN states are sequence dependent, and described later.

Audible indications for the channel states are also given. These take the form of voice reports either from the speaker or over the phone. These reports may be requested at any time by pressing the CHECK STATUS key, or phoning the unit.

Whenever any channel is in the unacknowledged alarm or RTN state, the Verbatim will solicit acknowledgment by phoning personel. The calling sequence itself is determined by the alarm call grouping and alarm ready scheduling configuration.

All audible indications can be silenced by pressing the ARM/DISARM key on the front panel. This action will also always acknowledge all unacknowledged conditions. Also, all annunciator state transitions and actions are suspended whenever the box is in program mode. Channel state transitions will still occur.

The annunciator state may at any time be completely reset by pressing the ARM/DISARM key twice. This action will also reset the state of each channel.

In terms of *ANSI/ISA-S18.1*, there is one more property that all Verbatim annunciator sequences share: there is no support for the *first out* sequence designations (F1, F2, F3). Groups of alarms and RTNs are always registered, reported and reset without regard to which one tripped out first.

## K.1

### Standard Annunciator Sequence (Manual Reset)

This section describes the default annunciator sequence used by the Verbatim . It is a minor variant of the *ANSI/ISA-S18.1* designation M-1 (Manual Reset with silence pushbutton). It may be configured by entering code 923 1 in program mode.

Operations in this sequence are detailed in Section 5. Briefly, channel states transit from normal to alarm when criteria violations persist for the trip delay. The alarm state is then locked in until acknowledgment is made. The transition from acknowledged back to normal happens upon manual reset or expiration of the alarm reset timer. The RTN states are omitted from the sequence.

The annunciator states include only those visual and audible indications described above. Also, the annunciator sequence follows the transitions described there too.

This sequence differs from the vanilla M-1 designation in two ways. The first involves the operation of the automatic reset timer. The true M-1 sequence is obtained by turning the alarm reset timers off (code 922). The second distinction involves configurations where no phone numbers are programmed. Here the transition from alarm to acknowledged happens automatically and immediately. There are never any audible or visual indications of the unacknowledged state. This sequence has ANSI designation M-1-5-6.

## K.2

### Clear On Return To Normal (Automatic Reset)

This section describes annunciator sequence options that are variants of the ANSI designation A-1 (automatic reset with silence pushbutton). The main distinction of these from the M-1 sequence is that the alarm state is automatically reset when the channel enters the RTN state. The Verbatim sequences in this category differ amongst themselves mainly in when this RTN transition is allowed to occur.

The basic A-1 sequence is obtained by executing code 923 3. Channel states transit from normal to alarm when criteria violations persist for the trip delay. The alarm state is then locked in until acknowledgment is made. If no phone numbers are configured, then this transition happens automatically and immediately (A-1-5-6). Otherwise, operator action is required. The transition from acknowledged back to normal happens via manual reset or expiration of the alarm reset timer. It also happens whenever the criteria violation for an acknowledged alarm returns to normal.

Designation A-1-4 is obtained by code 923 2. This sequence differs from A-1 only in that the unacknowledged alarms are not locked in. All visual and audible indications are automatically reset whenever the criteria violations return to normal for the trip delay period.

A minor variant of A-1-4 is obtained by code 923 4. Here, the indications for an acknowledged alarm will not be reset until it has been reported once, regardless of RTN status. Unacknowledged alarms will be reset completely without any lock-in whatsoever.

The implementation of these A-designates involves one wrinkle. The check for RTN condition is not performed continuously, but rather only at specific times. Hence, changes that happen in the midst of a report may not be reflected in the annunciator state until some time later.

## K.3

### Report Return To Normal (Ringback)

This section describes the annunciator sequence option that provides explicit indications of RTN conditions. This is a variant of the R-1-8 designation (ringback with silence pushbutton and common ringback audible). There are two differences between R and M or A designations. First is that the RTN state can be entered only from the acknowledged alarm state. M has no notion of RTN at all, and A allows the transition at any time. Second is that R locks in RTN states until acknowledged, whereas A immediately resets.

A variant of the **R-1-8** sequence is obtained by executing code **981 1**. Channel states transit from normal to alarm when criteria violations persist for the trip delay. The alarm state is then locked in until acknowledgment is made. If no phone numbers are configured, then this transition happens automatically and immediately (**R-1-5-6**). Otherwise, operator action is required.

The transition from acknowledged alarm to unacknowledged RTN is made whenever the criteria violation goes away for the trip delay period. The RTN state is then locked in until acknowledged. RTN acknowledgment is made in the same fashion as alarm acknowledgments. The channel states are reset either manually or by expiration of the reset timer. The reset timer begins running when the original alarm condition is acknowledged. This means that if a sufficiently long interval exists between acknowledgment of the alarm and the RTN, then the reset will happen immediately.

The main differences between this variant and the standard **R-1-8** sequence are as follows. First, there is no registration of momentary alarms once the RTN state is entered. Once the RTN state is acknowledged, no further calls will be triggered until the channel is reset. This is to say transitions in the channel state may continue, but will not be reflected in the annunciator state. Still, all reports will reflect the current state of the channels. Second, there is no visual indication for the RTN states. The LEDs will continue to reflect the acknowledged alarm status. Third, the silence pushbutton stops all flashing LED indications. Fourth, there is the automatic reset timer.

Unlike the implementation for the **A** designations, RTN conditions are checked continuously for all channels. So long as any unacknowledged alarm or RTN condition exists, the Verbatim will be making calls. Alarm conditions have priority. Hence, if an alarm is one call group and an RTN is in another, no calls will be placed to the RTN group until the alarm is acknowledged.

If the trigger for a call is an RTN, then the report will explicitly mention this before reporting the status of all channels in the group. An RTN report mentions RTN conditions only. Any acknowledgment while in RTN calling state acknowledges RTN conditions only. In contrast, any operator acknowledgment during an alarm call will also acknowledge all RTNs. But, the alarm reports do mention all unacknowledged RTN conditions.

If a new alarm occurs on any channel while in the RTN calling state, a change from RTN to alarm calling will occur as soon as possible. This can happen no sooner than the completion of any report in progress. Such reports may or may not include mention of the new condition depending on whether that channel has already been announced.

## K.4

### Annunciator Sequence Option Summary

The following paragraphs provide a concise summary of the available annunciator sequence options. The ANSI designator is given, along with the Verbatim configuration code, followed by a short functional description.

**M-1:** Manual Reset with Silence Pushbutton.

*Code (923 1)*

Alarm states are registered directly from configured criteria without regard for return to normal conditions. Alarm states are locked in and dialer will continue to call until acknowledged. Acknowledged alarms are reset via automatic timer. Total dialer reset and silence via arm/disarm key.

**M-1-5-6:** Manual Reset with Silence Pushbutton, No Flashing, and No Audible.

*Code (923 1) - with no phone numbers programmed*

Same as **M-1**, except the alarm state is immediately converted to acknowledged state.

**A-1:** Automatic Reset with Silence Pushbutton.

*Code (923 3)*

Same as **M-1** except the acknowledged alarm state will be cleared if the channel returns to normal. The check for this transition occurs only when all alarms have been acknowledged.

**A-1-5-6:** Automatic Reset with Silence Pushbutton, No Flashing, and No Audible.

*Code (923 3) - with no phone numbers programmed.*

Same as **A-1**, except the alarm state is immediately converted to the acknowledged state.

**A-1-4:** Automatic Reset with Silence Pushbutton and No Lock-in.

*Code (923 2)*

Same as **M-1** except BOTH the acknowledged and unacknowledged alarm states will be cleared if the channel returns to normal. The check for this transition occurs only in between alarm calls.

**A-1-4 variant:** Automatic Reset with Silence Pushbutton, No Lock-in, and Single Acknowledge Report.

*Code (923 4)*

Same as **A-1-4** except the clearing for the acknowledged alarm can't happen until after a single report has been made.

**R-1-8:** Ringback with Silence Pushbutton and Common Ringback Audible.  
*Code (981 1)*

Alarm and Return to normal states are registered from criteria and locked-in. Dialer will continue to call until all alarm and RTN states are acknowledged. Acknowledged alarms and RTNS are reset via automatic timer. Total dialer reset and silence via arm/disarm key.

**R-1-5-6:** Ringback with Silence Pushbutton, No Flashing, and No Audible.  
*Code (981 1) - with no phone numbers programmed.*

Same as **R-1-8** except all unacknowledged alarm and RTN states are immediately converted to the acknowledged state.

# Glossary

**ACCESS CODE** See Security Access Code.

**ACKNOWLEDGMENT** The act of advising the Verbatim autodialer that its alarm message has been heard. This is done either by pressing a touch tone 9 at the prompting beep, or by calling the unit back after the alarm call has ended. Once acknowledged, further activity on that particular channel will not cause further dialing until the expiration of the Alarm Reset Time. See Section 5.1, "Placing Inquiry Calls to the Verbatim autodialer," and Section 5.5, "Acknowledging the Alarm Call."

**ALARM CALL GROUPING** Special programming established to cause specific input channels to cause dialing of only selected phone numbers. Used to provide separate alarm functions according to category of personnel, such as maintenance, security, plumbing, etc. See Section 6.1, "Program Codes."

**ALARM CONDITION** For contact input channels, the Alarm Condition is the Open or Closed circuit condition opposite to that which was established as the Normal Condition for that channel. For example, for a channel programmed as Normally Open, the Alarm Condition would be Closed Circuit. Also see Violation. See Sections 3.3, "Programming Input Channels" and 5.3, "Receiving Alarm Calls."

**ALARM CRITERIA** The chosen determination of what will constitute an alarm condition (violation) for a given channel. See Normally Closed.

**ALARM READY SCHEDULING** A program setting which causes the Verbatim autodialer automatically disarm for certain time periods. This function prevents the product from sending alarm telephone calls during periods when personnel are stationed at the site and are able to deal with the problem directly.

**ALARM RESET TIME** The period of time, beginning at the moment an alarm is acknowledged, during which alarm dialing on behalf of that specific channel is suspended regardless of further activity of its input circuit. At the end of this period, the Acknowledged Alarm status is cleared for that channel. See Section 5.6, "Alarm Reset Timeout After Acknowledgment" and Section 6, "Advanced Programming."

**ALARM TRIP DELAY** The time required for an input violation to remain in violation before the unit trips into the Unacknowledged Alarm state. See Section 6, "Advanced Programming."



**ANALOG** Analog signals have variable values of current or voltage, with the specific value generally representing some physical parameter such as water level or pressure. The most common type of analog signal is a 4-20 milliampere current loop, with a transmitter (transducer and associated power supply) governing the current in a loop. This current is detected by one or more receiving devices in the loop, such as an optional analog input channel on a Verbatim autodialer.

**AUTOCALL** A special test calling function. When Autocall is turned on, the unit places test calls at regular intervals to provide ongoing assurance of Verbatim autodialer and phone line operation. See Section 6, "Advanced Programming."

**AUTODIALER** A device which constantly monitors a set of inputs from various external sensors, and places outgoing alarm calls when there is an alarm condition. It also allows inquiry calls.

**AUTOEXTEND** A unique feature on the Verbatim autodialer which automatically extends the available message recording time as required, selecting the optimum speech memory rate for the user's voice message recording. See Section 4.2.1, "Verifying/Extending Recording Time."

**CALL BACK** See Call Forward.

**CALL FORWARD** The unit may be commanded from the panel or over the phone, to place a call to a specific phone number. This is called Call Forwarding. If the number called is that of the person commanding the call from a remote telephone, then it is termed Call Back. This is typically done for test purposes. See Section 5.8, "Dialing Out and Conversing Through the Verbatim autodialer," and Section 6, "Advanced Programming."

**CALL OUT** The action of the Verbatim autodialer placing calls to outside personnel or facilities.

**CDL (Central Data Logger)** The combination of a modem, a serial interfaced printer and a special Racal-built interface box is called a Central Data Logger (CDL). A Racal autodialer/RTU may be configured to call and log data to the CDL printer. CDL RTUs first call the CDL printer to log alarm and status information then proceed on to calling personnel by voice.

**CLOSED CIRCUIT CONDITION** One of two possible states of a contact closure input circuit. Closed Circuit is the condition in which the contacts complete the electrical circuit connection. Open Circuit is the opposite condition, in which the contacts do not complete the electrical circuit connection. The Open Circuit condition is electrically equivalent to having no connection to the input circuit. A Closed Circuit input will measure zero volts DC from the input connection to the common connection point. An Open Circuit input will measure 5 volts DC. The Open or Closed Circuit status may

also be read without a voltmeter, by use of Program Code 0 ZZ 0, where ZZ is the 2-digit channel number. See Section 3.3, "Programming Input Channels" and 5.3, "Receiving Alarm Calls".

**COMMON** The combined electrical return connection point for all contact closure inputs. One side of all contact inputs are connected to Common. Physically, this Common connection point is any of the 4 terminals marked C on terminal strip TS1. The circuit board internally connects Common to the AC ground (GREEN) terminal on terminal strip TS3. See Section 2, "Installation."

**DEFAULT** Programming values which are built into the unit and remain in effect until the user alters them. Also, permanently available speech messages which are utilized when the user has not recorded his own messages.

**DELAY BETWEEN DIGITS** In some applications, an extra waiting time is needed between dialed digits. For example in some PBX systems, a 9 must be dialed, followed by a waiting time of several seconds before the main phone number may be dialed. See Section 3.2, "Programming Phone Numbers," Appendix F, "MODBUS Interface," and Section 6, "Advanced Programming."

**DESIGNATION NUMBER** The two-digit "order number" of a phone number in the overall set of phone numbers programmed. For example, the designation number for the third phone number is 03. See Programming Worksheet A. See Section 3.2, "Programming Phone Numbers," 6.1, "Program Codes," and 6.2, "Programming Operations."

**DIALER** See autodialer.

**DRY** Description of a sensor contact circuit that is not connected to any power source.

**EXIT DELAY** A delay period after a user arms the unit, before the unit will actually accept new alarms. Used to allow user to exit a protected entrance without tripping the unit into alarm. See Section 6, "Advanced Programming."

**GLOBAL** Essentially "over all" or "universal". Programming that simultaneously sets the same value for all channels, but excluding the Power Failure Alarm function.

**GROUPING** See Alarm Call Grouping.

**ID MESSAGE** See Station ID Message.

**INQUIRY CALL** A call placed by personnel to the Verbatim autodialer. See Section 5.1, "Placing Inquiry Calls to the Verbatim autodialer."

**LED** A lighted legend indicator on the front panel.

**LINK** See Alarm Call Grouping.

**MEMORY USE RATE** See Speech Memory Rate.

**MODEM** A device which allows digital data (as opposed to voice) to be transmitted between two sites, usually via public telephone lines. In the case of a Verbatim autodialer equipped with the CDL or SCADA option, a modem is built into the option card so that no external modem is required.

**NETWORK** The physical and higher level protocols for a specific vendor's PLC data communications. The Verbatim can support a maximum of 3 networks simultaneously. The actual number of networks and type of protocol are hardware options.

**NETWORK ADDRESS** The concatenation of the network ID, node, and PLC address. It is sometimes symbolized by '/net/node/addr' where net is the network ID, node is the node address, and addr is the PLC address. The network address suffices to uniquely identify any data object which the Verbatim can access.

**NETWORK ID** A voice message identifying a specific network. By default, the message is "Verbatim Net X", where 'X' is a number from 0 to 5. Custom messages, such as "Building 320 LAN" may be recorded. See 'NETWORK' entries below for more details.

**NETWORK 0** Refers to the discrete, analog, and RSC points internal to the VSS.

**NETWORK 1** Refers to devices connected to the 'NET1' port on the serial communications card. Protocols may vary.

**NETWORK 2** Refers to devices connected to the 'NET2' port on the serial communications card. Protocols may vary.

**NETWORK 3** Refers to devices connected to the MBPLUS port on the MBPLUS communications coprocessing card.

**NETWORK 4** Refers to devices connected to the Parallel port.

**NETWORK 5** Refers to devices connected to the Modem port on the serial communications card.

**NODE** The address of a specific PLC on the network. Each PLC is already configured with a unique integer as its node address. The Verbatim must also be given a unique number as its node address on each network to which it interfaces. The network ID and node together suffice to uniquely identify any PLC.

**NORMAL CONDITION** For contact closure inputs, the Normal Condition is that condition (open or Closed Circuit) which normally exists. The opposite condition would create an alarm. See Section 3.3, "Programming Input Channels" and 5.3, "Receiving Alarm Calls."

**NORMALLY CLOSED** Describes a monitored "contact type" input signal circuit, for which the normal, non-alarm state is associated with the circuit being closed (i.e. a completed connection being established between the two conductors of the input circuit). An alarm condition causes the circuit to be opened (broken), which the Verbatim autodialer would detect and begin placing alarm calls. This requires that this input be programmed as Normally Closed on the Verbatim autodialer.

**NORMALLY OPEN** Opposite of a Normally Closed circuit. The input signal is open in the normal, non-alarm state and closes when an alarm occurs. This requires that this input be programmed as Normally Open on the Verbatim autodialer, which is the default setting for a contact type input.

**NON-VOLATILE MEMORY** When AC power fails, the unit continues to operate for several hours on its internal Gel Cell battery. When this battery is near discharge, the unit automatically turns itself off. However all the user's programming and all user recorded messages are kept intact by Non-volatile Memory for up to ten years, so when power is later restored, no reprogramming or message recording will be required.

**OPEN CIRCUIT CONDITION** See Closed Circuit Condition.

**PHYSICAL CHANNEL OR PC** Internal inputs are sometimes call Physical Channels (PCs). PCs monitor user-supplied external sensors such as float switches, limit switches, etc. In most cases, the outputs of logic controllers may be connected directly to Physical Channel inputs without the need for interfacing relays or other signal conditioning. The normal Verbatim inputs, as distinguished from the RCs when necessary. The semantics are such that all RCs on network 0 are PCs.

**PLC ADDRESS** The data table location of an object within a specific PLC's internal memory. The format of the PLC address is vendor dependent. For network 0, the PLC address is the physical channel number.

**POWER FAILURE** The disappearance of 120 VAC power to the unit. The unit will continue to operate under power failure until its internal Gel Cell battery is discharged.

**PULSE TOTALIZER** The totalizer function accumulates a continuing count of the number of cycles of a train of pulses presented to the input. The pulses may be in the form of an open and closed circuit, or they may be in the form of a 5-volt logic signal.

**RECORDING RATE** In the process of digitally recording the user's voice messages into speech memory, the message is recorded into memory at one of four possible rates. The faster this rate of memory usage, the higher the recording fidelity. However, this results in less total available recording time than at slower rates. Rate 1 is the fastest rate giving the best sound quality. The Auto-

extend feature automatically selects the optimum rate to allow adequate recording time for the user's own set of messages at the best possible sound fidelity. See Section 4.2.1, "Verifying/Extending Recording Time," and Section 4.3, "Record Your Messages."

**REMOTE CHANNEL OR RC** A Verbatim I/O point whose value mirrors the value at some network address. Each active RC is associated with one and only one network address. The RC number can be viewed both as a 'speed dial' abbreviation for the lengthy network address and as a 'virtual' I/O point that supports alarm criteria. Different RCs can refer to the same network address. All data objects referenced by any RC are either 1 or 16 bits in length. 1-bit objects are termed "discrete" or "digital" points. 16-bit objects are sometimes termed "analog" points even though the data may actually be a discrete counter or timer. The type of object is implicit in the RC's network address. This is to say, any RC can be either discrete or analog.

Analog RCs are NEVER scaled to engineering units within the Verbatim Gateway. They can only have decimal integer values in the range 0 to 65535. Any desired must be done within the PLCs program. Floating point, hexadecimal, and octal data formats are not supported.

**REPEATS** The number of times a series of messages (including Station ID message) is spoken when an alarm call is placed. As used here, this number includes the first recital of the messages. For example, 3 repeats means 3 times total, not 4. See Section 5.3, "Receiving Alarm Calls" and Section 6.1, "Program Codes."

**RING ANSWER DELAY** The number of rings required before the Verbatim autodialer will answer an inquiry call. See Section 5.3, "Receiving Alarm Calls," and 6.1, "Program Codes."

**RTU (Remote Telemetry Unit)** A monitoring device, interfaced to a communications medium, whose mission is to communicate conditions at a remote or inaccessible site. RTUs are usually polled by a central computer on some schedule or interval. Additionally, RTUs may request polling to report any exceptions such as alarms or other events which require the attention of the central computer or its operators. When a Raco Verbatim autodialer is configured with the asynchronous communications module it is known as an RTU. The Verbatim RTU does not lose any of the basic features of the Verbatim autodialer. In addition, the Verbatim RTU is capable of receiving polling calls from the Raco SCADA Central Computer. Furthermore, alarms may be communicated to the Raco SCADA Central Computer or to a Raco Central Data Logger (CDL) printer.

**RUN TIME METER** A feature which, when turned on, accumulates the total number of hours that an input channel is in the Closed Circuit condition. Typically used to monitor equipment operation time, particularly alternating pump systems. See Section 3.3, "Programming Input Channels," and Section 6, "Advanced Programming."

**SCALE FACTOR** A translation factor which may optionally be entered in conjunction with the Pulse Totalizer function. The spoken Totalizer reading will be the actual number of pulses accumulated, divided the programmed scale factor. See Section 6, "Advanced Programming."

**SECURITY ACCESS CODE** A code optionally programmed by the user at the front panel. Once programmed, this code is required in order to perform any program operations over the phone. See Section 5.7, "Programming by Phone," and Section 6, "Advanced Programming."

**SPEECH MEMORY RATE** See Recording Rate.

**STATION ID MESSAGE** A message which is always included in all phone calls to or from the unit, intended to identify the unit. The default Station ID Message is "ID number is 1". See Section 4.1, "Planning Messages" and 4.3, "Record Your Messages."

**TIME BETWEEN ALARM CALLS** With the unit in Unacknowledged Alarm status, the waiting time from the time the unit terminates a given alarm call, until the time when the unit again accesses the phone line to place the next call. During this interval (default 2 minutes), personnel may call the unit back, which will acknowledge the alarm and suspend further calling. See Section 5.4, "Continued Dialing in the Absence of Acknowledgment," and Section 6, "Advanced Programming."

**VIOLATION** For contact closure inputs, a violation (also called Alarm Condition) is the Open or Closed Circuit condition which is opposite the condition which has been programmed as Normal for that channel. For example, if a given input channel is programmed for Normally Open operation, then a Closed Circuit is a violation for that input. If the violation persists for the Alarm Trip Delay time, the unit will go into Unacknowledged Alarm state and begin placing alarm calls. See Section 3.3, "Programming Input Channels," 5.3, "Receiving Alarm Calls," and 5.6, "Alarm Rest Timeout After Acknowledgment."

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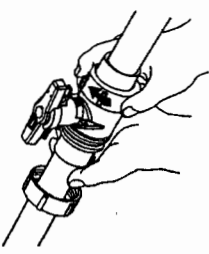
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# FCC Notice to Users

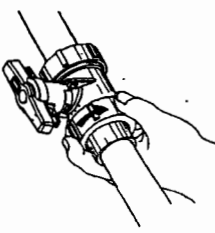
1. You must notify your telephone utility as follows:
  - a. Intention to install an FCC Part 68-registered device.
  - b. The FCC registration number: HKS-23J06304-AL-R
  - c. The ringer equivalence number: 0.3A
  - d. When the device is disconnected from the telco network and will not be reconnected.
2. These units may not be used on party lines.
3. The telco has the right to make changes in their network which may affect the operation of your unit, provided adequate notice is given to you in advance to permit continued correct operation.
4. In the event of operational problems, disconnect your unit by removing the modular plug from the modular telephone jack. To test the phone line, temporarily plug a working rotary-dial telephone into the jack normally used by the Verbatim. If the substitute telephone works correctly, your Verbatim has a problem and should be returned for repairs (in or out of warranty). If the substitute telephone does not work correctly, notify the telco that they have a problem and request prompt repair service (at no cost to the user).
5. The user may not under any circumstances (in or out of warranty) attempt any service or repairs on the Verbatim. It must be returned to RACO for all repairs.

Attach Valve to End Connector Socket and begin to tighten Union Nut.

**DO NOT USE ANY TYPE OF THREAD SEALANTS. "HAND TIGHTEN ONLY."**



**BE SURE THAT THE FACE OF THE END CONNECTOR SOCKET IS SQUARELY ALIGNED (FLUSH) WITH THE VALVE BODY AND IS FLUSH AGAINST THE O-RING.**



Attach final Union Nut to Valve Body.

**DO NOT USE THE REMAINING UNION NUT TO DRAW TOGETHER ANY GAPS BETWEEN THE END CONNECTOR AND THE VALVE BODY.**

**STEP 8**

Pressure test the system only after all solvent cement joints have fully cured. If any leaks are found at End Connectors during pressure check, use a strap wrench to tighten Union Nut 1/4 turn to stop the leak.

**DO NOT OVER TIGHTEN AS DAMAGE MAY OCCUR.**

**THREADED CONNECTIONS**

**WARNING: SOME PIPE JOINT COMPOUNDS OR TEFLON PASTES MAY CONTAIN SUBSTANCES THAT COULD CAUSE STRESS CRACKING TO PLASTIC. TRANSITIONS TO METAL PIPE REQUIRE THOROUGH CLEANING AND DEGREASING TO REMOVE ANY PIPE THREAD CUTTING OIL.**

Spears Manufacturing Company highly recommends the use of Spears BLUE 75™ thread sealant, which has been tested for compatibility with Spears products.



**STEP 1**

Apply Joint Sealant - Threaded connections require application of a quality grade thread sealant to seal and lubricate the joint assembly. Sealants must only be applied to male pipe threads.

Please follow the sealant Manufacturer's Application/Installation instructions. Choice of another appropriate thread sealant is at the discretion of the installer.

**STEP 2**

Assemble Joint - 1 to 2 turns beyond "FINGER TIGHT" are generally all that is required to make a sound plastic threaded connection.



Unnecessary OVERTIGHTENING will cause damage to both pipe and valve.

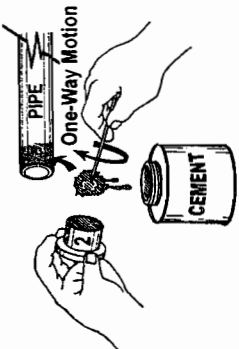
Follow Step 7 and Step 8 from Solvent Welding Instructions.

REPEAT PRIMER APPLICATOR IF NECESSARY.

**THE MOST FREQUENT CAUSE OF JOINT FAILURE IS INADEQUATE PRIMER PENETRATION AND SOFTENING OF BONDING SURFACES DURING THE WELDING OPERATION. TAKE EXTRA CARE THAT NO SOLVENTS ARE ALLOWED TO COME IN CONTACT WITH THE BALL OR OTHER INTERNAL VALVE COMPONENTS.**

**STEP 5**

Solvent Cement must be applied IMMEDIATELY to the primed surfaces before the primer dries, in an alternating 3-coat application. Using a brush or applicator no less than 1/2 the pipe diameter, apply a liberal coat of solvent cement to the primed pipe surfaces. Next, apply a light to medium coat to the End Connector Socket primed surface. If a "NET FIT" was experienced during the dry fit check (See Step 3) then apply an additional liberal coat again to the pipe surface.



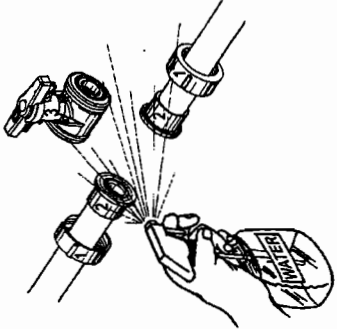
**STEP 6**

Immediately following the application of solvent cement, and before it begins to set, insert the End Connector Socket over the pipe end, push with a 1/4" twisting motion to evenly distribute the solvent cement within the joint. A full bead of solvent cement should form around the circumference of the joint. Hold joint together for approximately 30 seconds to make sure that the End Connector Socket does not back off of pipe. Use a cloth to remove any excess cement from the exterior juncture of the pipe and End Connector.



Repeat STEP 6 to attach opposite end connector to pipe and branch on 3-Way Valves.

Allow joint to cure according to solvent cement manufacturer's instructions.



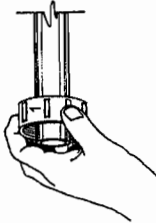
**STEP 7**

Apply a mild soapy-water solution to the valve body threads and the union nut threads for the assembly lubrication. Open the valve handle completely and support valve body to hold its own weight.

**STEP 1**

Pipe Preparation - Prepare connecting pipes as required. Pipe ends must be cut square at 90° using a wheel type cutter or a saw and miter box.

Regardless of the cutting method used, burrs will be created, which must be removed. All pipe ends should be beveled at 10° to 15°. A deburring tool is recommended, however a file may be used in its place as shown.

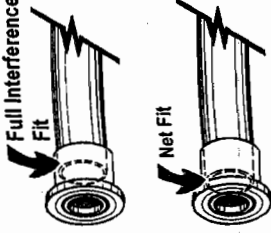


**STEP 2**

Wipe away all loose dirt & moisture from the pipes & components with a clean dry cloth. Slide Union Nuts (1) over pipe ends where each End Connector Socket is to be installed, being sure that the Union Nut threads will be facing the Valve body.

**STEP 3**

Check the Joint Interference fit between the pipe and the End Connector Socket. An interference fit is necessary for proper fusion of the joint. To check, lightly insert the End Connector Socket over the prepared pipe ends. **DO NOT FORCE THE SOCKET ONTO THE PIPE.**



Interference must occur between 1/2 the Socket depth (FULL INTERFERENCE) and the Socket bottom (NET FIT). Do not use components which do not properly mate.

Make sure that the face of each End Connector Socket is at a square 90° angle with the pipe end.

End Connector Socket O-rings must be free of any signs of dirt & debris. Clean as necessary. If O-rings must be removed, clean all surfaces and re-install by depressing the O-rings evenly into its retaining groove, being sure to avoid any wrinkles or creation of an uneven sealing surface.

**STEP 4**

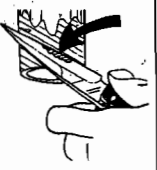
Primer is necessary to penetrate & soften both pipe and End Connector Socket surfaces in order for the solvent cement to properly bond.

Using a brush or applicator size no less than 1/2 the pipe diameter, apply a liberal coat of primer with a circular, scrubbing motion to the inside socket of the End Connector until the surface is softened and semi-fluid. This will occur in 5 to 15 seconds, depending on size and temperature.

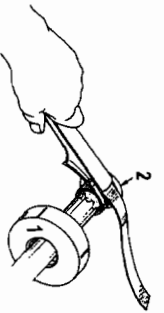


Apply primer to the outside of pipe ends in the same manner extending application area to slightly beyond the insertion depth of the End Connector Socket. Apply a second coat to both pipe and socket.

Check the penetration and softening by scraping the primed surfaces. A few thousandths of the semi-fluid surface should easily be removed.



**STEP 3**  
Wrench Make Up - Tighten pipe and valve components always be installed using conventional pipe wrenches. Do not use cause damage to plastic piping materials. Apply wrench make-up of no more than 1 to 2 turns beyond finger-tight thread engagement. Care must be taken in final positioning so as to avoid the need to "Back-up" the wrench assembly.



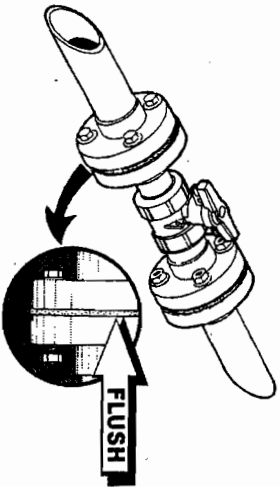
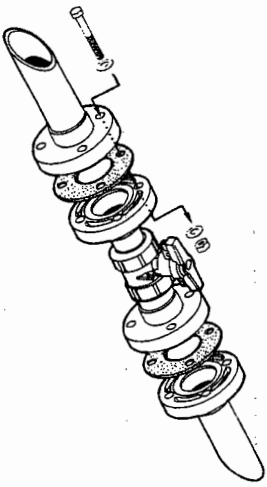
## FLANGED CONNECTIONS

Once a flange is attached to the pipe or valve, the method of joining two flanges are as follows:

**STEP 1**  
Use of well lubricated bolts & flat washers are required. Use an anti-seize lubricant such as IMS Cooper Flake.

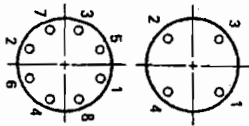


**STEP 2**  
With a 1/8" gasket having a shore "A" durometer of approximately 60 in place, align the bolt-holes of the mating flanges by rotating the ring into position. Insert all bolts, washers, and nuts.



Tighten the nuts by hand until they are snug.

AT THIS TIME, BE SURE THAT THE FLANGE AND GASKET SURFACES ARE FLUSH AND SQUARELY ALIGNED.

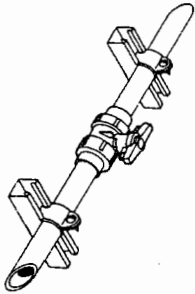


BOLT TORQUES	Torque Value
Valve Size	
1/2" to 1-1/2"	12 ft. lbs.
2" to 4"	25 ft. lbs.
6" Venturied	40 ft. lbs.

**STEP 3**  
Tighten Bolts - Establish a uniform pressure over the flange face by tightening the bolts in 5 ft. lbs. Increments following a 180° opposing sequence as shown in the table above. Care must be taken to avoid "BENDING" the flange when joining a Spears flange together. DO NOT USE BOLTS TO BRING TOGETHER IMPROPERLY MATED FLANGES.

## PRECAUTIONS AND WARNINGS

**CAUTION:** The system must be designed and installed so as not to pull the components in any direction. Pipe system must be cut and installed in such a manner as to avoid all stress loads associated with bending, pulling, or shifting. All piping systems must be supported.



**CAUTION: BEFORE THE VALVE IS CYCLED,** all dirt, sand grit or other material shall be flushed from the system. This is to prevent scarring of internal components; e.g. ball, cup, wedge, seats, etc.

**WARNING:** System should not be operated or flushed out at flow velocities greater than 5 feet per second.

## NOT FOR USE WITH COMPRESSED AIR OR GAS

**WARNING:** Do not use compressed air or gas to test any PVC or CPVC thermoplastic piping product or system, and do not use devices propelled by compressed air or gas to clear the systems. These practices may result in explosive fragmentation of system piping and components causing bodily injury or death.

All air must be bled from the system during the initial fluid fill. Pressure testing of the system must not be made until all solvent cement joints have properly cured. Initial pressure testing must be made at approximately 10% of the system hydrostatic pressure rating to identify potential problems prior to testing at higher pressures.

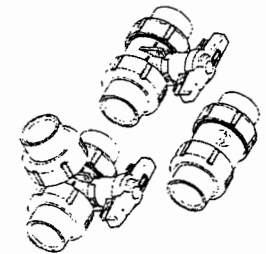
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TU-3A-1001

**True Union Ball, Ball Check, Any Ball Valve Installation Instructions**

TU-3A-1001



These instructions cover general installation for all Spears PVC, CPVC & PP True Union 2000 Industrial Ball, Ball Check & 3-Way Ball Valves & Regular Style True Union Ball & Ball Check Valves. All applicable instructions & procedures should be read thoroughly before starting. Suitability of the intended service application should be determined prior to installation. Plastic piping systems should be engineered, installed, operated & maintained in accordance with accepted standards & procedures for plastic piping systems.

## SPECIAL INSTALLATION INFORMATION

True Union type ball valves use removable end connectors. To avoid problems, NEVER ASSEMBLE THE JOINT TO THE END CONNECTORS WHILE THEY ARE ATTACHED TO THE VALVE CARTRIDGE.

Check Valves may be installed in either horizontal or vertical position with a minimum of 10 pipe diameters from any pump or other source of turbulence. Check valves MUST be installed with the valve's "FLOW" arrow pointing in the direction of flow.

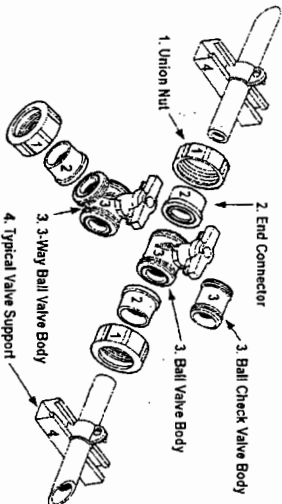
Vented Ball Valves : (special ordered "Bleach Valve") install valve with ball vent-hole on the pressure (upstream) side when in closed position.

**IMPORTANT:** Read Precautions & Warnings for all Valve installations at the end of these instructions. It is absolutely necessary that all design, installation, operation & maintenance personnel be trained in proper handling, installation & precautions for installation & use of plastic piping systems before starting.

**LUBRICATION WARNING:** Some lubricants, including vegetable oils and thread cutting oils, are known to cause stress cracking in thermoplastic materials. Commercially available pipe gasket lubricant suitable for PVC & CPVC should be used where lubrication is needed for installation or maintenance service (SEACORD EASE-ON or equivalent). These water-soluble lubricants can be mixed with water where a "MILD SOAP & WATER SOLUTION" is specified to be used. Choice of lubricant is at the discretion of the installer.

## INSTALLATION INSTRUCTIONS FOR SOLVENT WELDING APPLICATIONS

Remove Union Nuts (1) and End Connectors (2) from the Valve Body (3). Instructions apply to Ball, Ball Check & 3-Way. All components should be removed from packaging & exposed to the installation environment for a minimum of 1 hour to thermally balance the components. Wipe clean and match all components to their assigned identification numbers.





**SOIL VAPOR EXTRACTION  
&  
GROUNDWATER TREATMENT SYSTEM**

**Submittal Data**

Job No. 11757

*For*  
NYS Dormitory Authority  
515 Broadway  
Albany, NY 12207-2964  
*Contact: Mr. Peter Bujanow*

---

*Project:*  
*Gowanda Day Hab Center*

---

*By*  
**BISCO Environmental**  
91 Pacella Park Drive  
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*JOHN*  
*FRISCH*  
*X 237*



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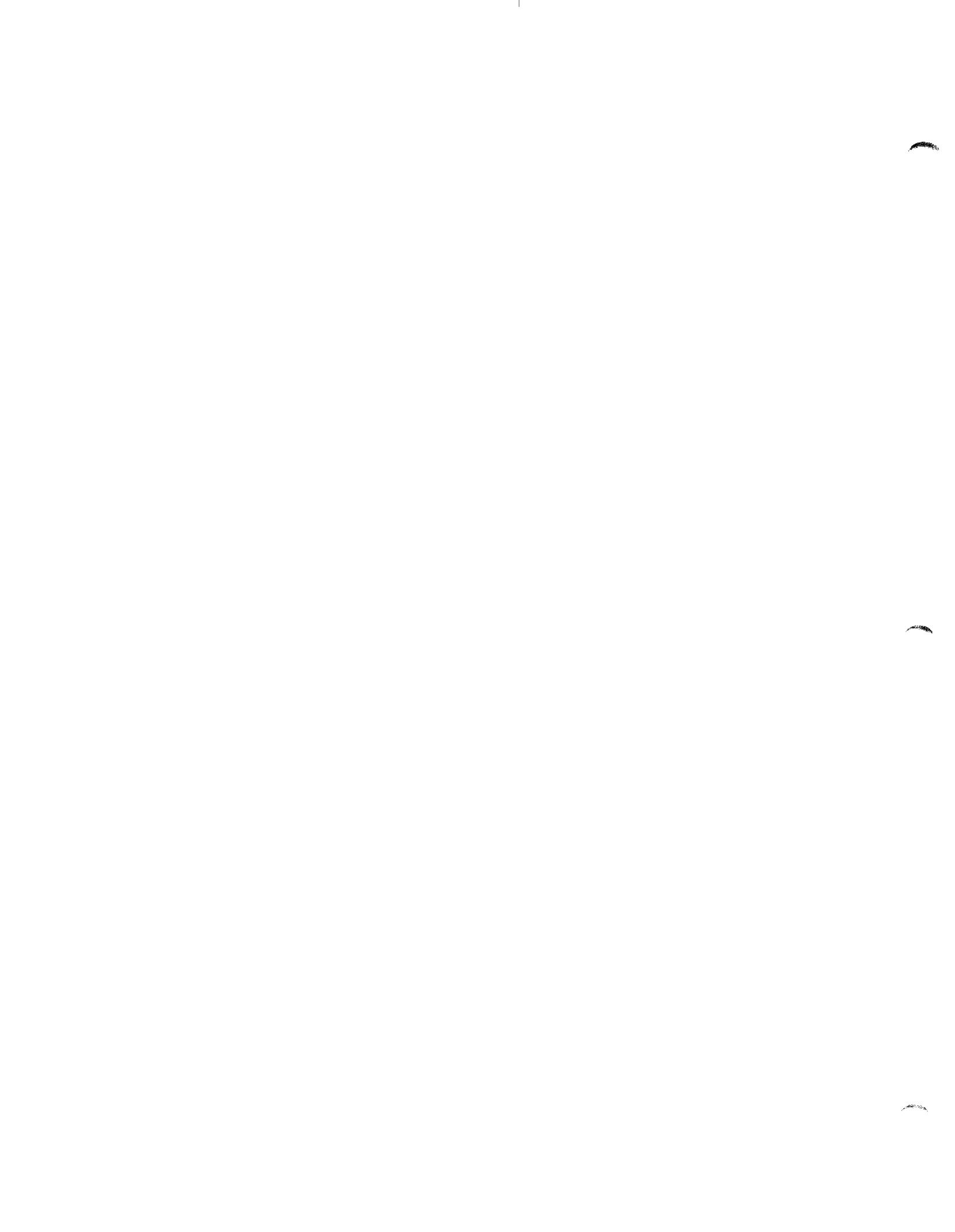
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# SECTION 1

# SOIL VAPOR EXTRACTION SYSTEM





# ROOTS™ Universal RAI-J Whispair™ Rotary Positive Blowers

Frames 33J thru 56J



## BASIC BLOWER DESCRIPTION

Patented Universal RAI-J Whispair blowers are heavy duty rotary units in a compact, sturdy design engineered for continuous service when operated within speed and vacuum/pressure ratings.

The basic model features a cast iron casing with a computer-designed cast relief for noise and shock suppression, carburized and ground alloy steel spur timing gears secured to steel shafts with a taper mounting and locknut, and cast iron involute impellers. Oversized anti-friction bearings are used, with a cylindrical roller bearing at the drive shaft to withstand V-belt pull. Detachable rugged steel mounting feet permit easy in-field adaptability to either vertical or horizontal installation requirements.

The Universal RAI-J incorporates thrust control, and has grease lube on the drive end and splash lube on the gear end. ROOTS exclusive "Figure 8" gearbox design improves oil distribution and lengthens bearing and gear life.

## LOWER AIR PULSATION

Patented *Whispair* blowers operate with up to 50% less pressure pulsation than conventional blowers due to the pressure equalizing effect of the Whispair design.

In *conventional* blowers, as the impeller opens up to the outlet port, the higher pressure air in the discharge line rapidly expands into the lower pressure pocket formed by the impeller and the blower case. The resulting shock wave strikes the advancing surface of the impeller at sonic velocity. Four pressure pulses occur during each revolution, transmitting shock loads to the gear and bearings.

## LONGER BEARING LIFE

The pre-pressurization of the low pressure pocket through the Whispair cavity smooths the pulsations and results in less shock being transmitted through the impellers to the bearings, resulting in approximately 20% longer bearing life.

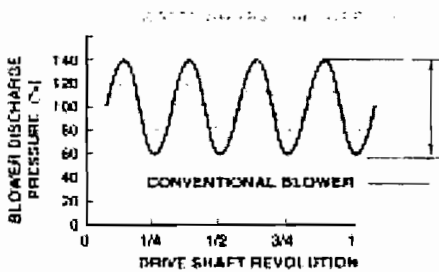
## LOWER VIBRATION

The reduction in the magnitude of the pressure pulsation results in smoother operation.

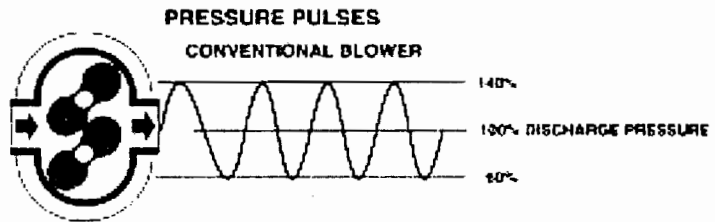
## LOWER NOISE

The pressure pulses, inherent in the rotary-lobe design, are also the major source of blower noise. The rapid backflow of air into the blower from the discharge line, four times per revolution, results in high noise levels in the conventional blower. The Whispair design controls the backflow of air into the blower reducing noise by approximately 5 dBA vacuum, 3 dB pressure.

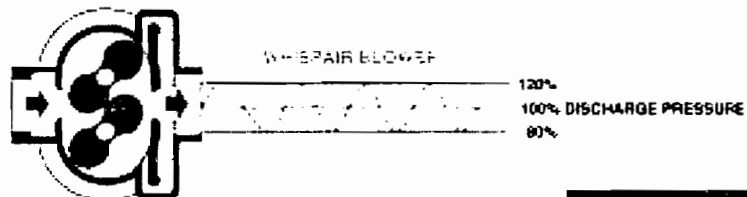
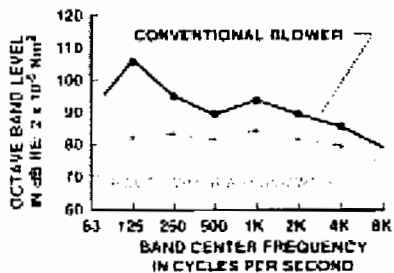
PEAK-TO-PEAK PRESSURE PULSE



PRESSURE PULSES



TYPICAL BLOWER NOISE CURVE



**Roots**

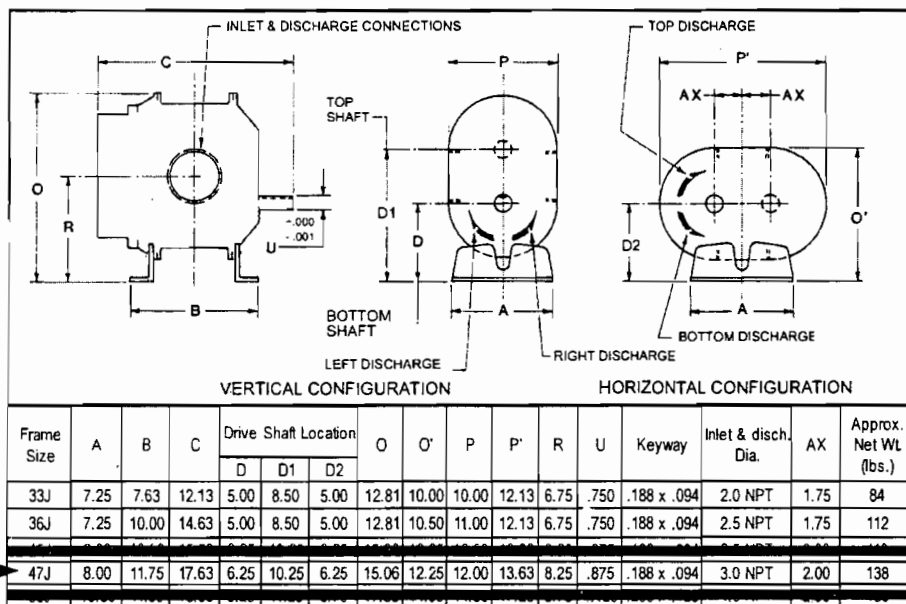


## PERFORMANCE TABLE

Frame Size	Speed RPM	4" Hg Vacuum		6" Hg Vacuum		8" Hg Vacuum		10" Hg Vacuum		12" Hg Vacuum		14" Hg Vacuum		15" Hg Vacuum		16" Hg Vacuum		MAX. PRESSURE			
		CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	PSI	CFM
33J	1160	47	0.8	40	1.1	33	1.4	27	1.7										7	88	2.4
	2800	148	2.9	141	2.7	134	3.4	128	4.1	121	4.9	113	5.6						12	116	9.5
	3600	197	2.7	190	3.6	184	4.6	177	5.3	170	6.3	163	7.2	158	7.6			12	165	12.4	
36J	1160	83	1.2	74	1.7	65	2.2	55	2.7										7	57	3.8
	2800	251	3.2	241	4.4	232	5.7	223	6.5	214	7.9	202	9.1						7	224	9.5
	3600	332	4.4	323	6.0	313	7.8	304	8.7	294	10.3	284	11.9	278	12.7			7	306	12.5	
45J	860	66	1.1	56	1.5	46	1.9												7	37	3.4
	1760	175	2.2	164	3.1	154	4.0	144	4.9	134	5.8								10	133	9.5
	3600	398	5.2	387	7.1	377	8.9	367	10.3	356	12.2	345	14.1	339	15.0	332	15.9	10	358	20.5	
47J	860	89	1.3	76	1.9	63	2.5	51	3.0										7	53	4.4
	1760	233	2.9	220	4.1	207	5.3	194	6.3	181	7.5								7	196	9.0
	3600	526	6.9	513	9.3	500	11.8	488	13.6	474	16.1	460	18.5	452	19.8			7	490	19.5	
56J	700	103	1.5	95	2.2	82	2.9	70	3.5										7	72	4.9
	1760	342	4.3	329	5.9	316	7.5	303	9.1	290	10.7	276	12.3						10	290	17.9
	2850	588	7.5	570	10.6	557	13.2	545	15.2	532	17.9	517	20.6	510	21.9	502	23.2	10	517	38.0	

Notes: 1. Vacuum ratings based on inlet air at standard temperature 68° F, discharge of 30" Hg and specific gravity of 1.0.  
2. Pressure ratings based on inlet air at standard pressure of 14.7 psia, standard temperature of 68 F, and specific gravity of 1.0.

## OUTLINE DRAWING & DIMENSIONAL TABLE



## DESIGN AND CONSTRUCTION FEATURES

1. Detachable steel mounting feet.
2. Rigid one-piece cast iron casing
3. Anti-friction bearings
4. Thrust control
5. Splash-lubricated spur timing gears
6. Connections in standard pipe sizes
7. Straight, precision machined two-lobe impellers
8. Ground steel shafts

## Dresser, Inc.



Roots

S-33A93  
April 2002

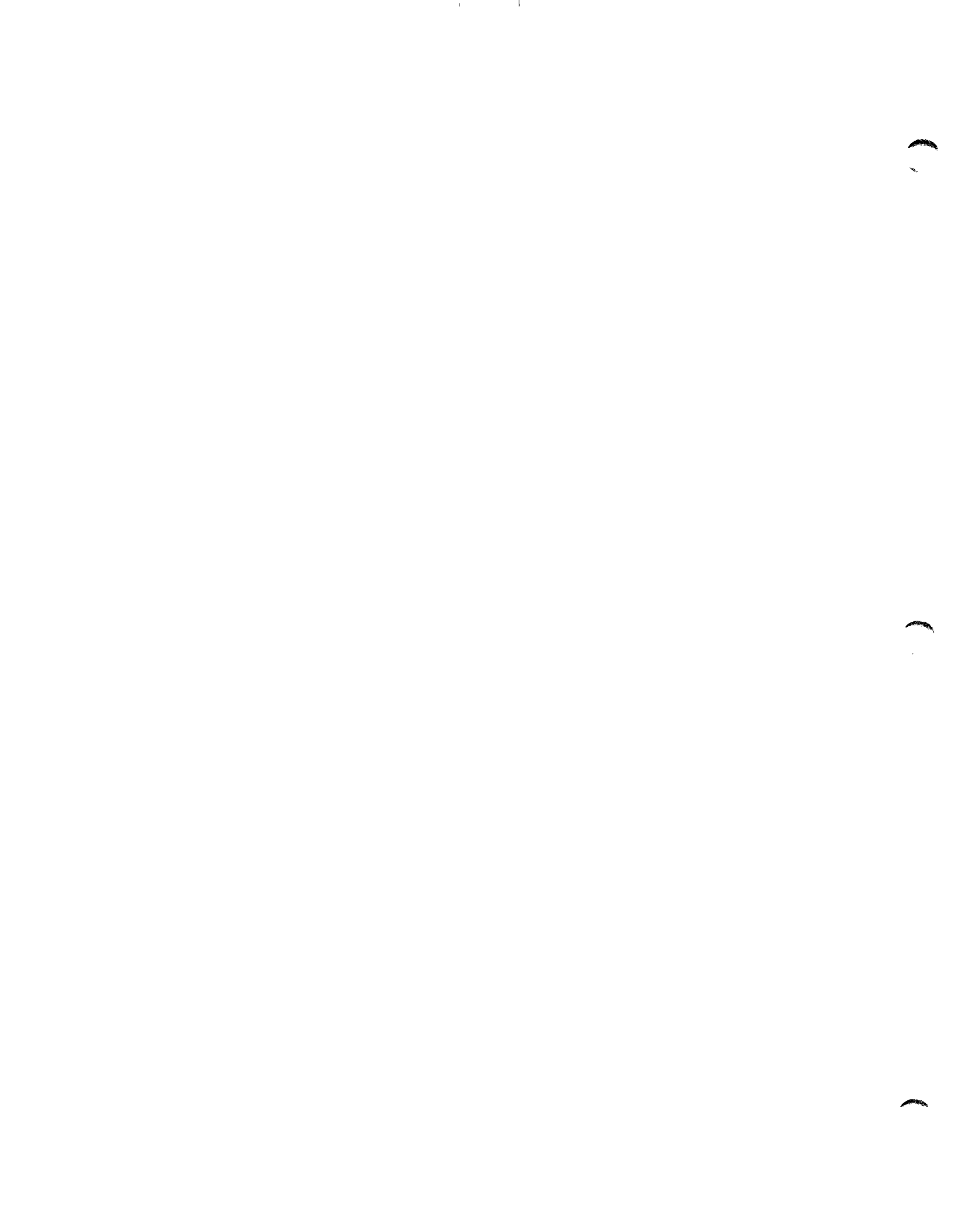
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All information subject to change without notice.

Dresser ROOTS  
2135 Hwy 6 South  
Houston, TX 77077  
PH: 281-966-4700  
FX: 281-966-4309  
Toll Free: 1-877-363-ROOT(S)

Dresser ROOTS - Connersville  
900 West Mount Street  
Connersville, IN 47331  
PH: 765-827-9200  
FX: 765-827-9266

Dresser ROOTS, Holmes Operation  
PO Box B7  
Off St. Andrews Rd  
Turnbridge, Huddersfield  
England HD1 6RB  
PH: +44-1484-422222  
FX: +44-1484-422668

website: [www.rootsblower.com](http://www.rootsblower.com) • email: [dmd\\_roots@dresser.com](mailto:dmd_roots@dresser.com)



Company: BISCO Environmental  
 Address: 91 Pacella Park Drive Randolph, MA 02368  
 781-963-0090 / 781-986-1540  
 Contact: Tim Mahoney  
 Dated : 08/17/2004  
 Customer: Gowanda

ROOTS BLOWER PERFORMANCE SUMMARY : Program Version 1.4 Release Date 31/03/2004

AMBIENT CONDITIONS:

Gas	AIR	
Relative Humidity	100%	
Molecular Weight	28.535	
k-Value	1.391	
Specific Gravity	.985	
Ambient Temperature	68	deg F
Ambient Pressure	14.59	PSIA
Elevation	200	feet

STANDARD CONDITIONS:

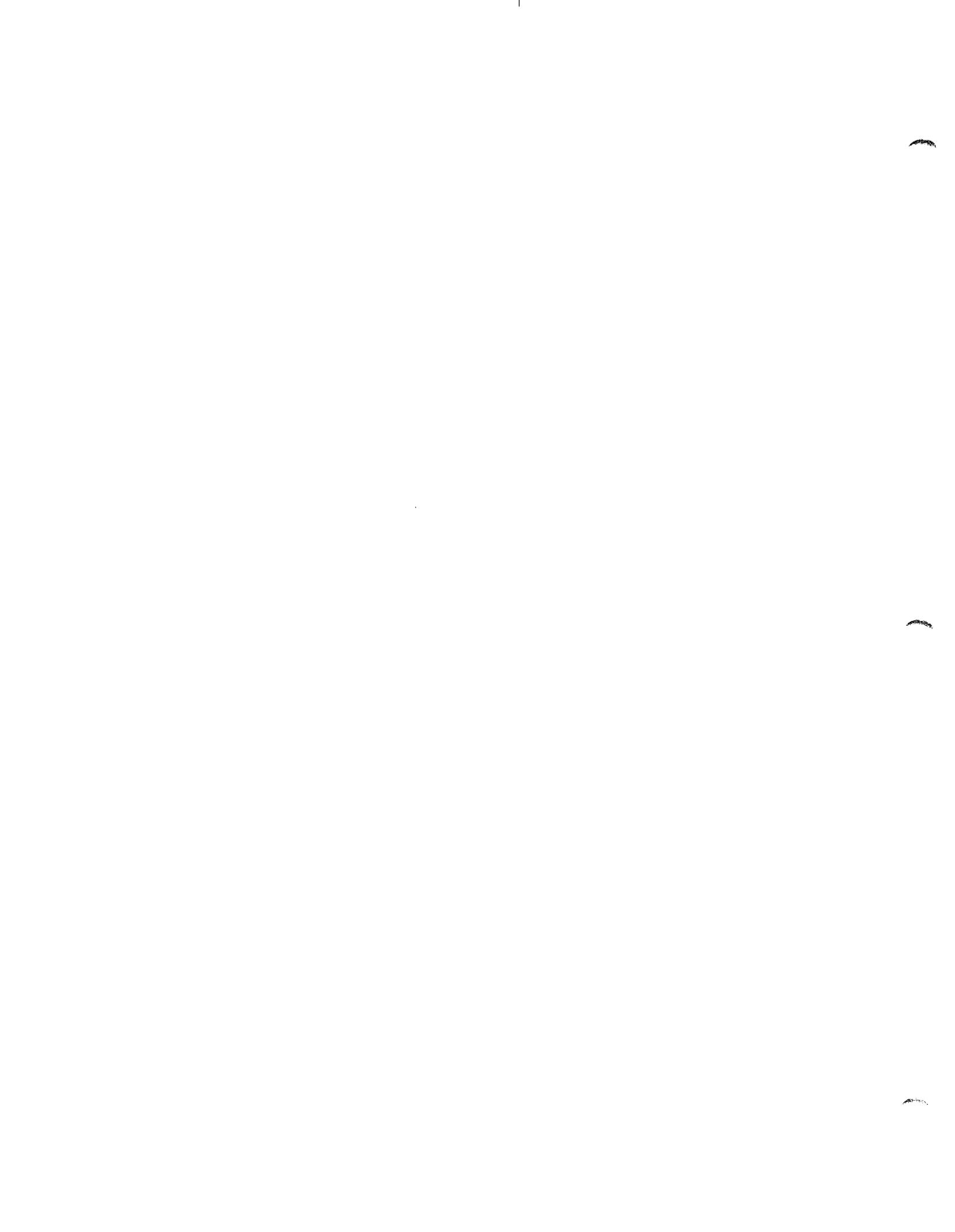
Pressure	14.7	PSIA
Temperature	68	deg F
Relative Humidity	36	%

INPUT CONDITIONS:

Actual Volume	353	ICFM	+/-5 %
Standard Volume	200	SCFM	
Mass/Weight Flow	16	#/min	+/-5 %
System Inlet Pressure	12	in Hg Vac	
Inlet Pressure Loss	7	in H2O	
Blower Inlet Pressure	8.47	PSIA	
System Discharge Pressure	14.59	PSIA	
Discharge Pressure Loss	7	in H2O	
Blower Discharge Pressure	14.84	PSIA	
Inlet Temperature	68	deg F	

SELECTED UNIT DETAIL:

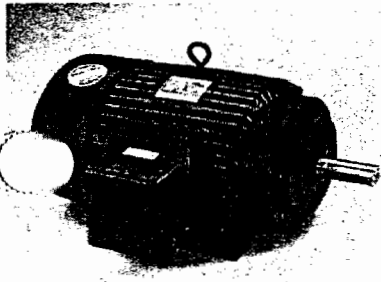
Model	47	URAI
Speed	2884	RPM 80%
Blower Differential Pressure	6.37	PSI 87%
Power at Blower Shaft	13.2	BHP +/- 4%
Temperature Rise	135	deg F 60%
Discharge Temperature	203	deg F
Discharge Volume	252	ACFM
Relief Valve Setting	NO RELIEF VALVE SPECIFIED	
Power at the relief valve Setting	NO RELIEF VALVE SPECIFIED	
Temp. Rise at the Relief Valve Setting	NO RELIEF VALVE SPECIFIED	
Discharge Temp At Relief Valve Setting	NO RELIEF VALVE SPECIFIED	
Gear Tip Speed	3022	FPM
V-Belt: Est. B10 Brg Life:	192986	hours
Coupling: Est. B10 Brg Life:	192986	hours
Est. Free Field Noise @ 1 m.	88.5	dBa
CFR	0.1595	
Weight	128	lbs.
Shaft Dia.	0.875	in.
Min. Sheave Dia.	5	in.
Inlet/Disch Conn.	3T	

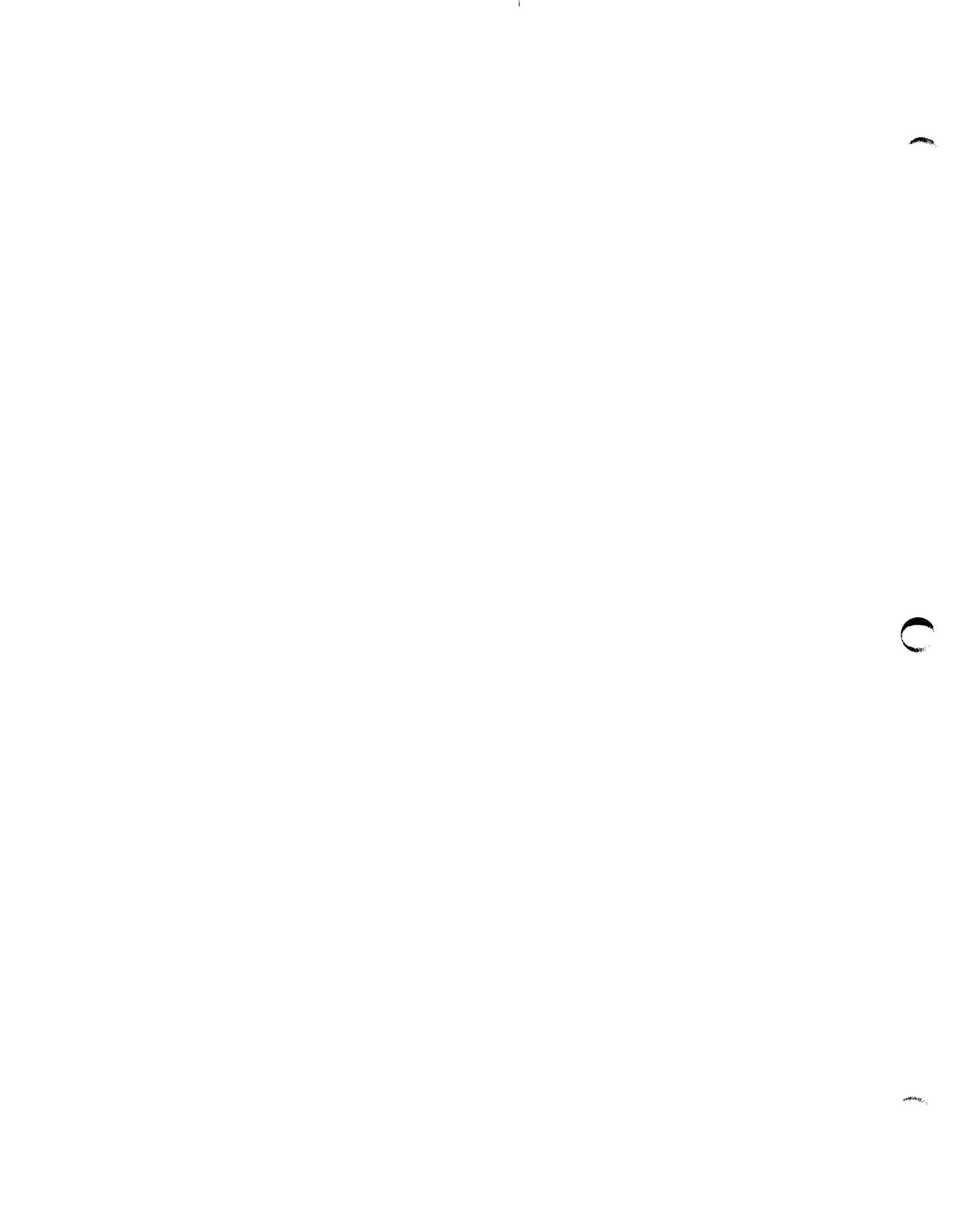


## Product Listing

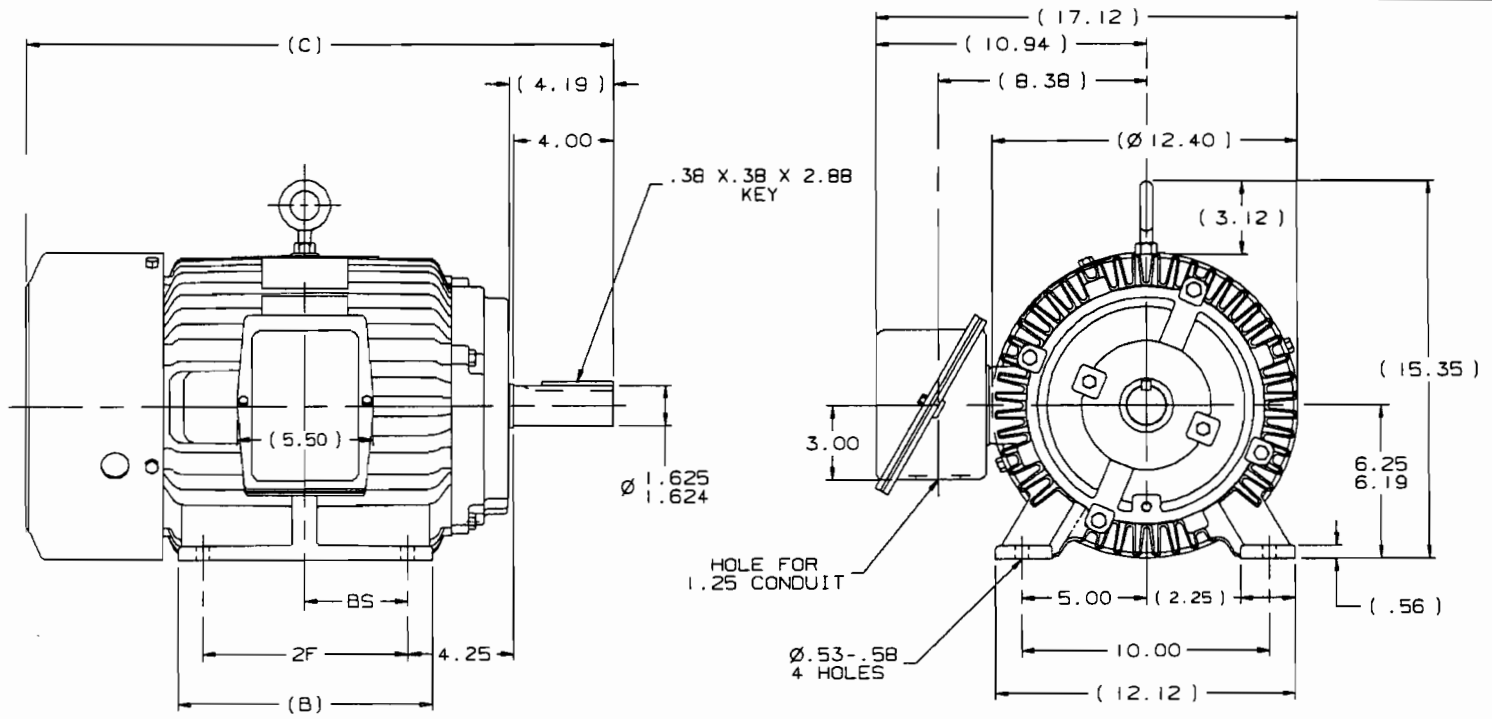
**Model Number:** 256TTFC4026**Catalog Number:** U652**Product Type:** SQ CAGE IND RUN**Normally Stocked:** YES**Enclosure:** TEFC**Frame:** 256T[Dimensional Drawing B-SS200142-1350 PDF](#)[Connection Diagram A-EE7308 PDF](#)[Dimensional Drawing B-SS200142-1350 DXF](#)[Connection Diagram A-EE7308 DXF](#)**HP/KW:** 20**Frequency (HZ):** 60**Speed (RPM):** 1800**Mounting:** RIGID**Phase:** 3**Motor Wt:** 420**Volts:** 208-230/460**Insulation Class:** F**F.L. Amps:** 55-51/25.5**Duty:** CONTINUOUS**Service Factor:** 1.15**Max. Ambient:** 40**Bearing:** BALL/BALL**F.L. Eff.:** 91**DE Bearing:** 309**Thermal Protection:** NONE**OPE Bearing:** 208**KVA Code:** G**Hazardous Location:** NONE**Footnotes:** Rated 60/50 hertz, 190/380 or 380 volt at next lower horsepowerPerformance/Certification Data

- Ball bearings (roller bearings, per footnote "RB")
- 1.15 Service factor
- Items with footnote 20 are nameplated 60/50 hertz at next lowest horsepower
- Motors accept C-face kits as shown in column below
- Severe duty kits available for cast iron frame motors, see Accessories section
- Cast iron motors feature: shaft slinger, regreasable bearings (182T and larger), lead lugs (364T and larger), and bearing caps on 444T and larger
- UL Recognized and CSA Certified









- NOTES:
1. BOX CAN BE ROTATED IN 90° STEPS
  2. BOX CAN BE MOUNTED ON OPPOSITE SIDE BY REMOVING BRACKETS AND TURNING FRAME 180°
  3. NAMEPLATE TO BE READ FROM CONDUIT BOX SIDE OF MOTOR

(SS200010, SS200130)

DASH	FRAME	B	C	2F	BS
1175	254T	10.25	23.69	8.25	4.12
1350	256T	12.00	25.44	10.00	5.00

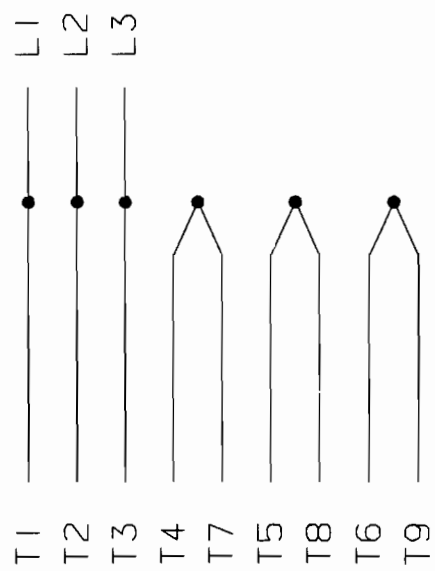
2	09-20-1988	UPDATED SHAFT HEIGHT	CN 16763	DRS	✓ MAX. SURFACE ROUGHNESS UNLESS NOTED OTHERWISE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
					MATL SPEC	TOL. ON XX*.02 XXX*.005 XXXX*.0005 ANGLES: 1°30"	DRWN BY JL
1	09-21-1988	NEW DRAWING	CN 10013	JL	FINISH		
						PART NAME OUTLINE - TEFC 250 FR. - BB - TS - CAST 'C' BOX	DRNG NO B-SS200142 CADD FILE NO. SS200142
REV	DATE	CHANGE	NAME	DISTRIBUTION - WA - LB - WP - LM			

LN SHOP BOOK PURCHASED

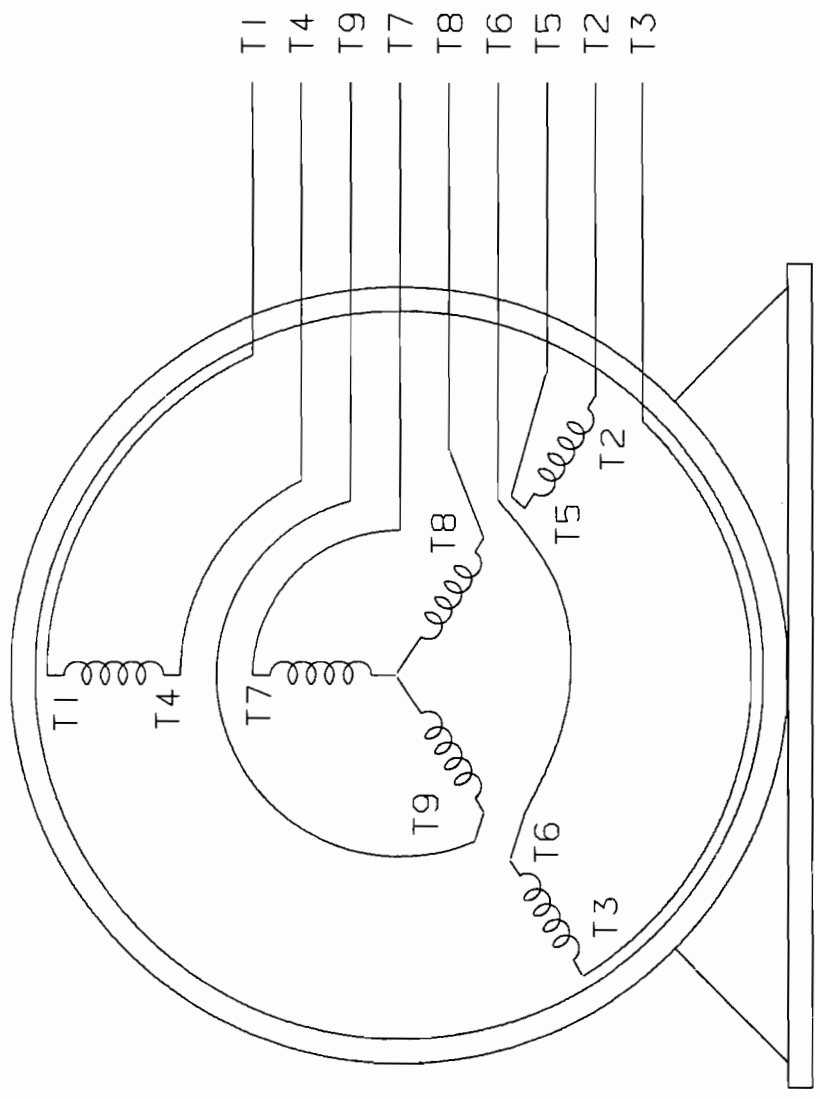
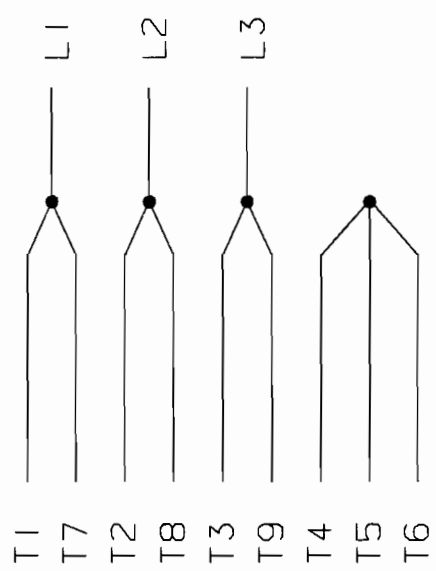


THREE PHASE  
DUAL VOLTAGE MOTOR

HIGH VOLTAGE



LOW VOLTAGE



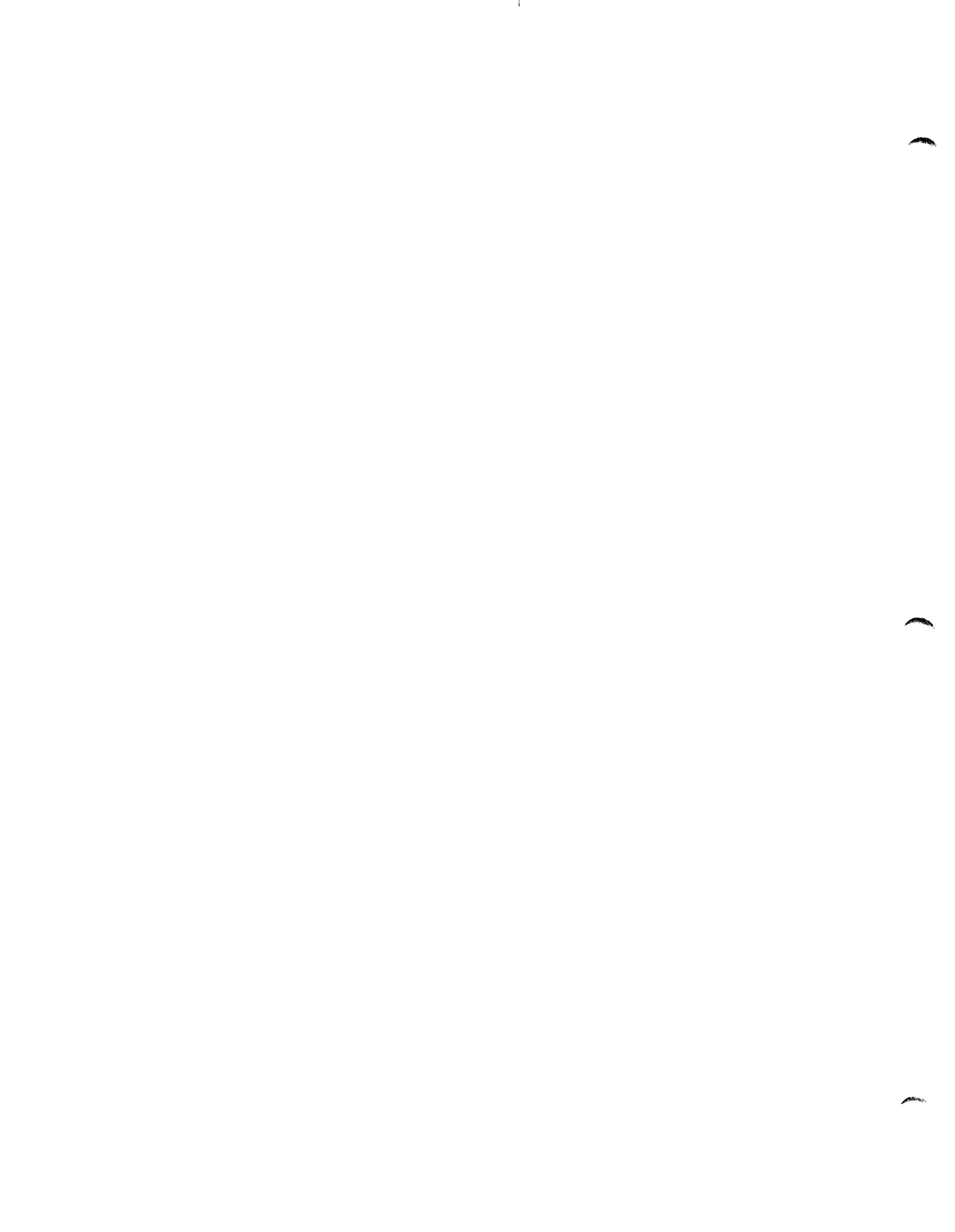
VIEW OF TERMINAL END

REF.  
WINDING DIAGRAM

T8Y, T2Y, T2BL, T4BX, T2EC, T2G  
T6BZ, T2B, T6BL, T4AV, T6B, T4B

✓ MAX. SURFACE ROUGHNESS UNLESS NOTED OTHERWISE TOL. ON XX ± .02 XXX ± .005 XXXX ± .0005 ANGLES ± 7° 30"		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
MATL SPEC		DRAWN RM 11-20-1990	BY
FINISH		CHKO ML 11-21-1990	BY
REFERENCE DRW.		APPD TB 11-21-1990	BY
PART NAME CONNECTION DIAGRAM 3Ø - DUAL VOLTAGE MOTOR		DRWG NO A - EE7308	
1 4 11-20-1990	REDRAWN ON CADD	PURCHASED	
REV DATE	CHANGE	SHOP BOOK	CADD FILE NO. EE7308

DISTRIBUTION - WA - LB - WP - LM - BR





P.O. Box 8003  
 Wausau, WI 54401-8003  
 PH:(715) 675-3311

**Certification Data Sheet**  
 (DATA IS BASED ON 460 VOLTS)

**Model #:** 256TTFC4026  
**Winding:** 2154329

**Outline Drawing:** B-SS200142-1350  
**Connection Diagram:** A-EE7308

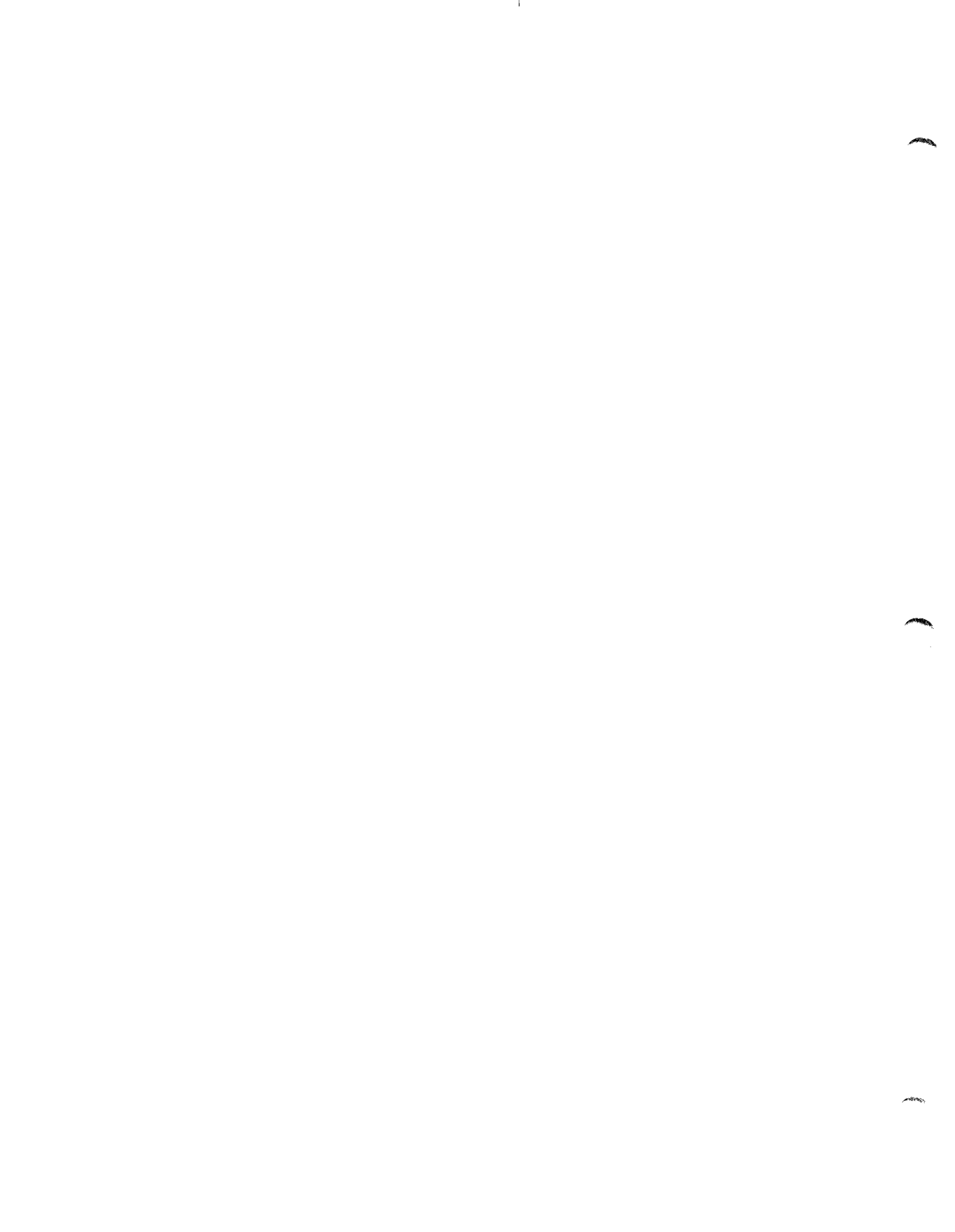
<b>NP HP:</b> 20	<b>DESIGN:</b> B	<b>Frame:</b> 256T
<b>NP VOLTS:</b> 460	<b>FREQ:</b> 60 HZ	<b>Max Load Inertia:</b> 125
<b>NP AMPS:</b> 25.5	<b>LR CODE:</b> G	<b>Approx Mtr Wgt:</b> 420
<b>NP RPM:</b> 1755	<b>95% PF Corr:</b> 7	<b>Rotor Inertia:</b> 1.7
<b>NP EFF:</b> 91%	<b>Sound @ 1M:</b> 65 dBA	<b>Starts/Hour:</b> 7 (NEMA WK2)
<b>NP PF:</b> 81%	<b>Ambient:</b> 40 C	<b>Stall Time:</b> 20 Sec
<b>GTD EFF:</b> 89.5%	<b>Service Factor:</b> 1.15	<b>Insulation:</b> F
<b>Thermal Protection:</b> NONE		<b>Duty:</b> CONTINUOUS

**EQUIVALENT WYE CKT. PARAMETERS (OHMS PER PHASE)**

<u>R1</u>	<u>R2</u>	<u>X1</u>	<u>X2</u>	<u>XM</u>
0.28258	0.25844	1.14736	1.704	27.122
<u>RM</u>	<u>ZREF</u>	<u>XR</u>	<u>TD</u>	<u>TD0</u>
85.2	14.2	5	0.016	0.295

	AMPS	KW	RPM	TQ(ft-lb)	EFF(%)	PF(%)	R/R(C)
No LD	10	.5	1800	0	0	6	0
1/2 LD	15	8.2	1780	29.5	91	68.5	0
3/4 LD	20	12.2	1770	44.5	91.7	78	0
1.0 LD	26	16.5	1755	60	91	81	65
1.15 LD	29	19	1745	69.5	90.2	81.5	85

	MTR AMPS	NEMA AMPS	MTR TQ	NEMA TQ	PF (%)
L.R.	145	145	163 %	150 %	36
B.D.	90		245 %	200 %	64



**Mechanical Information**

**Shaft Material:** STANDARD

**Enclosure:** TEFC

**Frame:** 256T

**Frame Material:** CAST IRON

**Shaft:** T

**Grease:** STANDARD

**Hazardous Location:** NONE

**Mounting:** RIGID

**Electrical Type:** STANDARD

**Spaceheaters:** NONE

**Orientation:** HORIZONTAL

**Conduit Assembly:** F1

**Bearings DE:** 309

**Bearings ODE:** 208

FORM 4118 8-20-2002

Date Printed: 9/14/2004

*The Above is Typical, Sinewave Power Data Unless Stated Otherwise.*





**D33  
D33H**

# Chamber-Absorption Silencers

## Application

Blower Discharge Silencer for maximum silencing at blower speeds above transition speed.

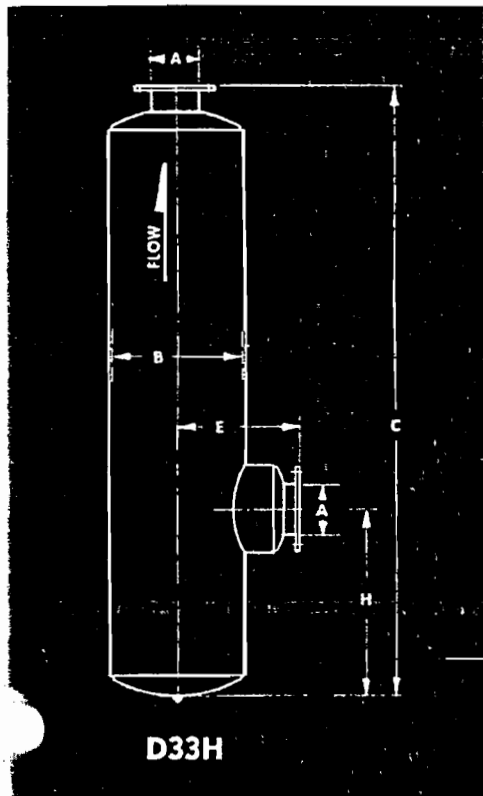
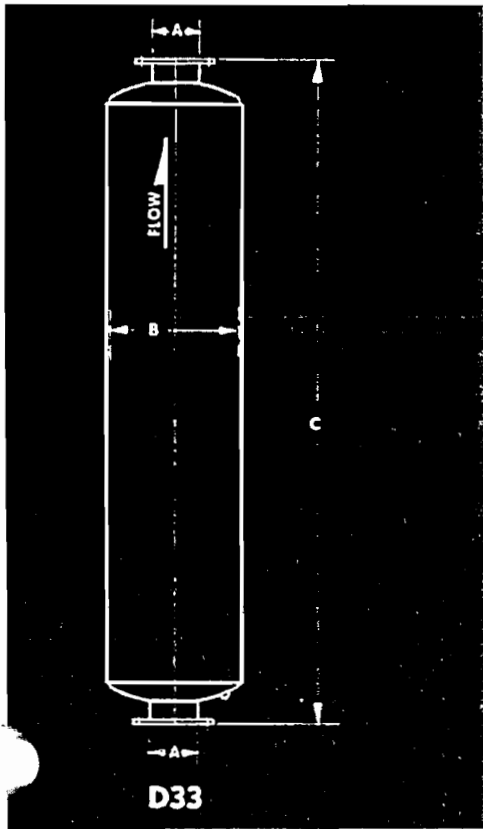
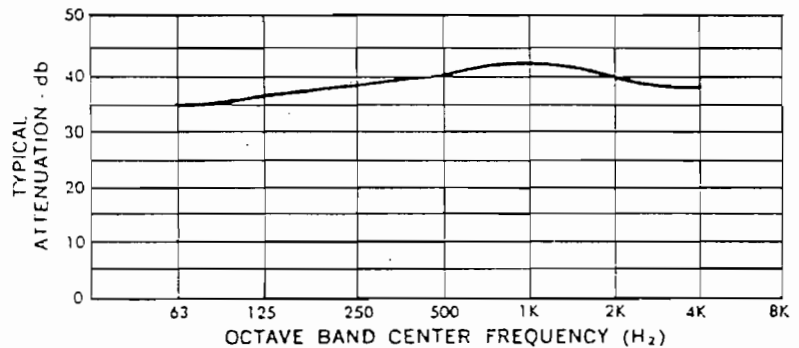
## Design

A multi-chamber silencer containing a high frequency absorption device in addition to a special arrangement of volumes and air passageways to effectively reduce both pulsation and excessive high frequency through the process of converting noise energy into heat. D33 and D33H may be installed horizontally or vertically. Design parameters permit nozzle orientation to suit installation requirements.

## Construction

All welded steel sheet and plate construction for long service life. Acoustic absorption material temperature limits far exceed application temperatures. Exterior surfaces are prime coated. Flanges are drilled to match 125 lb. American Standard Flanges. Inspection openings, mounting brackets, relief valve nozzles or special paint are available at extra charge.

## Typical Attenuation Curve



Model	A	B	C	Wt.
D33-2	2*	8	33	25
D33-2 1/2	2 1/2*	10	33	53
D33-3	3*	10	51	75
D33-4	4**	14	33	139
D33-5	5**	16	65	200
D33-6	6**	18	72	281
D33-8	8	22	98	715
D33-10	10	26	123	958
D33-12	12	30	136	1353
D33-14	14	36	148	1826
D33-16	16	42	182	2906
D33-18	18	48	189	4175
D33-20	20	48	201	4525
D33-22	22	54	214	5337
D33-24	24	54	232	6560

\* NPT Connections  
\*\* Available in NPT or Flange Connections

Model	A	B	C	E	H		Wt.
					Min.	Max.	
D33H-2	2*	8	30	9	6	10	30
D33H-2 1/2	2 1/2*	10	31	10	7	11	40
D33H-3	3*	10	49	12	7	11	50
D33H-4	4**	14	38	14	8	17	120
D33H-5	5	16	62	15	9	20	165
D33H-6	6	18	69	17	10	24	215
D33H-8	8	22	95	26	12	26	715
D33H-10	10	26	120	34	14	36	958
D33H-12	12	30	133	40	16	40	1353
D33H-14	14	36	165	48	17	40	1826
D33H-16	16	42	179	54	19	44	2906
D33H-18	18	48	186	60	21	46	4175
D33H-20	20	48	198	66	22	47	4525
D33H-22	22	54	211	72	24	48	5337
D33H-24	24	54	229	72	26	54	6560





**SOLBERG**

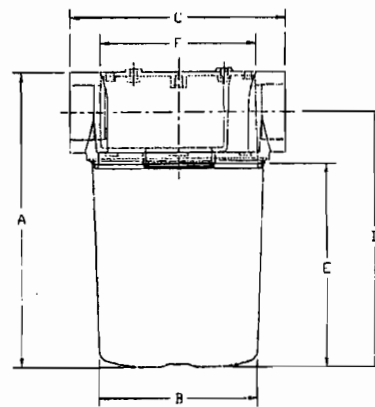
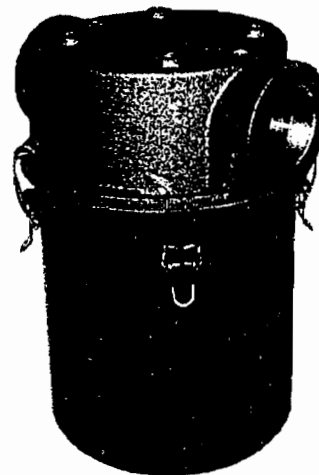
# CT Series Compact T Style Vacuum Filters 2" and 2 1/2"



- Compact Design
- Multi-Stage Filtration
- Quick Change Out
- Vacuum Tested

## BENEFITS

- **Compact** design for space restrictions; **Minimal** service area needed
- **Integrated Inlet Baffle**
- Inlet is above the element to **Extend** element life and maintenance intervals
- "T" style design **Minimizes** piping requirements
- "Drop-Down" housing for easy servicing and containment of particles
- Cast aluminum head **Resists** corrosion
- Pressure differential ports standard for monitoring
- Casting has 4 unthreaded tap holes for mounting bracket
- Versatile: Contact SMI for pressure applications
- **Vacuum level:** Typically  $1 \times 10^{-3}$  mmHg ( $1.3 \times 10^{-3}$  mbar)

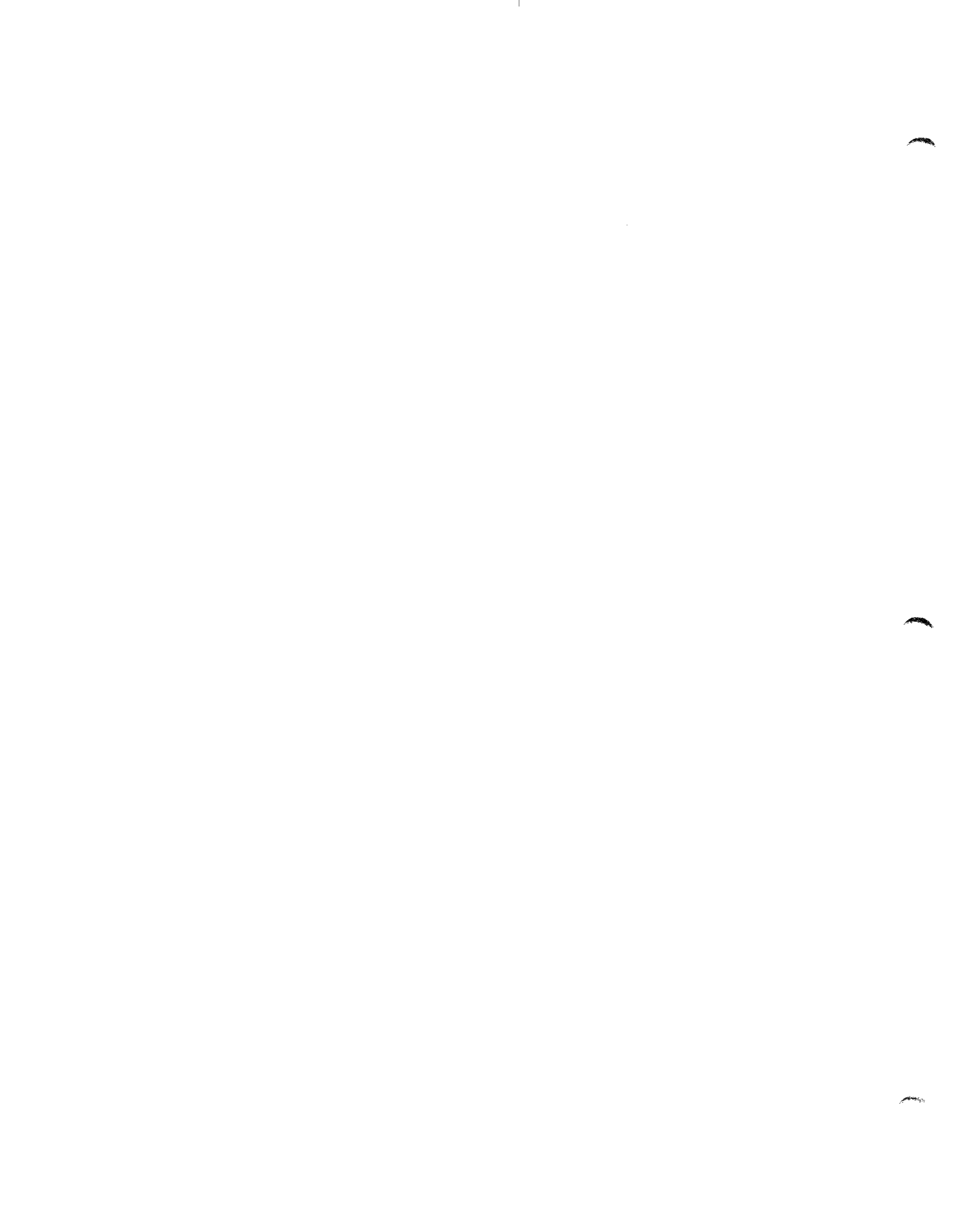


Dimension tolerance  $\pm 1/8"$

## OPTIONS (Inquires Encouraged)

- Various media alternatives
- See Through Bottom for Visual Inspection (Now available for 3" & 4" sized CT, contact Solberg for info on 2" & 2 1/2" sizes)

with Polyester Element	with Paper Element	FPT Inlet & Outlet	DIMENSIONS - inches						Rated Flow SCFM		Approx. Wt. lbs
			A	B	C	D	E	F	Nominal Rating	Element Rating	
CT-851-200C	CT-850-200C	2"	13	7 5/8	9	10 7/8	9	5 5/8	175	290	16
<del>CT-851-200C</del>	<del>CT-850-200C</del>	<del>2 1/2"</del>	<del>13</del>	<del>7 5/8</del>	<del>9</del>	<del>10 7/8</del>	<del>9</del>	<del>5 5/8</del>	<del>210</del>	<del>230</del>	<del>18</del>
CT-235P-300C	<del>CT-234P-300C</del>	3"	18 13/16	9 7/8	13 1/2	16 13/16	13 1/8	14	300	570	30
<del>CT-235P-300C</del>	<del>CT-234P-300C</del>	<del>3"</del>	<del>18 13/16</del>	<del>9 7/8</del>	<del>13 1/2</del>	<del>16 13/16</del>	<del>13 1/8</del>	<del>14</del>	<del>300</del>	<del>570</del>	<del>30</del>





# SMALL COMPACT FILTER SILENCERS WITH STANDARD FILTER DESIGN

"FS" Series 1/2" - 3" MPT

## APPLICATIONS

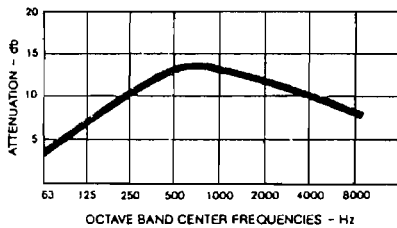
- Industrial & Severe Duty
- Piston Compressors
- Screw Compressors
- Blowers - Side Channel & PD Type
- Hydraulic Breathers - fine filtration
- Engines
- Construction/Contractor Industry
- Workshop
- Medical/Dental Industry
- Pneumatic Conveying
- Waste Water Aeration
- Sparging

## FEATURES & SPECIFICATIONS

- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron
- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tube is positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with baked enamel finish and powder coated weatherhood
- Interchangeable elements: Polyester, Paper
- Low pressure drop center bracket and outlet pipe design
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 10"-15" H<sub>2</sub>O Over Initial Delta P
- Pressure drop graphs available upon request

FILTER SILENCERS  
FS, MBFS, QB, 2G, SLCR Series

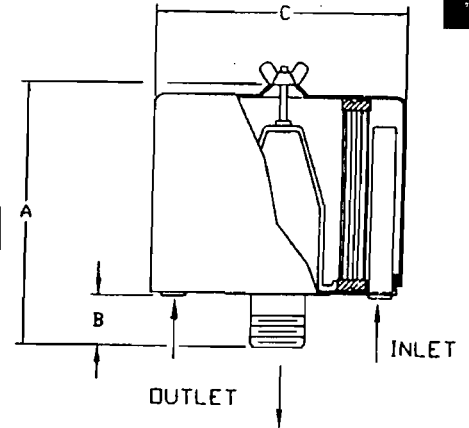
TYPICAL NOISE ATTENUATION - FS SERIES



Noise attenuation may vary due to the wide range of applications and machines

## OPTIONS (Inquiries Encouraged)

- Various media available
- 1/8" & 1/4" tap holes
- Pressure Drop Indicator
- Available in **Stainless Steel**
- Epoxy coated housings
- Hot dipped galvanized housings
- Special connections, NPT

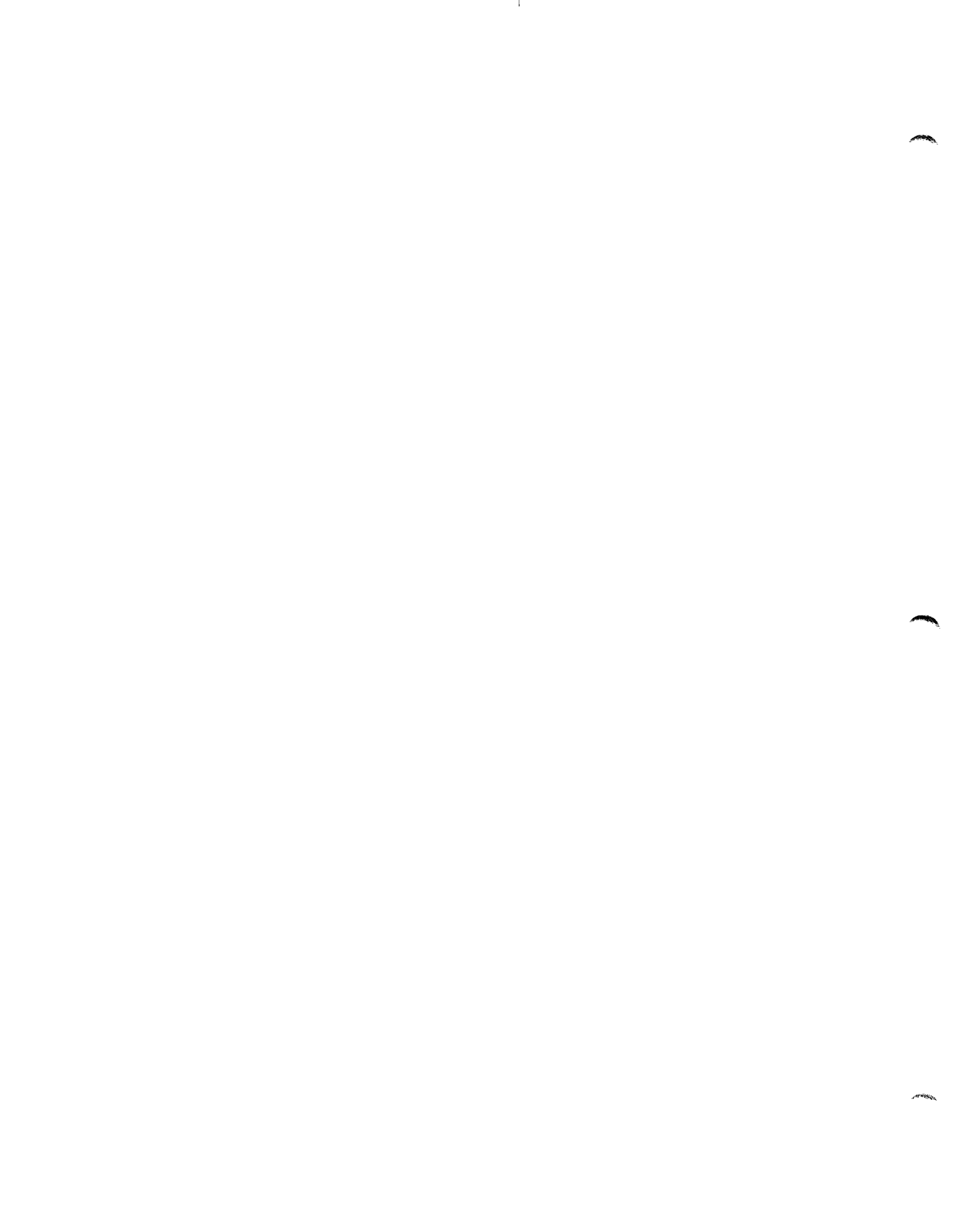


Dimension tolerance  $\pm 1/8"$

**I = Industrial Duty S = Severe Duty**

	with Polyester Element	with Paper Element	MPT Outlet	DIMENSIONS - inches			Rated Flow SCFM			No. of Tubes	Approx. Wt. lbs
				A	B	C	Piston	Blower, Fan	Element Rating		
I	FS-15-050	FS-14-050	1/2"	4	1 1/2	6	10	10	35	1	2
I	FS-15-075	FS-14-075	3/4"	4	1 1/2	6	20	25	35	2	2
I	FS-15-100	FS-14-100	1"	4	1 1/2	6	25	35	35	3	2
S	FS-19P-100	FS-18P-100	1"	6 5/8	1 5/8	6	35	55	100	3	3
I	FS-19P-125	FS-18P-125	1 1/4"	6 5/8	1 5/8	6	55	70	100	5	3
I	FS-19P-150	FS-18P-150	1 1/2"	6 5/8	1 5/8	6	70	85	100	5	4
I	FS-31P-200	FS-30P-200	2"	7 1/4	2 1/4	10	85	135	195	5	8
S	FS-231P-200	FS-230P-200	2"	12 1/4	2 1/4	10	135	135	300	7	14
I	FS-31P-250	FS-30P-250	2 1/2"	7 1/4	2 1/2	10	100	195	195	5	8
I	FS-231P-250	FS-230P-250	2 1/2"	12 1/4	2 1/2	10	100	195	195	5	8
I	FS-231P-300	FS-230P-300	3"	13	3	10	200	300	300	9	15

Solberg - Where the Best is in Store for You!



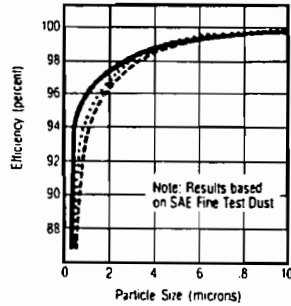


# REPLACEMENT ELEMENTS

## POLYESTER ELEMENTS

Particle Size vs. Filter Efficiency on polyester media at indicated face velocity:

15 cfm/ft<sup>2</sup> media —————  
 30 cfm/ft<sup>2</sup> media .....  
 45 cfm/ft<sup>2</sup> media - - - - -



- 99+% removal efficiency to 5 micron
- Reinforced with epoxy coated steel wire on both sides of cloth
- Washable - lukewarm water & mild detergent
- Dust loading capacity is increased 40 - 50% with polyurethane prefilter
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Optimal sealing surface & design

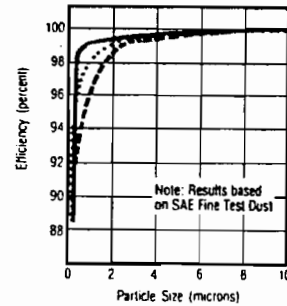
## ADVANTAGES

- Less maintenance
- More durable
- Moisture resistant
- Handles hot air and oil mist from unload cycle of reciprocating/piston compressor

## PAPER ELEMENTS

Particle Size vs. Filter Efficiency on paper media at indicated face velocity:

10 cfm/ft<sup>2</sup> media —————  
 15 cfm/ft<sup>2</sup> media .....  
 20 cfm/ft<sup>2</sup> media - - - - -



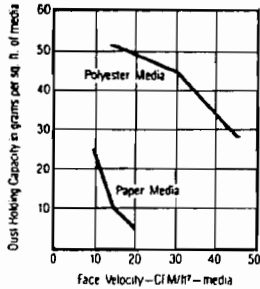
- 99+% removal efficiency to 2 micron
- Heavy duty industrial strength paper surrounded by heavy gauge galvanized expanded metal
- Dust loading capacity is increased 40 - 50% with polyurethane prefilter
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Optimal sealing surface & design

## ADVANTAGES

- Optimal surface area per given size
- Higher efficiency than many alternative media
- Cost Effective

**FILTER SILENCERS**  
FS, MBFS, QB, 2G, SLCR Series

Face Velocity vs. Dust Holding Capacity



### Legend

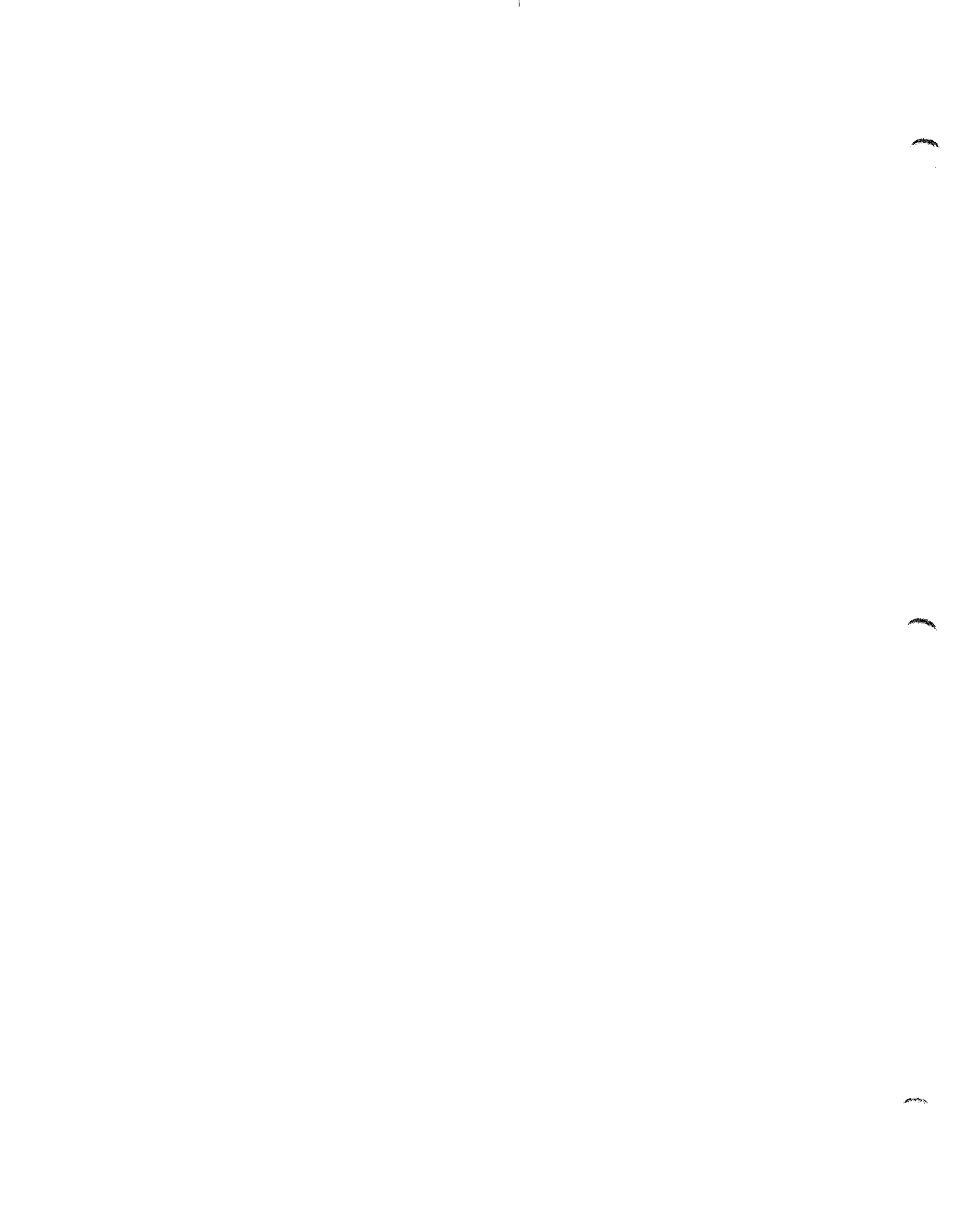
- B= Closed one end w/ Bolt hole, open on other end
- C= Closed one end, open on other end
- F= Felt gaskets on open end(s)
- G= Galvanized metal endcaps
- I= Injection molded santoprene
- M= Molded plastisol
- N= Neoprene gaskets on open end(s)
- R= Mixed Rubber/cork gasket on open ends
- T= Tin plated metal endcaps

Polyester	Paper	STD Endcap Features	DIMENSIONS - inches			Polyester Surface Area ft <sup>2</sup>	Paper Surface Area ft <sup>2</sup>	Rated Flow SCFM
			ID	OD	HT			
05	04	I	---	2 1/4	1	0.2	0.2	8
07	06	I	---	3	1 3/8	0.58	0.58	12
11	10	I	---	4	1 3/8	1.1	1.1	35
15	14	M	3	4 3/8	2 5/16	0.50	1.12	35
19P®	18P	M	3	4 3/8	4 3/4	1.5	3.0	100
<b>231P</b>	<b>230P</b>	<b>M</b>	<b>3 5/8</b>	<b>5 3/4</b>	<b>9 1/2</b>	<b>4.5</b>	<b>11.5</b>	<b>300</b>
843	842	T	2 3/8	3 7/8	2 3/4	0.60	1.7	55
849	848	T	2 9/16	5	4 7/8	2.0	5.0	115
851	850	TR	3 1/2	5 7/8	8 3/4	4.5	14.0	290
879	878	TB	2 9/16	5	4 7/8	2.0	5.0	115
239	238	GBN	4 7/8	9 1/4	10	11.5	52	570
35P	34P	M	4 3/4	7 7/8	4 13/16	4.0	11	275
235P	234P	M	4 3/4	7 7/8	9 5/8	8.3	22.8	570
335P	334P	M	4 3/4	7 7/8	14 1/2	12	34	800
245P	244P	GN   M	6	9 3/4	9 5/8	14	35.5	880
345P	344P	GN	6	9 3/4	14 1/2	22.1	57	1100
275P	274P	GN	8	11 3/4	9 5/8	19	45.4	1100
375P	374P	GN	8	11 3/4	14 1/2	28	68.1	1500
377P	376P	GN	9	14 5/8	14 1/2	50	125	1825
385P	384P	GN	14	19 5/8	14 1/2	50	140	3300
485P	484P	GN	14	19 5/8	21 1/2	75	200	4705
685P	---	GN	14	19 5/8	28 1/2	100	---	6600

P= Polyurethane Prefilter

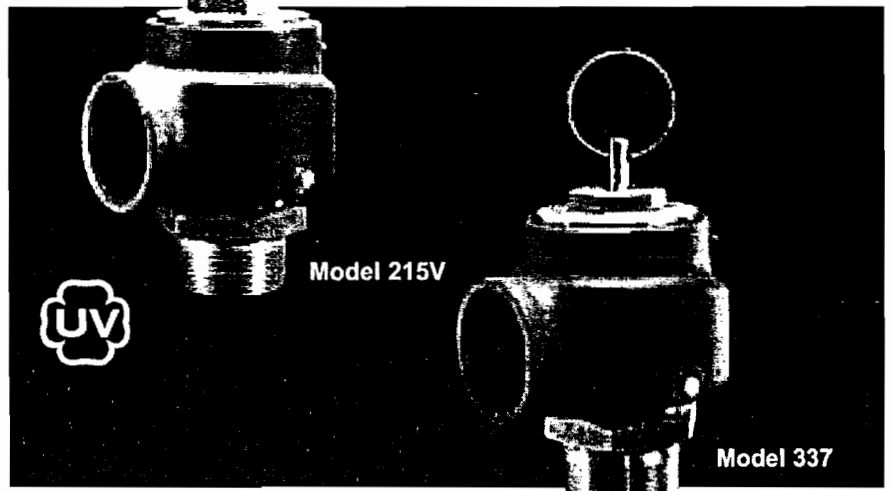
Dimension tolerance ± 1/8"

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**Models 215V, 337** Model 337 is ASME Section VIII,  
Air/Gas vacuum, 'UV' National Board Certified, Safety Valves



#### Pressure and Temperature Limits

##### Model 337:

1 to 60 psig [0.07 to 4.1 barg]  
-20° to 406°F [-29° to 208°C]

#### Vacuum Limits

##### Model 215V:

2-inch HG  
to 29-inch HG  
[67.7 to 982 mbarg]  
-20° to 400°F [-29° to 205°C]

#### Applications

- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.

#### Features and Benefits

- **Large nozzle design** provides high capacity.
- **Flat bronze valve seats are lapped** for optimum performance.
- **Warn ring offers easy adjustability** for precise opening with minimum pre-open or simmer and exact blowdown control.
- **Pivot between disc and spring** corrects misalignment and compensates for spring side thrust.

#### Model Descriptions

- **Model 337 has 'pull-ring' lift device** for easy manual testing.
- **Every valve is 100% tested/inspected** for pressure setting, blowdown and leakage.
- **All adjustments are factory sealed** to prevent tampering or disassembly.

#### Option

- SS trim. (nozzle and disc) (Variation 03)



**Models 215V, ~~997~~**

**Model Number/Order Guide**

Model Number Position

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----

Example

2	1	5	V	-	H	0	1	A	Q	E	0	0	1	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---



**Model**  
215V  
~~997~~



**Inlet Size**  
H - 2-inch [50.8 mm]  
~~2 1/2 inch [63.5 mm]~~  
K - 3-inch [76.2 mm]



**Variation (01 through 99)**  
01 - Bronze Disc and Nozzle  
~~00 - 304 Stainless Steel~~  
60 - BSP Connections

**Design Revision**  
Indicates non-interchangeable revision. Current Design is at Revision 'A'



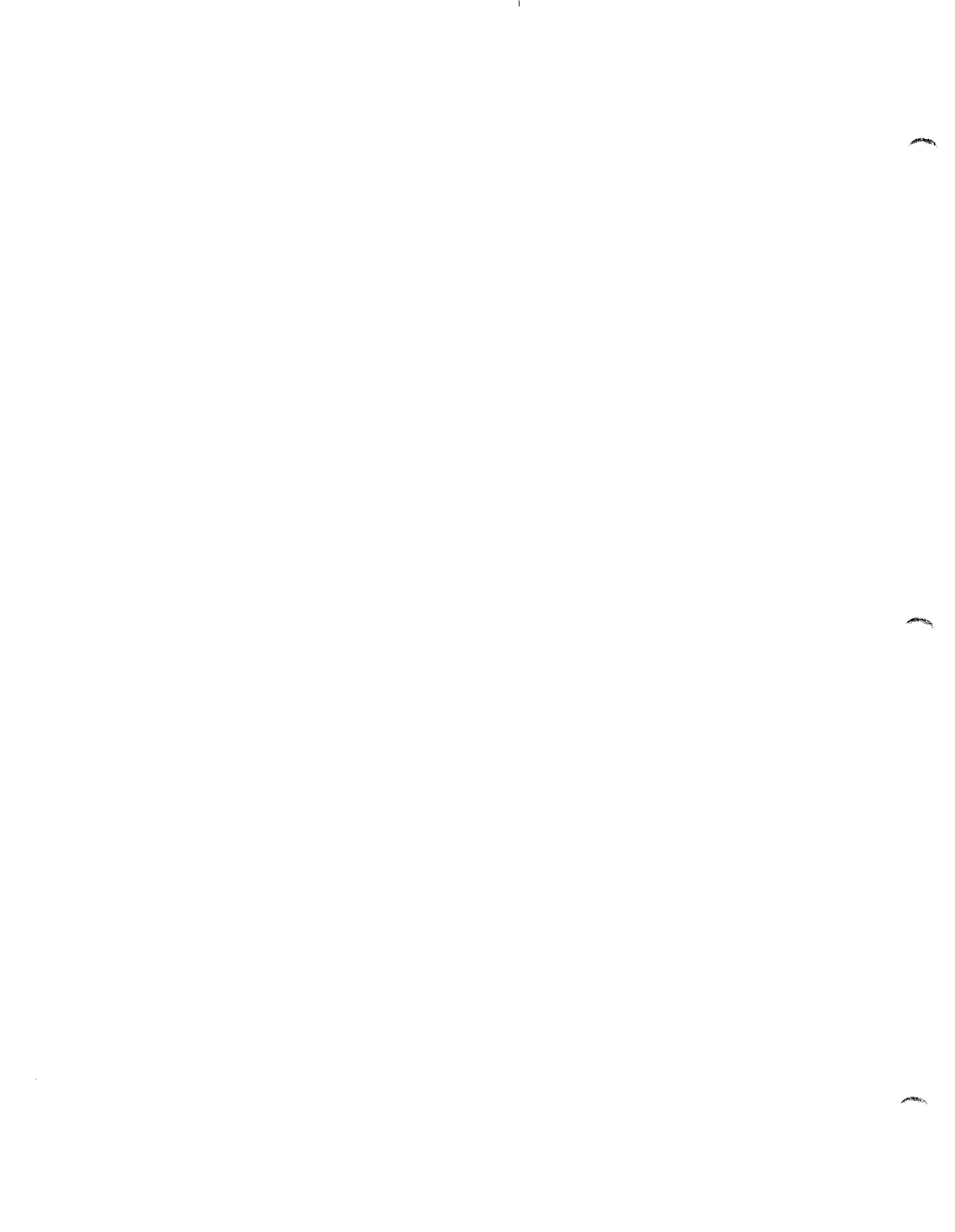
**Valve Service**  
~~1 - Air/Nitrogen Section (Model 997 only)~~  
Q - Vacuum (Model 215V only)  
~~2 - Non-Vacuum (Model 997 only)~~



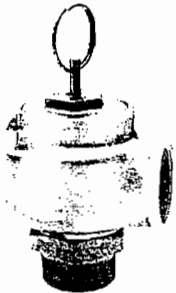
**Spring Material**  
E - SS



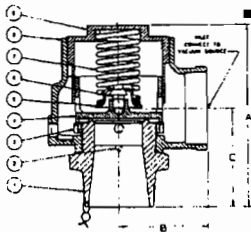
**Set Pressure**  
~~Model 215V, 2-inch HG [68 mbarg] (0001) through 22-inch HG [743 mbarg] (0007)~~  
Model 215V, 2-inch HG [68 mbarg] (0002) through 22-inch HG [743 mbarg] (0022) vacuum



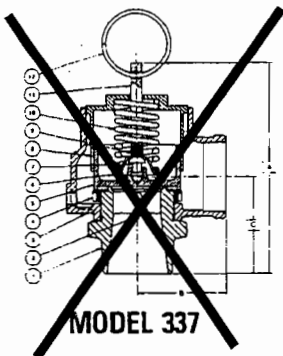
**MODELS  
215V  
337**



**MODEL 337**



**MODEL 215V**



**MODEL 337**

1281 Old U.S. 70  
Black Mountain, NC 28711  
704-669-3700  
FAX 704-669-3737

**KEYSTONE**  
ANDERSON, GREENWOOD

**PRESSURE LIMITS** 337 — 60 PSIG (0002) — 300 PSI

**VACUUM LIMITS** 215V — 22" HG. -300°F.

**APPLICATIONS**

- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.

**FEATURES**

High capacity full nozzle design. Bronze nozzle, disc and guide with cast iron housing. Flat bronze valve seats are lapped for optimum performance. Warn ring offers easy adjustability for precise opening with minimum preopen or simmer and exact blowdown control. Pivot between disc and spring corrects mis-alignment and compensates for spring side thrust. Model 337 has "pull-ring" lift device for easy manual testing. Every valve 100% tested/inspected for pressure setting, blowdown and leakage. All adjustments are factory sealed to prevent tampering or dis-assembly.

**OPTIONS**

Stainless steel trim (nozzle and disc).

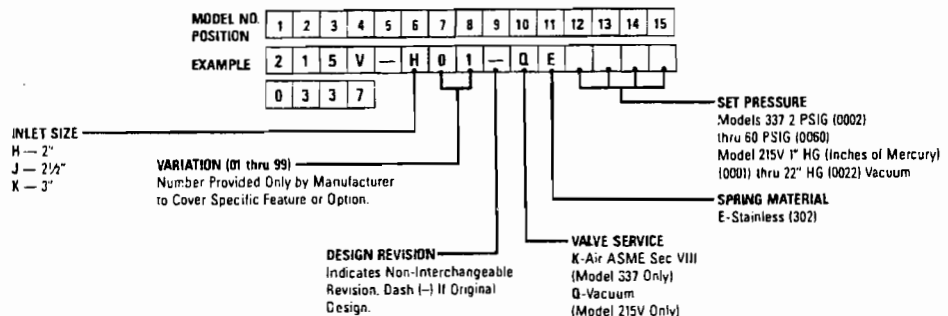
**SPECIFICATIONS**

SIZE IN & OUT	A		B	C	WGHT LBS.
	37	215V			
2"	7	6½	3	3¼	8
2½"	7	7½	3½	3¾	11
3"	8	8½	4	4¼	20

**CAPACITIES** SCFM Air, 60°F., 10% Accumulation

Set Pressure PSIG	MODEL 337			Set Inches Mercury	MODEL 215V		
	2"	2½"	3"		2"	2½"	3"
5	527	799	1157	1	140	213	318
10	743	1127	1632	2	217	319	477
15	959	1488	1982	3	264	400	599
20	1062	1609	2331	4	299	443	677
25	1221	1850	2680	5	331	511	776
30	1360	2091	3029	6	352	593	872
35	1539	2512	3379	7	372	594	877
40	1698	2573	3728	8	391	592	888
45	1857	2814	4076	9	405	598	896
50	2017	3055	4425	10	413	615	916
60	2335	3537	5175	12.8 to 22	426	616	915

**MODEL NUMBER/ORDER GUIDE**

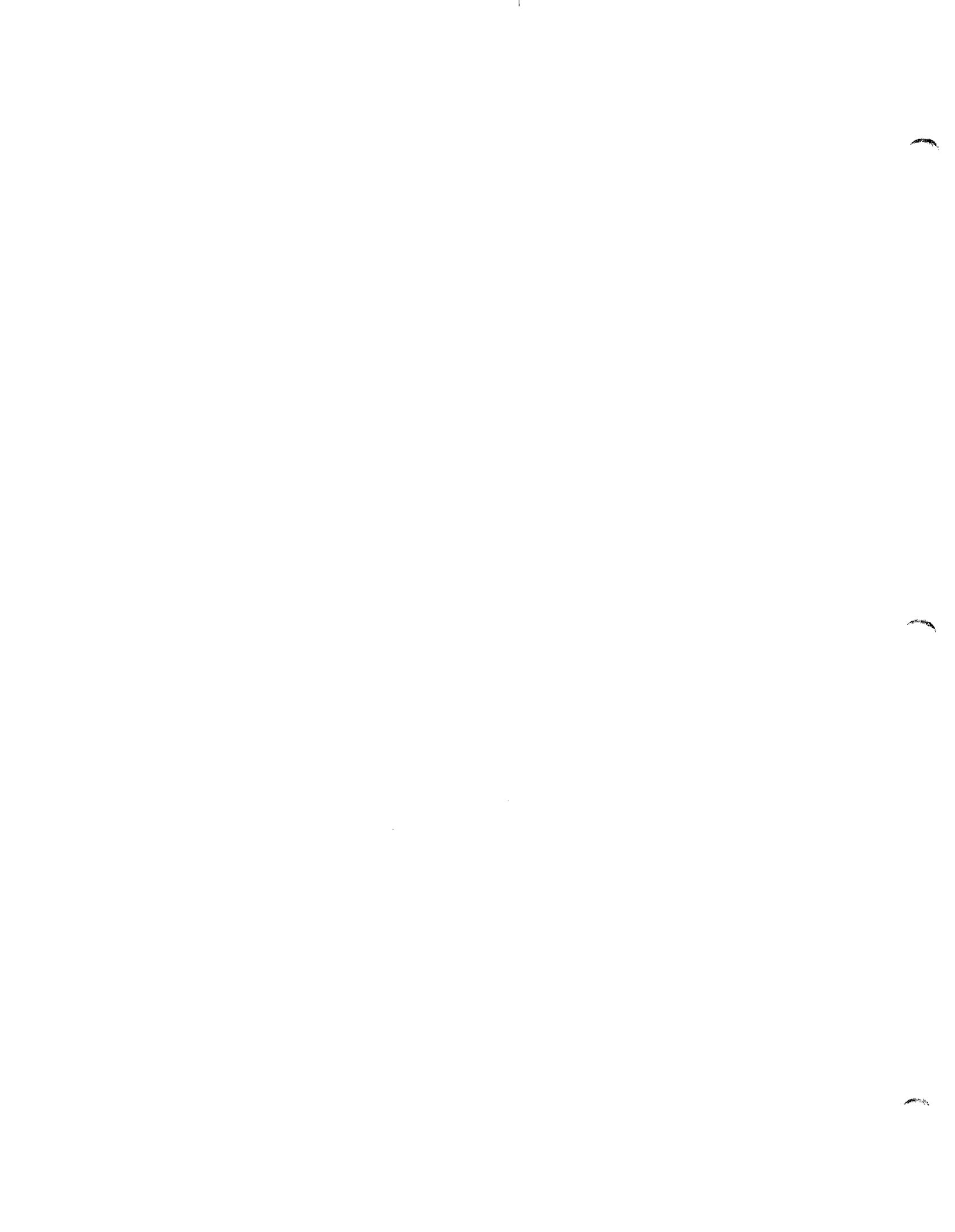


IMPORTANT: Kunkle Valve Division is not liable for any damage resulting from misuse or misapplication of its products (see warranty).

ASME Standard



N.B. Certified

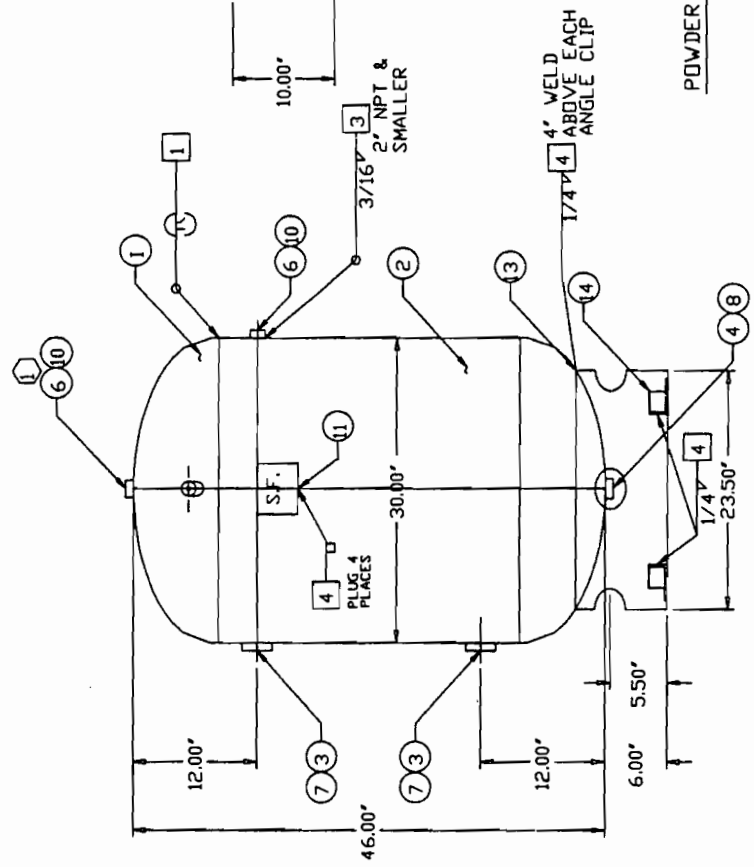
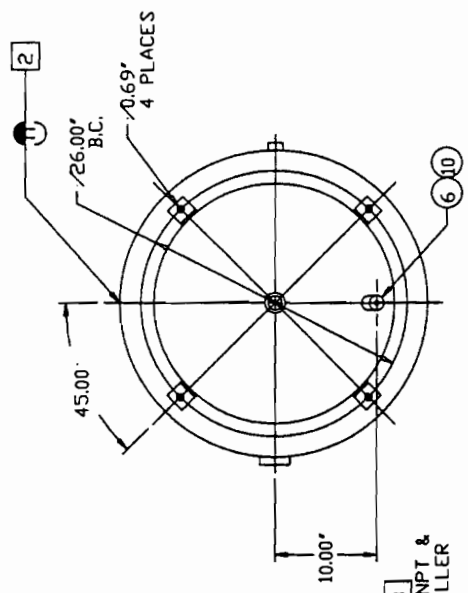




## SECTION 2

### TANKS

#2 .227 X 29-1/2' X 93-3/4'  
 #13 3/16" X 60 X 78" (7 TO 1)



POWDER PAINT H.H. GREY PRIMER

ATTACHMENT WPS  
 3/16 & BELOW A569 SFI-6  
 5/16 & ABOVE A36 SFI-2-1  
 STRUCTURAL A36 SFI-2-1  
 1/4 A635 SFI-3

30' X 46' VERTICAL - AIR RECEIVER - 120 GALLONS

NO.	DATE	REVISION	ENG	OCM
1	11/20/02	1/4" NPT WAS 1" NPT		

HEAD THK: 186 MIN. C.A. NONE MAT'L SA414-G EFF B5Z  
 SHELL THK: .227 NOM. C.A. NONE MAT'L SA455 EFF 70Z  
 NAT'L BD. YES  
 MAWP 200 PSI AT 400 ° F  
 MDMT -20 ° F AT 200 PSI  
 STAMP: 'U' STAMP  
 CRN: C6406.IC  
 REF: AIR ENERGY

ITEM	P/N	DESCRIPTION	QTY
1	H30186J	30" DD 2 1/2 SE JOGGLE HEAD 2	
2	R100015	227 ROLLED SHELL	1
3	F102002	2" RAD. O-RING NPT	2
4	F101000	1" SERIES 385 NPT	1
5			
6	F100250	1/4" SERIES 381 NPT	3
7	F502000	2" PLASTIC PLUG	2
8	F501000	1" PLASTIC PLUG	1
9			
10	F500250	1/4" PLASTIC PLUG	3
11	S100001	NAME PLATE	1
13	S100164	3/16" BASE RING	1
14	R400001	1/4" X 2" X 2' LG	4

DESIGN & CALCULATIONS COMPLY WITH  
 ASME CODE SECTION VIII, DIV. 1.  
 20..... EDITION  
 ..... ADDENDA

WPS  
 1 SFI-1 SK 1  
 2 SFI-1 SK 2  
 3 SFI-2-1  
 4 SEE ATTACHMENT

NDE  
 A MAGNETIC PARTICLE  
 B SPOT X-RAY PER UW52  
 C FULL X-RAY PER UW51  
 D SEAL WELDING REQUIRED

ENG APPL./DATE  
 GCM APPL./DATE

AIR ENERGY W/ NO TOP PLATE AND 1" NPT DRAIN)

STEEL FAB  
 OAKVILLE, ONT. ABINGDON, VA  
 DRAWN BY: LPS  
 DATE: 7/18/02  
 P/N: A12276

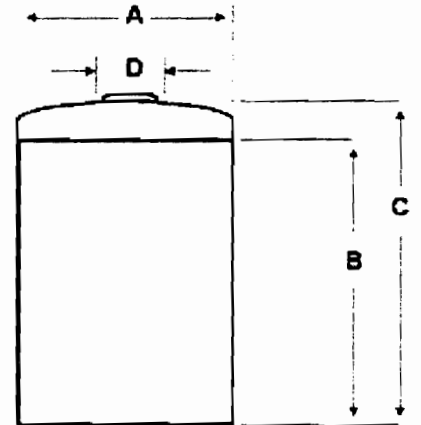




**Cylindrical Closed-Top Flat Bottom Tanks [CXF] \*\***

Stock Number	Capacity		Dimensions (inches)			
	US Gal.	Liters	A	B	C	D
<u><a href="#">.F00050A*</a></u>	50	185	23	N/A	30	8
<u><a href="#">CXF00060A*</a></u>	60	225	23	N/A	39	6
<u><a href="#">CXF00075A*</a></u>	75	285	23	N/A	48	6
<u><a href="#">CXF00110A*</a></u>	110	415	31	35	41	8
<u><a href="#">CXF00150A*</a></u>	150	570	31	36	59	6
<u><a href="#">CXF00200A*</a></u>	200	755	40	42	48	6
<u><a href="#">CXF00220A*</a></u>	220	820	43	39	43	8
<u><a href="#">CXF00240A*</a></u>	240	905	48	34	45	6
<u><a href="#">CXF00300A*</a></u>	300	1135	43	56	59	12
<u><a href="#">CXF00300B</a></u>	300	1135	35	73	80	16
<u><a href="#">CXF00300C*</a></u>	300	1135	46	41	51	10
<u><a href="#">CXF00360A*</a></u>	360	1360	57	34	46	6
<u><a href="#">CXF00375A</a></u>	375	1415	45	56	62	18
<u><a href="#">CXF00500D</a></u>	500	1890	46	74	81	16
<u><a href="#">CXF00525A</a></u>	525	1985	56	41	52	16
<u><a href="#">CXF00550B</a></u>	550	2080	48	69	76	18
<u><a href="#">CXF00550C</a></u>	550	2080	64	36	48	18
<u><a href="#">CXF00600A*</a></u>	600	2270	64	42	52	6
<u><a href="#">.F00600B*</a></u>	600	2270	54	62	68	12
<u><a href="#">CXF00700A</a></u>	700	2645	69	34	46	16
<u><a href="#">CXF00750A</a></u>	750	2835	46	107	118	16
<u><a href="#">CXF00850A</a></u>	850	3215	56	74	82	16
<u><a href="#">CXF00850B</a></u>	850	3215	48	106	117	18
<u><a href="#">CXF01100B</a></u>	1100	4160	86	36	53	18
<u><a href="#">CXF01100A</a></u>	1100	4160	64	78	90	18
<u><a href="#">CXF01200B</a></u>	1200	4540	77	57	66	16
<u><a href="#">CXF01500B</a></u>	1500	5675	86	52	72	18
<u><a href="#">CXF01500C</a></u>	1500	5675	64	112	124	18
<u><a href="#">CXF01550A</a></u>	1550	5867	76	73	86	16
<u><a href="#">CXF01650A*</a></u>	1650	6245	72	92	103	12
<u><a href="#">CXF02000A</a></u>	2000	7570	90	72	87	18
<u><a href="#">CXF02000B</a></u>	2000	7570	86	78	100	16
<u><a href="#">CXF02050A</a></u>	2050	7755	64	152	165	16
<u><a href="#">CXF02200A</a></u>	2200	8325	77	102	114	16
<u><a href="#">CXF02500B</a></u>	2500	9460	90	91	107	18
<u><a href="#">CXF02800A</a></u>	2800	10595	95	83	98	16
<u><a href="#">.F03000A</a></u>	3000	11355	90	111	127	18
<u><a href="#">CXF03200A</a></u>	3200	12110	95	99	114	16

Click on the stock number for a dimensional drawing.



### Cylindrical Closed-Top Flat Bottom Tanks [CXF]

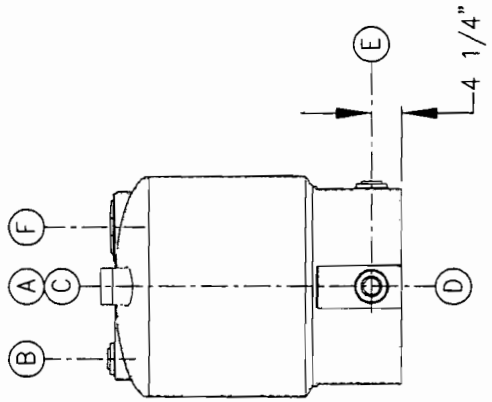
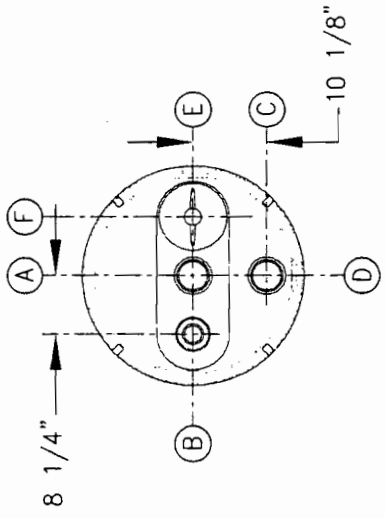
Available in 21 standard sizes, these durable, one-piece molded flat bottom tanks are ideal for indoor or outdoor process or bulk storage. Manufactured of linear polyethylene, they offer greater low temperature impact resistance than fiberglass and are more economical than stainless steel. They are highly chemical resistant and FDA approved.

Translucent walls with molded calibration scales

UV stabilized for sunlight protection

Domed heads with manway / filler openings for easy access

MARK	SIZE	TYPE	DESCRIPTION	SERVICE
A	4"	fNPT	FULL COUPLING, F x F THREADED, WELDED	INFLUENT PORT
B	2"	fNPT	THREADED BULKHEAD FITTING	LEVEL SENSOR PORT
C	4"	fNPT	HALF COUPLING, THREADED WELDED	VENT PORT
D	2"	fNPT	THREADED BULKHEAD FITTING	EFFLUENT PUMP PORT
E	2"	fNPT	THREADED BULKHEAD FITTING	DRAIN
F	8"	THREADED	PROVIDED ACCESS OPENING	ACCESS OPENING



NOTES:  
 1) TANK SHOWN IS BASED ON A MODEL CFX00110A  
 AS MANUFACTURED BY TERRACON TANK.

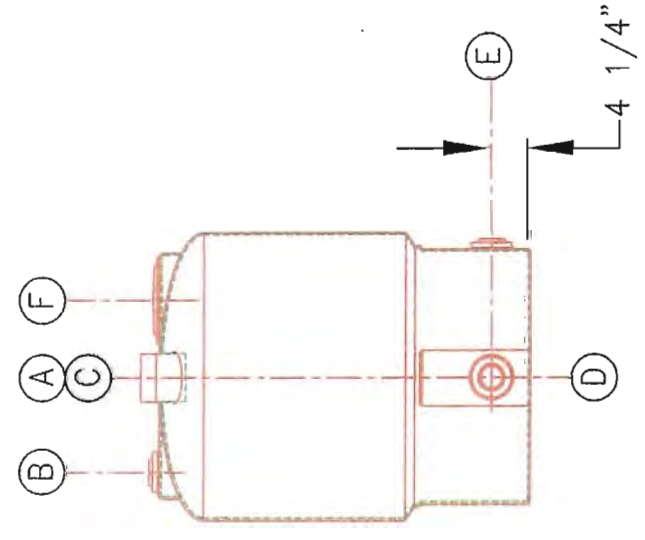
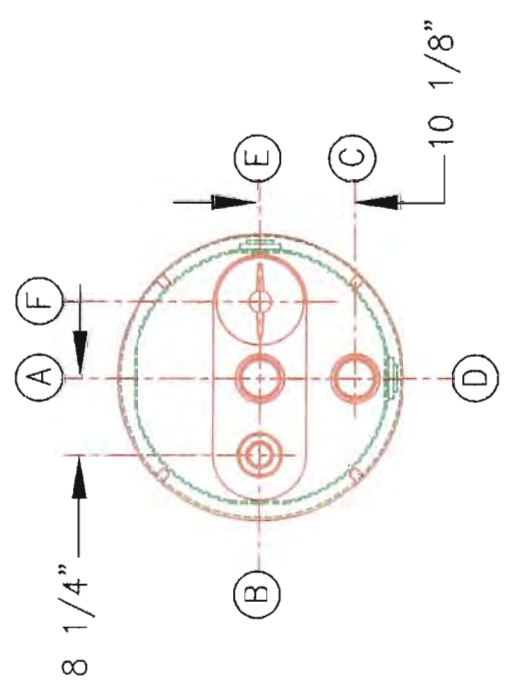
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**BISCO Environmental**  
 Soil & Groundwater Remediation Equipment  
 Randolph, Massachusetts 02368

TITLE	INFLUENT EQUALIZATION TANK
FITTING LOCATION	
NY'S DORMITORY AUTHORITY GOWANDA DAY HAB CENTER	JOB NO. 11757
SCALE 1"=20"	DWG NO. 11757TML-03
SIZE B	SHEET 1 OF 1
REV	REV

REV.	DESCRIPTION	DATE	APPR.
	REVISIONS		

MARK	SIZE	TYPE	DESCRIPTION	SERVICE
A	4"	FNPT	FULL COUPLING, F x F THREADED, WELDED	INFLUENT PORT
B	2"	FNPT	THREADED BULKHEAD FITTING	LEVEL SENSOR PORT
C	4"	FNPT	HALF COUPLING, THREADED WELDED	VENT PORT
D	2"	FNPT	THREADED BULKHEAD FITTING	EFFLUENT PUMP PORT
E	2"	FNPT	THREADED BULKHEAD FITTING	DRAIN
F	8"	THREADED	PROVIDED ACCESS OPENING	ACCESS OPENING



NOTES:  
 1) TANK SHOWN IS BASED ON A MODEL CFX00110A  
 AS MANUFACTURED BY TERRACON TANK.

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DRWN BY	TJM	DATE	9/15/04
CHK BY		DATE	
APPR BY		DATE	
TITLE INFLUENT EQUALIZATION TANK			
FITTING LOCATION			
NYS DORMITORY AUTHORITY		JOB NO. 11757	
GOWANDA DAY HAB CENTER			
SCALE	SIZE	DWG NO.	SHEET
1"=20"	B	11757TML-03	1 OF 1
			REV

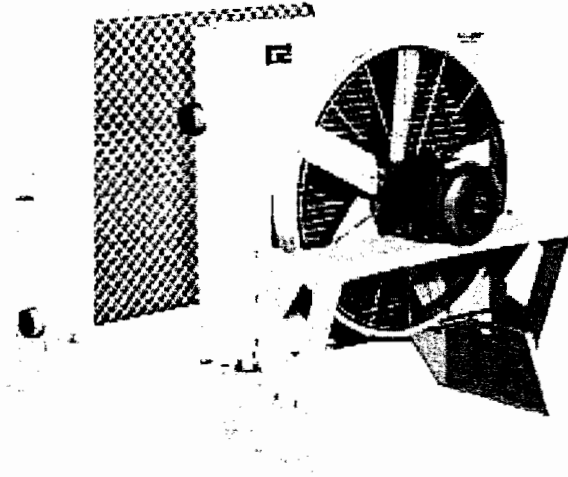
REV.	DESCRIPTION	DATE	APPR.
	REVISIONS		



## SECTION 3

# HEAT EXCHANGER

ACA - 6301 through ACA 6602



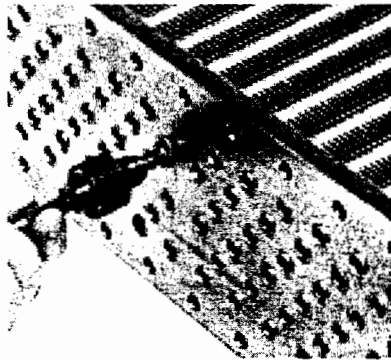
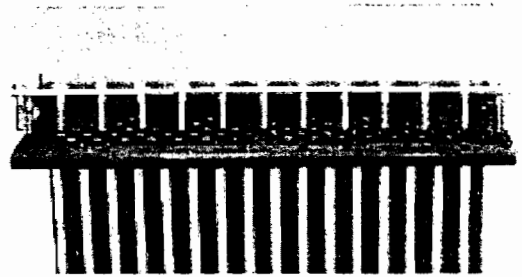
*Serviceable Core® Construction*

Air coolers are an essential part of any compressed air system, by cooling the air, and condensing water vapor into a liquid state for removal. When air is compressed, the compression induces heat into both the air and the water entrained in the air.

The American Industrial ACA series heat exchanger cools air with air, making it a simple inexpensive way to cool when compared to other water-cooled or refrigerant cooled systems. The unique compact *serviceable core*<sup>®</sup> design provides efficient cooling and low maintenance under the warmest environmental conditions. By using an ACA series air-cooled after cooler, machine tools will receive cooler dryer air, provide longer trouble free life, experience less down time, and be cost effective to operate on a continuous basis.

## SERVICEABLE CORE<sup>®</sup>

Core covers disassemble for easy access and cleaning. Repairable design for applications that require limited down time or in the event of a mishap requiring repair. Roller expanded tube to tube-sheet joint. 100% mechanical bond. Positive gasket seal is field replaceable for field maintenance or repair.



## SUPERIOR COOLING FINNS

Copper tubes are mechanically bonded to highly efficient aluminum cooling fins. Die-formed fin collars provide a durable precision fit for maximum heat transfer. Custom fin design forces air to become turbulent and carry heat away more efficiently than old flat fin designs.

## CONSTRUCTION MATERIALS & RATINGS

Standard Construction Materials		Standard Unit Ratings	
Tubes	Copper	Operating Pressure	150 psig
Fins	Aluminum	Operating Temperature	400 °F
Cabinet & Pipes	Steel	Consult factory for optional materials and ratings.	
Fan Guard	Zinc Plated Steel		
Manifolds	Steel		

note: AIHTI reserves the right to make reasonable design changes without notice.

# ACA Series selection

## Compressed Air

Normally air compressors have airflow rates based on the horsepower. Rotary Screw compressors normally discharge air at 180 °f - 200 °f, prior to after-cooling. Reciprocating compressors normally discharge air at 250 °f - 275 °f, prior to after-cooling. Compressors are rated in CFM or cubic feet per minute of free air at inlet conditions. For practical purpose we will use sea level at 68 °f and 36% relative humidity as a norm. Altitude, differing ambient conditions with respect to temperature and humidity will all affect heat exchanger performance to a degree. Moisture content in air actually increases the Btu/hr load requirement for cooling air by adding an additional condensing load to the gas load requirement. As air rapidly cools, moisture in the compressed air stream will condense and separate into droplets, the more humidity present the more condensation will occur.

## Sizing

The performance curves provided are for air. However, gases other than air may be applied to this cooler with respect to compatibility by applying a correction factor. Please take time to check the operating specifications thoroughly for material compatibility, pressure, and size before applying an American Industrial heat exchanger into your system.

## Terms

**Approach Temperature** is the desired outlet temperature of the compressed gas minus the inlet ambient air temperature of the external air flowing over the coil.

**SCFM** (Standard Cubic Feet per Minute)

^ cubic foot of air at 68 °f, 14.696 psia, & 36% relative humidity, per minute.

**CFM** (Cubic Feet per Minute)

Air at inlet atmospheric conditions.

**ACFM** (Actual Cubic Feet per Minute)

Air at current pressure, temperature, & humidity conditions without reference to a standard.

## To Determine the Heat Load

If the heat load (Btu/hr) is unknown a value can be calculated based upon system operational requirements. To properly calculate the heat load (Btu/hr) to be rejected, several items must be known with certainty (see below).

- Flow rate SCFM (standard cubic feet pr minute)
- Type of gas and its makeup.
- System inlet pressure to the heat exchanger.
- Ambient temperature where the heat exchanger will be located (hottest condition).
- Temperature of the gas at the heat exchanger inlet.
- Temperature of the gas desired at heat exchanger outlet.
- Maximum acceptable pressure loss or cooled gas.

## Using The Chart

American Industrial has created a quick reference chart for selecting ACA heat exchangers for Rotary Screw compressors (see page 214) [This chart offers basic information based upon compressor horsepower and average airflow rates. To properly use the chart, select the compressor horsepower at the left or the air flow rate. Next select the approach to ambient that is desired. Where the two columns intersect is shown the proper ACA model number.]

## Using The Graphs

American Industrial provides performance graphs for ease of model selection. The following calculation examples (page 213), illustrate formulas to determine model selection sizes. It should be noted that there are some assumptions made when applying the basic principles for calculation in the formula. Altitude, humidity, materials, pressures, etc... all contribute to the final selection. Contact American Industrial for more detailed calculation.

## Selection

The selection process is important, many considerations should be made when selecting a heat exchanger. Once the proper Fs requirement is calculated, it is time to apply the data to the graph and make a selection.

- 1) Find the Flow rate in SCFM located at the bottom of the graph. Follow the graph line up until it matches the calculated Fs from your calculations. If the point falls just above one of the model graphed lines, select the next larger size. If the point is on a line select it as your choice.
- 2) Check carefully the pressure differential. Units with operating pressures from 70+ psig will have no greater than 2.0 psid within the published flow range. For lower inlet pressure see the pressure drop curves for more detail.
- 3) Calculate a Nozzle size using the nozzle size calculation to verify your selection has the proper port sizes for your required inlet pressure.

## Formula: Nozzle Calculation

$$\text{Nozzle Size} = \sqrt{\frac{(\text{SCFM} \times 4.512) \times 144}{(270,000 \times d) \times .7854}}$$

All numbers in equation are constants except for SCFM and (d) "density".

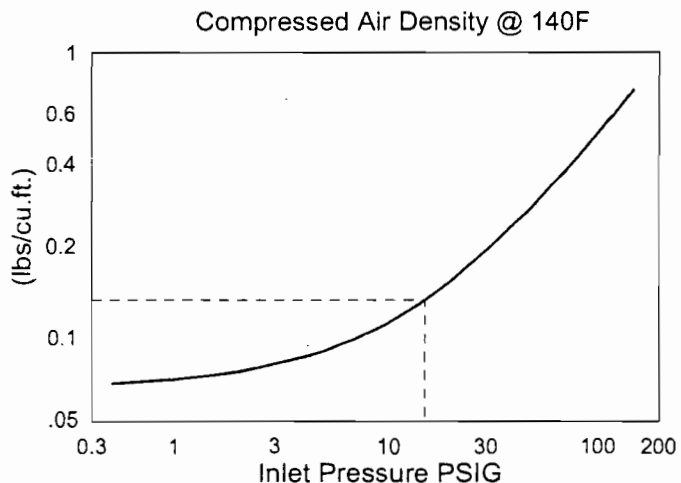
## Example:

Flow rate = 200 SCFM

Pressure = 15 psig

Density = (d) from Compressed Air Density Graph

$$\sqrt{\frac{(200 \times 4.512) \times 144}{(270,000 \times .14) \times .7854}} = 2.09" \text{ or } (2" \text{ Nozzle})$$





**Examples:** (Note: All air flow rates must be converted to SCFM)

### Application 1 Air Rotary Screw Compressor

Determine the heat load "Q" = Btu/hr

$$Q = [\text{SCFM} \times \text{CF} \times (T_1 - T_2)] \text{ or } [350 \times 1.13 \times 105^\circ] = 41,528 \text{ Btu/hr}$$

$T_1$  = Inlet gas temperature: 200°F

$T_2$  = Outlet gas temperature: Ambient + 10°F = (95°F)

$T_a$  = Ambient temperature: 85°F

Airflow rate: 350 SCFM

PSIG = Operating Pressure 100 psig

CF = Correction factor: 1.13

S = Specific gravity with air being 1.0

C = Specific heat (Btu/Lb °f): .25

Model Selection - ACA-4362

Determine the Fs =  $\frac{\text{Btu/hr}}{T_2 - T_a}$  or  $\frac{41,528}{10} = 4,153 \text{ Fs}$  Refer to graph example on page 215

$$\text{CF} = (.0753 \times S \times C \times 60) \text{ or } (.0753 \times 1.0 \times .25 \times 60) = 1.13$$

$$\sqrt{\frac{(350 \times 4.512)}{(270,000 \times .50)} \times 144} = 1.46" \text{ or } (1.5" \text{ minimum nozzle})$$

### Application 2 Methane Gas

Determine the heat load "Q" = Btu/hr

$$Q = [\text{SCFM} \times \text{CF} \times (T_1 - T_2)] \text{ or } [500 \times 1.428 \times 210^\circ] = 149,940 \text{ Btu/hr}$$

$T_1$  = Inlet gas temperature: 300°F

$T_2$  = Outlet gas temperature: 90°F

$T_a$  = Ambient temperature: 60°F

Gas flow rate: 500 SCFM

PSIG = Operating pressure: 150 psig

CF = Correction factor: 1.428

S = Specific gravity with air being 1.0: .55

C = Specific heat (Btu/Lb °f)

Model Selection - ACA-6421

Determine the Fs =  $\frac{\text{Btu/hr}}{T_2 - T_a}$  or  $\frac{149,940}{30} = 4,998 \text{ Fs}$  Refer to graph example on page 215

$$\text{CF} = (.0753 \times S \times C \times 60) \text{ or } (.0753 \times .55 \times .575 \times 60) = 1.428$$

$$\sqrt{\frac{(500 \times 4.512)}{(270,000 \times .74)} \times 144} = 1.44" \text{ or } (1.5" \text{ minimum nozzle})$$

### Application 3 Low Pressure Blower

Determine the heat load "Q" = Btu/hr

$$Q = [\text{SCFM} \times \text{CF} \times (T_1 - T_2)] \text{ or } [76 \times 1.13 \times 150^\circ] = 12,882 \text{ Btu/hr}$$

$T_1$  = Inlet gas temperature: 250°F

$T_2$  = Outlet gas temperature: 100°F

$T_a$  = Ambient temperature: 90°F

CF = Correction Factor: 1.13

PSIG = Operating pressure: 2 psig

Airflow rate: 90 ACFM

S = Specific gravity with air being 1.0

C = Specific heat (Btu/lb °f): .25

$\Delta P$  = 5" water column or less (example pg. 220)

Model Selection - ACA-3302

Determine the Fs =  $\frac{\text{Btu/hr}}{T_2 - T_a}$  or  $\frac{12,882}{10} = 1,288 \text{ Fs}$  Refer to graph example on page 215

To Convert  
ACFM to SCFM =  $\frac{\text{ACFM} \times (\text{PSIG} + 14.7) \times 528}{(T_1 + 460) \times 14.7} = \frac{90 \times 16.7 \times 528}{710 \times 14.7} = 76 \text{ SCFM}$

$$\sqrt{\frac{(76 \times 4.512)}{(270,000 \times .075)} \times 144} = 1.76" \text{ or } (2.0" \text{ minimum nozzle})$$

Pressure Drop (see page 220 for graphs)

Since gas is compressible the density of the gas changes from one temperature or pressure to the next. While the mass flow rate may not change, the pressure differential across the heat exchanger will change dramatically from high (70-125 psig) to low (1-5 psig) pressure. A low pressure condition requires larger carrying lines to move flow than does the same gas rate under a higher pressure. At lower pressures the differential pressure across the heat exchanger can be quite high compared to the same flow rate at a higher pressure. For that reason it is suggested that the pressure differential graphs on page 220 be consulted prior to making your final selection.

The ACA series heat exchanger is designed to be easily modified to accept larger port sizes in the event your system pressure requires larger nozzles. Consult our engineering department for more exacting information regarding pressure differential issues.

# ACA Series selection

## ROTARY SCREW COMPRESSORS (200°F @ 125 PSI & 36% relative humidity)

Compressor Horse Power (HP)	Average Air Discharge Cubic feet per minute (SCFM)	Model Size Selection			
		*Approach Temperature °F ( $T_2 - T_a$ )			
		5°F	10°F	15°F	20°F
15	60	ACA - 3302	ACA - 3242	ACA - 3242	ACA - 3182
20	80	ACA - 3302	ACA - 3242	ACA - 3242	ACA - 3182
30	130	ACA - 3362	ACA - 3302	ACA - 3242	ACA - 3242
40	165	ACA - 3362	ACA - 3302	ACA - 3302	ACA - 3242
60	250	ACA - 4362	ACA - 3362	ACA - 3302	ACA - 3302
75	350	ACA - 6362	ACA - 4362	ACA - 3362	ACA - 3302
100	470	ACA - 6362	ACA - 6362	ACA - 3362	ACA - 3362
125	590	ACA - 6422	ACA - 6362	ACA - 4362	ACA - 3362
150	710	ACA - 6422	ACA - 6362	ACA - 6362	ACA - 4362
200	945	ACA - 6482	ACA - 6422	ACA - 6362	ACA - 6362
250	1160	ACA - 6482	ACA - 6422	ACA - 6362	ACA - 6362
300	1450	ACA - 6542	ACA - 6482	ACA - 6422	ACA - 6362
350	1630	ACA - 6542	ACA - 6482	ACA - 6422	ACA - 6362
400	1830	ACA - 6602	ACA - 6482	ACA - 6422	ACA - 6422
500	2150	ACA - 6602	ACA - 6542	ACA - 6482	ACA - 6422

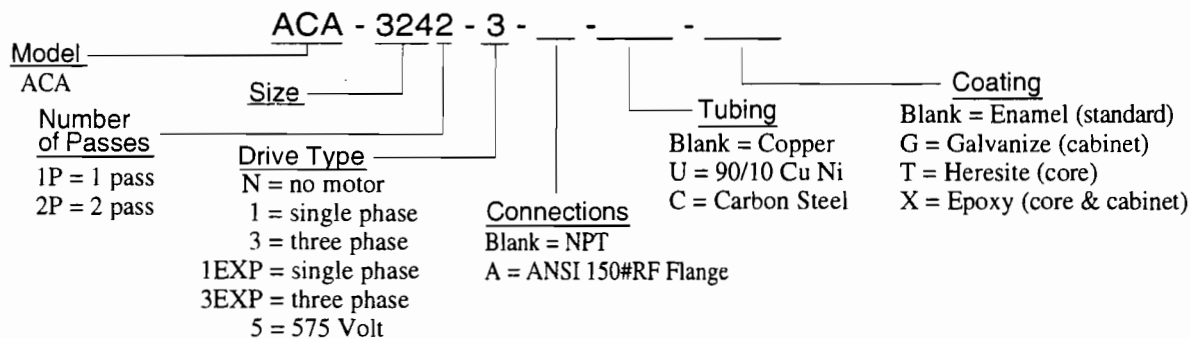
### \*Approach Temperature

the desired outlet temperature of the compressed gas minus the inlet ambient air temperature of the external air flowing over the coil.

$T_2$  - Outlet gas temperature

$T_a$  - Ambient temperature

Example of a model:



Using the performance graphs (page 215)

The Flow vs. Fs graph is calculated based upon SCFM units.

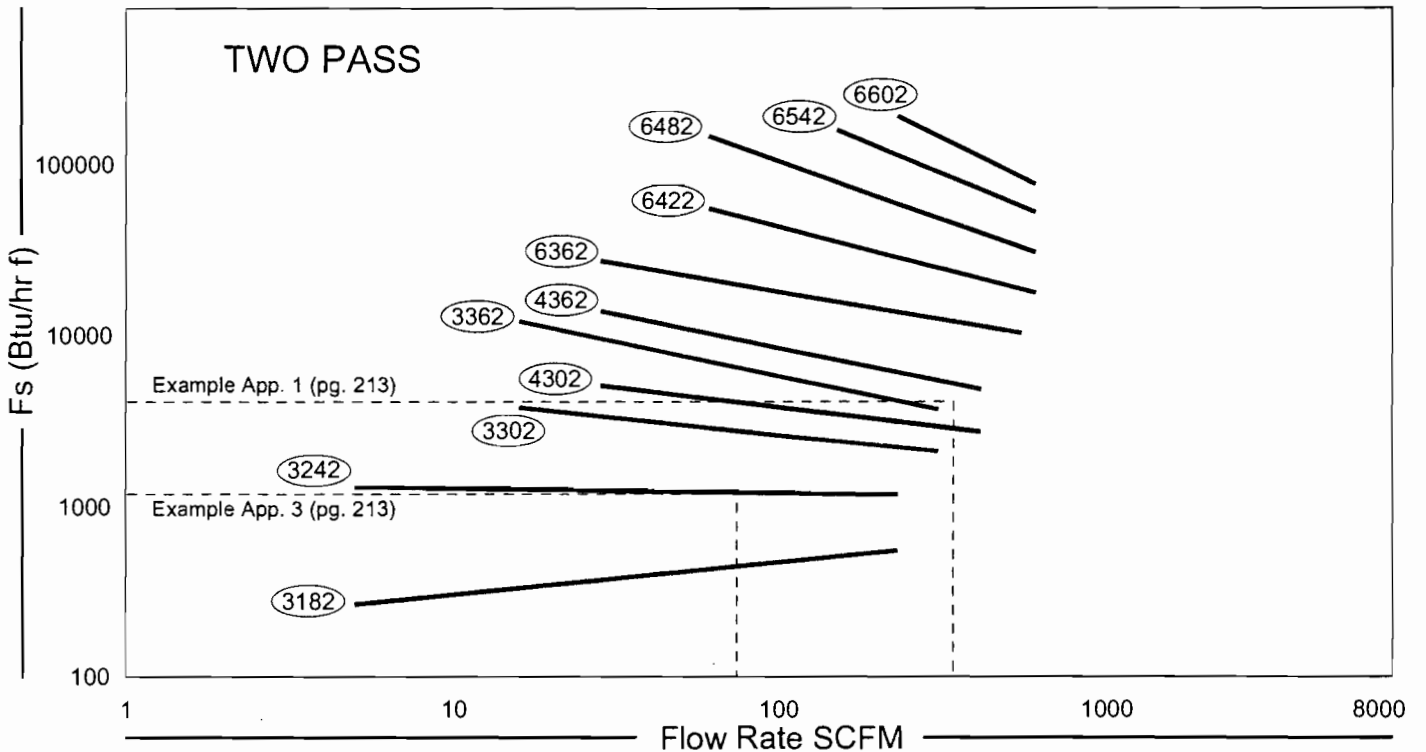
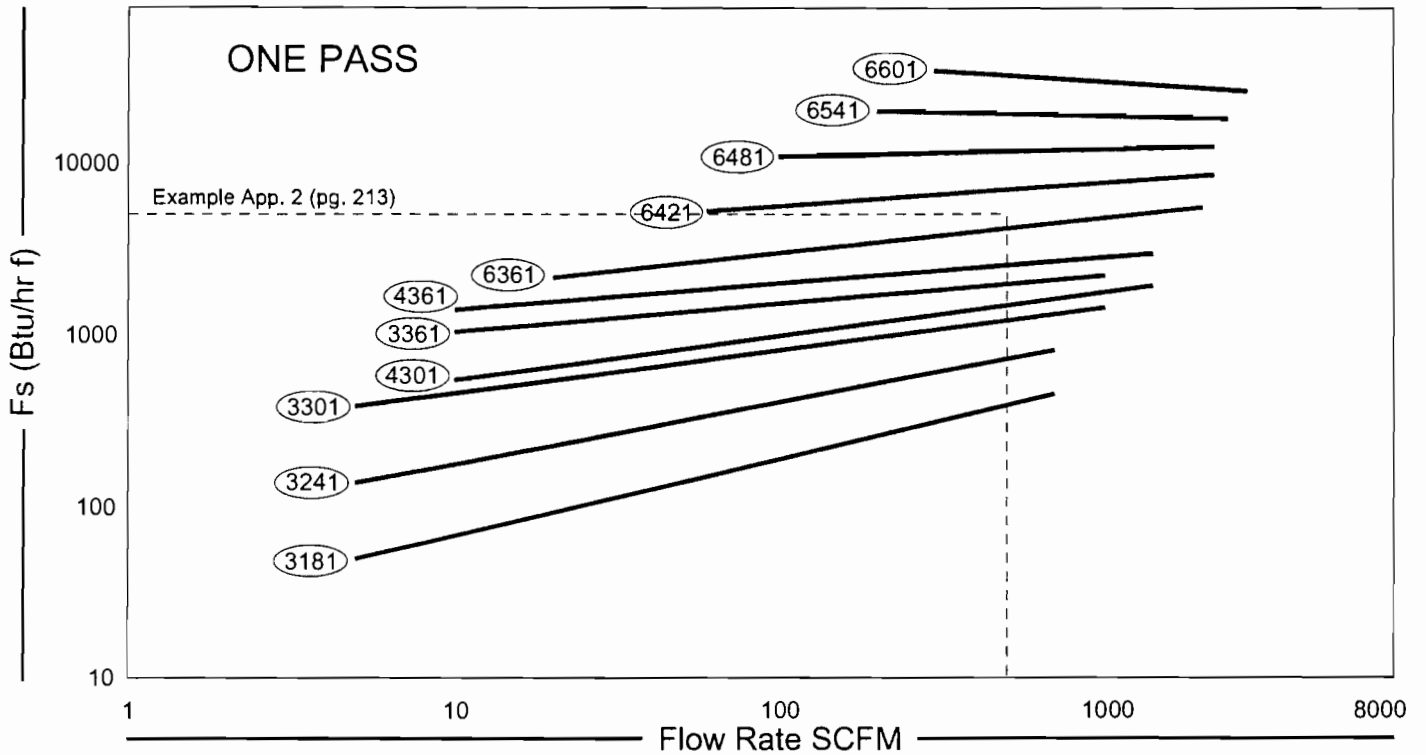
To convert volumetric Actual Cubic Feet per Minute (ACFM) into Standard Cubic Feet per Minute (SCFM) see page 213 application 3.

To select a model, locate the flow rate in SCFM located at the bottom of the graph. Proceed upward on the graph until the SCFM flow rate intersects with the calculated

Fs. The curve closest, on or above the intersection point is the proper selection.

Using the one pass graph or two-pass graph depends upon pressure differential, flow, and performance requirements. The actual surface area for one or two pass units is the same. However, the airflow velocity in the tubes increases with the number of passes giving slightly higher pressure differentials and better cooling performance.

# ACA Series performance



**Example**

Application #3 (p.5)

SCFM = 76

DPSI required = 5" H2O

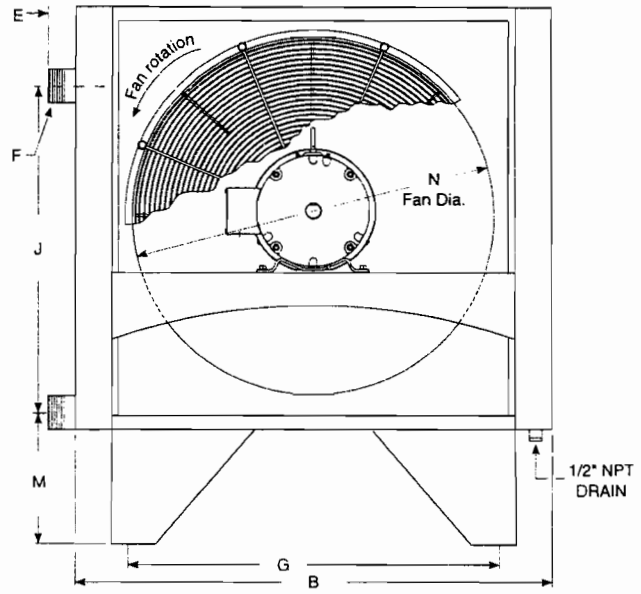
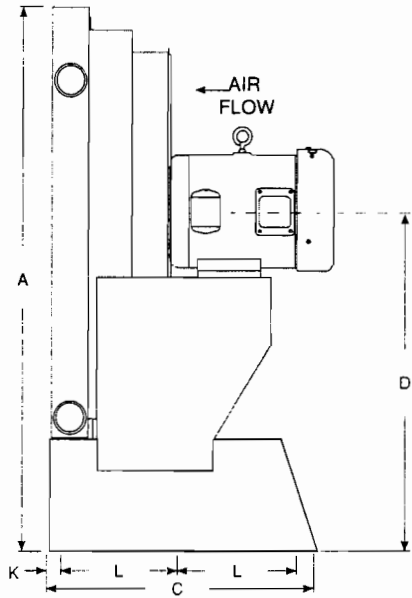
Model selection = ACA-6421-3

Fs = 1,288 Nozzle check (p.4) = 3.10 or 3"NPT

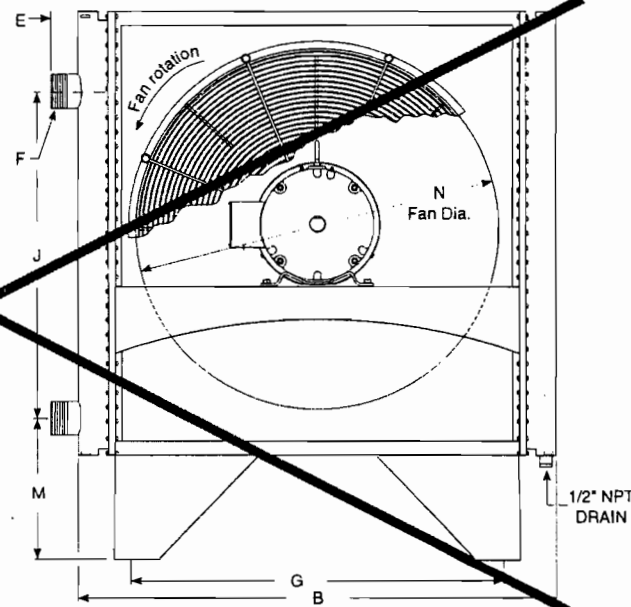
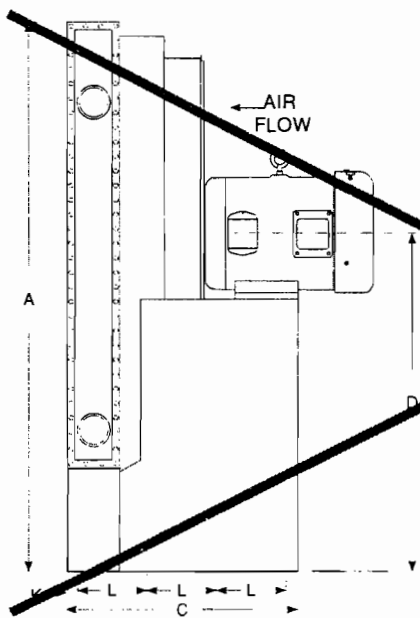
$$F_s = \frac{\text{Heat Load (Btu/hr)}}{\text{Process exiting temperature (T}_2\text{)} - \text{Ambient air entering the cooler (T}_a\text{) from cooler}}$$

note: AIHTI reserves the right to make reasonable design changes without notice.

# ACA Series dimensions



ACA - 3182 through ACA - 4362



ACA - 6302 through ACA - 6602

DIMENSIONS (inches)												
Model	A	B	C	D	E	F NPT	G	J	K	L	M	N
ACA - 3182	30.6	23.0	19.8	20.25	2.5	1.5	16.3	12.98	1.5	8.38	11.93	14.0
ACA - 3242	36.6	29.0	19.8	23.25	2.5	1.5	22.3	17.48	1.5	8.38	11.93	22.0
ACA - 3302	42.6	35.0	19.8	26.25	2.5	2.0	28.3	21.75	1.5	8.38	12.15	28.0
<del>ACA - 4002</del>	<del>42.6</del>	<del>38.8</del>	<del>19.8</del>	<del>26.25</del>	<del>2.5</del>	<del>2.5</del>	<del>28.3</del>	<del>21.55</del>	<del>1.5</del>	<del>8.38</del>	<del>12.95</del>	<del>28.0</del>
ACA - 6302	42.6	38.8	19.8	26.25	2.5	3.0	28.3	21.07	1.5	8.38	12.98	28.0
<del>ACA - 6002</del>	<del>46.6</del>	<del>41.8</del>	<del>19.8</del>	<del>26.25</del>	<del>2.5</del>	<del>2.0</del>	<del>34.0</del>	<del>26.25</del>	<del>1.5</del>	<del>8.38</del>	<del>12.15</del>	<del>32.0</del>
ACA - 4362	48.6	42.0	19.8	29.25	2.5	2.5	34.4	26.05	1.5	8.38	12.35	32.0
ACA - 6362	48.5	43.9	19.8	29.25	2.5	3.0	34.3	26.0	1.5	8.38	12.7	32.0
ACA - 6422	54.5	50.8	27.36	32.25	2.5	4.0	40.3	29.4	2.0	6.75	13.3	36.0
ACA - 6482	60.6	56.8	27.36	35.25	2.5	4.0	46.3	34.1	2.0	6.75	13.3	42.0
ACA - 6542	66.6	62.8	28.83	38.25	2.5	4.0	52.3	38.6	2.0	6.75	13.3	48.0
ACA - 6602	72.4	67.9	30.6	41.25	2.5	4.0	58.3	43.05	2.0	6.75	13.3	48.0

note: AIHTI reserves the right to make reasonable design changes without notice.

# ACA Series motor data

## ELECTRIC MOTOR DATA

Model	Horse Power	Phase	Hz	Volts	RPM	NEMA Frame	Enclosure Type	Full Load Amperes	Service Factor	Thermal Overload
ACA-3181/2-1	.25	1	60-50	115/230 - 90/190	1725-1440	48	TEFC	3.2/1.6/2.8-1.4	1.15	NO
ACA-3181/2-3	.25	3	60-50	208 - 230/460 - 190/380	1725-1440	48	TEFC	1.3/65/1.1-55	1.15	NO
ACA-3241/2-1	.25	1	60-50	115/230 - 90/190	1140-950	56	TEFC	6.8/3.1-3.4	1.15	NO
ACA-3241/2-3	.25	3	60-50	208 - 230/460 - 190/380	1140-950	56	TEFC	1.7/2.0/1.0	1.15	NO
ACA-3301/2-1	.5	1	60-50	115/230 - 90/190	1140-950	56	TEFC	9.6/4.7-4.8/10.4/5.2	1.15	NO
ACA-3301/2-3	.5	3	60-50	208 - 230/460 - 190/380	1140-950	56	TEFC	2.4-2.7/1.35-2.5/1.25	1.15	NO
ACA-4301/2-1	.5	1	60-50	115/230 - 90/190	1140-950	56	TEFC	9.6/4.7-4.8/10.4/5.2	1.15	NO
ACA-4301/2-3	.5	3	60-50	208 - 230/460 - 190/380	1140-950	56	TEFC	2.4-2.7/1.35-2.5/1.25	1.15	NO
ACA-6301/2-3	1.0	3	60-50	208 - 230/460 - 190/380	1140-950	56	TEFC	4/2-3.7/1.85	1.15	NO
ACA-6361/2-3	1.0	3	60-50	208 - 230/460 - 190/380	1140-950	56	TEFC	4/2-3.7/1.85	1.15	NO
ACA-4361/2-3	1.0	3	60-50	208 - 230/460 - 190/380	1140-950	56	TEFC	4/2-3.7/1.85	1.15	NO
ACA-6361/2-3	3.0	3	60-50	208 - 230/460 - 190/380	1725-1440	182T	TEFC	8.4-6.8/3.4	1.15	NO
ACA-6421/2-3	5.0	3	60-50	208 - 230/460 - 190/380	1140-950	213T	TEFC	8.2-7.6/3.8	1.15	NO
ACA-6481/2-3	5.0	3	60-50	208 - 230/460 - 190/380	1140-950	213T	TEFC	14.0/7.0	1.15	NO
ACA-6541/2-3	7.5	3	60-50	208 - 230/460 - 190/380	1140-950	254T	TEFC	20.4/10.2	1.15	NO
ACA-6601/2-3	10	3	60-50	208 - 230/460 - 190/380	1140-950	256T	TEFC	28.0/14.0	1.15	NO

### ELECTRIC MOTOR NOTES:

- Motor electrical ratings are an approximate guide and may vary between motor manufacturers. Consult ratings on motor data plate prior to installation and operation.
- Explosion proof, high temperature, severe duty, chemical, IEC, Canadian Standards Association, and Underwriters Laboratory recognized motors are available upon request.
- American Industrial reserves the right to enact changes to motor brand, type and ratings regarding horsepower, RPM,FLA,and service factor for standard products without notice. All specific requirements will be honored without change.
- Fan rotation is clockwise when facing the motor shaft.
- The above motors contain factory lubricated shielded ball bearings (no additional lubrication is required).
- Abbreviation Index**  
TEFC.....Totally Enclosed, Fan Cooled  
EXP.....Explosion Proof

### CLASS I, DIV. 1, GROUP D or CLASS II, DIV. 2, GROUP F & G EXPLOSION PROOF MOTOR DATA

Model	Horse Power	Phase	Hz	Volts	RPM	NEMA Frame	Enclosure Type	Full Load Amperes	Service Factor	Thermal Overload
ACA-3181/2-1	.25	1	60	115/230	1725	48	EXP	5.8/2.8	1.0	YES
ACA-3181/2-3	.25	3	60	208-230/460	1725	48	EXP	1.4-1.3/65	1.0	YES
ACA-3241/2-3	.33	3	60	115/230	1140	56	EXP	6.8/3.5	1.0	YES
ACA-3241/2-1	.33	3	60	208-230/460	1140	56	EXP	1.18-1.6/8	1.0	YES
ACA-3301/2-3	.75	1	60	115/230	1140	56	EXP	9.4/4.8	1.0	YES
ACA-3301/2-1	.75	3	60	208-230/460	1140	56	EXP	2.5-2.4/1.2	1.0	YES
ACA-4301/2-3	.75	1	60	115/230	1140	56	EXP	9.4/4.8	1.0	YES
ACA-4301/2-1	.75	3	60	208-230/460	1140	56	EXP	2.5-2.4/1.2	1.0	YES
ACA-6301/2-1	1.0	3	60	230/460	1140	56	EXP	3.8/1.9	1.0	YES
ACA-3361/2-3	1.0	3	60	230/460	1140	56	EXP	3.8/1.9	1.0	YES
ACA-4361/2-3	1.0	3	60	230/460	1140	56	EXP	3.8/1.9	1.15	YES
ACA-6361/2-3	3	3	60	230/460	1725	182	EXP	8.8/4.4	1.15	YES
ACA-6421/2-3	5	3	60	230/460	1160	215	EXP	15.0-13.8/6.9	1.15	YES
ACA-6481/2-3	5	3	60	230/460	1160	215	EXP	15.0-13.8/6.9	1.15	YES
ACA-6541/2-3	7.5	3	60	230/460	1160	256	EXP	21.6-20.4/10.2	1.15	YES
ACA-6601/2-3	10	3	60	230/460	1160	256	EXP	29-26/13	1.15	YES

NOTE: Basic electric drive units are supplied with one of the corresponding above listed motors.

# ACA Series motor data

## 575 VOLT ELECTRIC MOTOR DATA

Model	Horse Power	Phase	Hz	Volts	RPM	NEMA Frame	Enclosure Type	Full Load Amperes	Service Factor	Thermal Overload
ACA-3181/2-5	1/2	3	60	575	1725	56	TEFC	.52 .56	1.15	NO
ACA-3241/2-5	1/3	3	60	575	1140	56	TEFC	.52 .56	1.15	NO
ACA-3301/2-5	1/2	3	60	575	1140	56	TEFC	1.08	1.15	NO
ACA-4301/2-5	1/2	3	60	575	1140	56	TEFC	1.08	1.15	NO
ACA-6301/2-5	1	3	60	575	1140	56	TEFC	1.6	1.15	NO
ACA-3361/2-5	1	3	60	575	1140	56	TEFC	1.6	1.15	NO
ACA-4361/2-5	1	3	60	575	1140	56	TEFC	1.6	1.15	NO
ACA-6361/2-5	3	3	60	575	1725	182T	TEFC	3.3	1.15	NO
ACA-6421/2-5	5	3	60	575	1140	213T	TEFC	5.9	1.15	NO
ACA-6481/2-5	5	3	60	575	1140	213T	TEFC	5.9	1.15	NO
ACA-6541/2-5	7.5	3	60	575	1140	254T	TEFC	8.0	1.15	NO
ACA-6601/2-5	10	3	60	575	1140	256T	TEFC	10.5	1.15	NO

## COMMON DATA

Model	Air Flow		Sound Level dB(A) @ 7ft	Weight		Serviceable Core
	CFM	m <sup>3</sup> /s		w/ motor	w/o motor	
ACA-3181/2	1550	0.731	72	131	111	NO
ACA-3241/2	2900	1.36	76	154	134	NO
ACA-3301/2	4450	2.10	76	184	160	NO
ACA-4301/2	4450	2.10	76	211	187	NO
ACA-6301/2	4450	2.10	76	343	305	YES
ACA-6361/2	6650	2.86	76	218	235	NO
ACA-4361/2	6350	2.99	79	289	251	NO
ACA-6361/2	10500	4.95	91	402	342	YES
ACA-6421/2	14300	6.75	87	636	443	YES
ACA-6481/2	18700	8.82	88	753	560	YES
ACA-6541/2	23350	11.02	91	938	691	YES
ACA-6601/2	29300	13.83	91	1104	835	YES

### NOTES:

TEFC = Totally Enclosed, Fan Cooled

To estimate the sound level at distances other than 7 feet (2.1 meters) from the cooler, add 6 db for each halving of distance, or subtract 6 db for each doubling of the distance.

### Example:

The Sound Level of the ACA-3181/2 is 72 dB at 7ft. At 3.5ft (7ft x 0.5 = 3.5ft) the sound level is 66 dB (72dB - 6dB = 66dB). At 14ft (7ft x 2 = 14ft) the sound level is 78dB (72dB + 6dB = 78dB).

### Pressure Drop Graphs (see page 220)

Each graph represents a specific pressure drop at differing flow rates and inlet pressures. The four graphs for each model series size represents the more popular milestone pressure differentials commonly applied.

To use the graphs for selection purposes follow the steps below.

- 1) Locate the operating pressure at the bottom of the desired pressure drop chart.
- 2) Locate the flow rate in SCFM at the left end of the chart.
- 3) Follow the "Pressure" line vertically and the "Flow" line horizontally until they cross, note the location.
- 4) The curve on, or closest above will be exact or less pressure drop than requested and suitable for the application.
- 5) There may be several units shown above the intersection point, all of which will produce less than the desired pressure drop at the required flow.

### Example: Application 3 Low Pressure Blower

Flow = 76 SCFM

Operating pressure = 2 PSIG

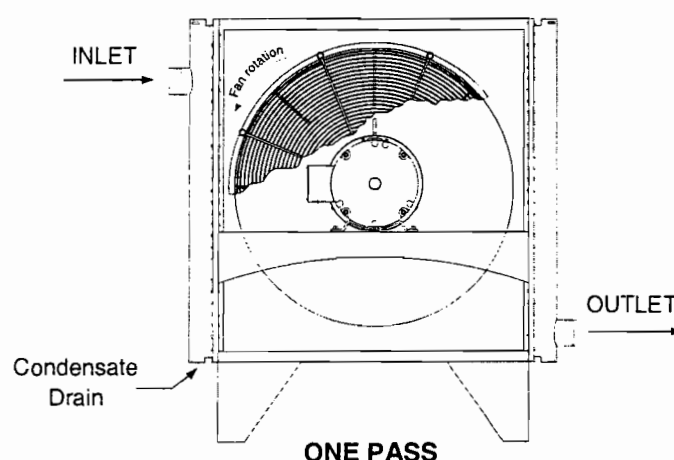
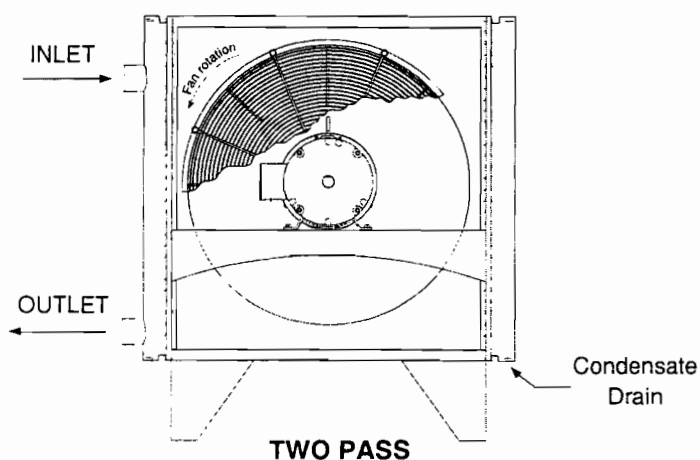
Initial selection from graph page 215 = ACA-3302

Desired pressure drop = 5" H<sub>2</sub>O or less. (USE the "Pressure Drop 5" H<sub>2</sub>O" curves page 220)

From the pressure drop graph, page 220. Acceptable choice - ACA-3302 is on the line, ACA-3242 is well below the line.

The ACA-3302 meets the pressure drop requirement, but exceeds the capacity requirement. However, even though the ACA-3242 exceeds 5" of water pressure drop, other considerations should be made prior to selection such as unit physical size, cost, availability, and port size.

## PIPING HOOK UP



### Receiving:

a) Inspect unit for any shipping damage before uncrating. Indicate all damages to the trucking firms' delivery person and mark it on the receiving bill before accepting the freight. Make sure that the core and fan are not damaged. Rotate the fan blade to make sure that it moves freely. The published weight information located in this brochure is approximate. True shipment weights are determined at the time of shipping and may vary. Approximate weight information published herein is for engineering approximation purposes and should not be used for exact shipping weight. *Since the warranty is based upon the unit date code located on the model identification tag, removal or manipulation of the identification tag will void the manufacturers warranty.*

b) When handling the ACA heat exchanger, special care should be taken to avoid damage to the core and fan. All units are shipped with wood skids for easy forklift handling

c) Standard Enamel Coating: American Industrial provides its standard products with a normal base coat of oil base air cure enamel paint. The enamel paint is applied as a temporary protective and esthetic coating prior to shipment. While the standard enamel coating is durable, American Industrial does not warrant it as a long-term finish coating. It is strongly suggested that a more durable final coating be applied after installation or prior to long-term storage in a corrosive environment to cover any accidental scratches, enhance esthetics, and further prevent corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

### Installation:

a) American Industrial recommends that the equipment supplied should be installed by qualified personal who have solid understanding of system design, pressure and temperature ratings, and piping assembly. Verify the service conditions of the system prior to applying any ACA series cooler. If the system pressure or temperature does not fall within the parameters on ACA rat-

ing tag located on the heat exchanger, contact our factory prior to installation or operation.

b) In order for the heat exchanger to properly function, installation should be made with minimum airflow obstruction distance of not less than twenty (20) inches on both fan intake and exiting side of the heat exchanger.

c) Process piping should be as indicated above with the process flow entering into the upper port and exiting out the lower port (see illustration). This configuration will allow for condensate moisture to drain completely from the equipment. It is recommended that an air separator or automatic drip leg be applied to the outlet side of the heat exchanger to trap any moisture that develops.

d) Flow line sizes should be sized to handle the appropriate flow to meet the system pressure drop requirements. If the nozzle size of the heat exchanger is smaller than the process line size an increased pressure differential at the heat exchanger may occur.

e) ACA series coolers are produced with both brazed ACA-3181 through ACA-4362, and serviceable core® ACA-6301 through ACA-6602 style coils. A brazed construction coil does not allow internal tube access. A serviceable core® will allow full accessibility to the internal tubes for cleaning and maintenance. ACA series coolers are rated for 150 PSIG working pressure, and a 400°f working temperature.

f) Special Coatings: American Industrial offers as customer options, Air-Dry Epoxy, and Heresite (Air-Dry Phenolic) coatings at additional cost. American Industrial offers special coatings upon request, however American Industrial does not warrant coatings to be a permanent solution for any equipment against corrosion. It is the responsibility of the customer to provide regular maintenance against chips, scratches, etc... and regular touch up maintenance must be provided for long-term benefits and corrosion prevention.

## ACA Series *installation & maintenance*

g) Electric motors should be connected only to supply source of the same characteristics as indicated on the electric motor information plate. Prior to starting, verify that the motor and spin freely without obstruction. Check carefully that the fan turns in the correct rotation direction normally counter clockwise from the motor side (fan direction arrow). Failure to operate the fan in the proper direction could reduce performance or cause serious damage to the heat exchanger or other components. Fan blades should be rechecked for tightness after the first 100 hours of operation.

### Maintenance

Regular maintenance intervals based upon the surrounding and operational conditions should be maintained to verify equipment performance and to prevent premature component failure. Since some of the components such as, motors, fans, load adapters, etc... are not manufactured by American Industrial maintenance requirements provided by the manufacture must be followed.

a) Inspect the entire heat exchanger and motor/fan assembly for loosened bolts, loose connections, broken components, rust spots, corrosion, fin/coil clogging, or external leakage. Make immediate repairs to all affected areas prior to restarting and operating the heat exchanger or its components.

b) Heat exchangers operating in oily or dusty environments will often need to have the coil cooling fins cleaned. Oily or clogged fins should be cleaned by carefully brushing the fins and tubes with water or a non-aggressive degreasing agent mixture (Note: Cleaning agents that are not compatible with copper, brass, aluminum, steel or stainless steel should not be used). A compressed air or a water stream can be used to dislodge dirt and clean the coil further. Any external dirt or oil on the electric motor and fan assembly should be removed. Caution: Be sure to disconnect the electric motor from its power source prior to doing any maintenance.

c) In most cases it is not necessary to internally flush the coil. In circumstances where the coil has become plugged or has a substantial buildup of material, flushing the coil with water or a solvent may be done. Flushing solvents should be non-aggressive suitable for the materials of construction. Serviceable Core® models can be disassembled and inspected or cleaned if required.

d) Most low horsepower electric motors do not require any additional lubrication. However, larger motors must be lubricated with good quality grease as specified by the manufacture at least once every 6-9 months or as directed by the manufacture. T.E.F.C. air ventilation slots should be inspected and cleaned regularly to prevent clogging and starving the motor of cooling air. To maintain the electric motor properly see the manufactures requirements and specifications.

e) Fan blades should be cleaned and inspected for tightness during the regular maintenance schedule when handling a fan blade care must be given to avoid bending or striking any of the blades. Fan blades are factory balanced and will not operate properly if damaged or unbalanced. Damaged fan blades can cause excessive vibration and severe damage to the heat exchanger or drive motor.

Replace any damaged fan with an American industrial suggested replacement.

f) ACA heat exchanger cabinets are constructed using 7ga. through 18ga. steel that may be bent back into position if damaged. Parts that are not repairable can be purchased through American Industrial.

g) Coil fins that become flattened can be combed back into position. This process may require removal of the coil from the cabinet.

h) It is not advisable to attempt repairs to brazed joints of a brazed construction coil unless it will be done by an expert in silver solder brazing. Brazed coils are heated uniformly during the original manufacturing process to prevent weak zones from occurring. Uncontrolled reheating of the coil may result in weakening of the tube joints surrounding the repair area. In many instances brazed units that are repaired will not hold up as well to the rigors of the system as will a new coil. American Industrial will not warranty or be responsible for any repairs done by unauthorized sources. Manipulation in any way other than normal application will void the manufactures warranty.

i) Units containing a Serviceable Core® have bolted manifold covers that can be removed for cleaning or repair purposes.

### Service Sequence

American Industrial has gone to great lengths to provide components that are repairable. If the ACA unit requires internal cleaning or attention the following steps will explain what must be done to access the internal tubes. Be sure to order gasket kits or repair parts prior to removal and disassembly to minimize down time.

a) To clean the internal tubes first remove all connection pipes from the unit.

b) Be sure the unit is drained of all water etc...

c) Place the ACA unit in an area that it can be accessed from all sides.

d) Remove the manifold cover bolts and hardware and place them into a secure place.

e) The manifold covers are tightly compressed and may need some prying to separate them from the gasket, physically remove the cover assemblies from both sides.

f) The tubes are now accessible for cleaning. We suggest a mild water-soluble degreaser be used with a brush. Tubing I.D. is .325 a plastic bristle brush on a rod will work best for cleaning the tubes. Steel brushes should be avoided since the steel is harder than the copper tubing and may heavily score the tubes if used.

g) If there are any leaking tubes you may plug them by forcing a soft metal plug into the hole and tapping it tight. You may in some cases weld the leaking tube shut however, care should be taken since excessive heat may cause surrounding tube joints to loosen and leak.



**Sizing Program Air/Air Heat Exchanger**

**Performance of One Unit**

by Mark A. Loeffler

Customer: **Bisco**

Model Selection: **ACA 6 30 2 - 3**

Required Sq.ft: **43.2**

Date: August 17, 2004

Unit Design Sq.Ft: **43.4**

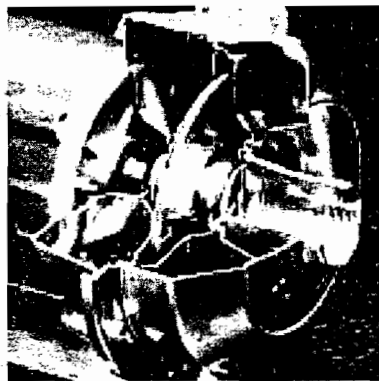
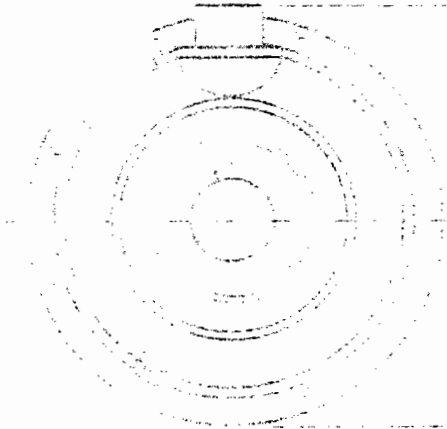
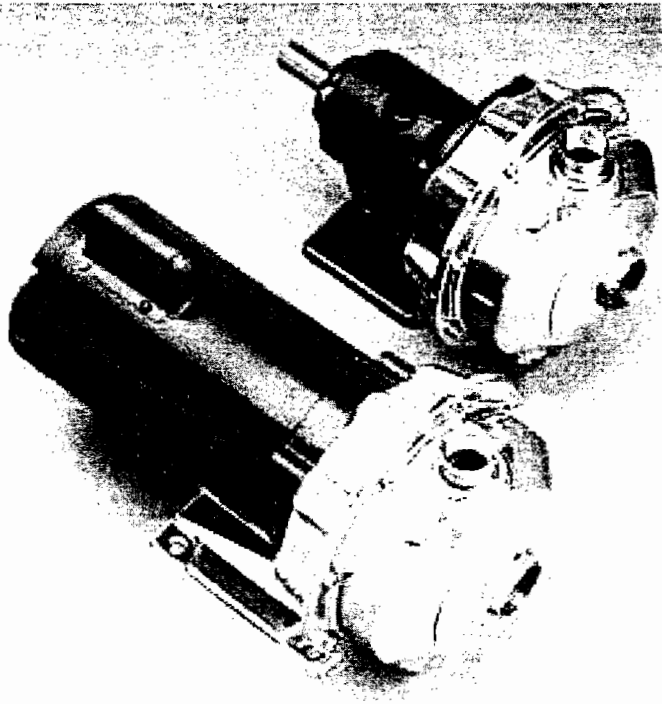
Job:

9 Conditions				
10 TUBE SIDE			FAN SIDE	
11 Fluid		AIR		AIR
12 Specific Gravity		1.00	Elevation	Sea Level + feet
13 Flow Rate	SCFM	200.00	FAN Flow	CFM
14 Calc Flow Rate	SCFM	200.0		
15 Flow Rate	ACFM	0.0		F <sub>s</sub> 5289
16 Calc Flow Rate	ACFM	241.8		
17 Operating Pressure	PSIG	0.5	Atmospheric Pressure	PSIA 14.696
18 Operating Presssure	In. H2O	0.0		
19 Temperature Entering	F	200.0		90.0
20 Temperature Exiting	F	94.5		94.9
21 Approach Temperature	F	4.5		
22 Specific Heat	BTU/lb-f	0.2500		0.2502
23 Viscosity	Cps	0.0195		0.0184
24 Conduct	Btu/hr ft <sup>2</sup> F/ft	0.0166		0.0155
25 Calculation				
26 Heat Load	BTU/hr	23801		23801
27 Mol weight		28.97		28.97
28 Density	lb/ft <sup>3</sup>	0.0622		0.0722
29 Flow Rate	lbs/hr	902.3		19273.8
30 Mass Vel.	lb/hr-ft <sup>2</sup>	17698		5294
31 Pressure Drop	inches water	8.2		
32 Pressure Drop	PSI	0.295	Face Velocity	Ft/min 724
33 Velocity Tubes	f/sec	79.04	Fin Velocity	Ft/min 1222.34
34 Reynolds	Nr	10156		5766
35 U value	clean	16.71		Dirt 16.60
36 Fouling	(hr)(ft <sup>2</sup> )(F)/Btu	0.0004		
37 Selection				
38 Required Area	Sq.Ft.	43.17	LMTD	33.0
39 Surface Area	Sq.Ft.	43.44		
40 Configuration				
41 Tube Diameter	inch	0.375	Fins Per Inch	8
42 Tube Wall	inch	0.025	Estimated l=	1
43 Length Tubes	inch	30.0	Enter Number Passes	2
44 Parallel Tube Rows		6	Estimated Nozzle	inch 3.1
45 Number Tubes		177.00	Nozzle size	inch 3.00
46 Coil Weight Empty	Lbs	114.2	Manifold	inch 4.00
47 Construction Materials				
48 Tubes	Copper	Fins Aluminum	Cabinet Carbon Steel	
49 Tanks	Carbon Steel		Gaskets Hypalon	
50 Coating	Enamel		Fan Nylon Composite	
51 Coil Size	30 X 30	Nozzle	3.0 NPT	
52 HP 1	Phase 3	Hertz/Volts	60/208 230-460	Class TEFC RPM 1140
53 Braze coil core		Serviceable core	X	
54				
55				
56				



## SECTION 4

### PUMPS



# **NPE 316L SS**

**NPE Series  
End Suction  
Centrifugal  
Pumps**

***Bombas  
Centrífugas de  
Succión Final  
Serie NPE***

**A Full Range of Product Features**  
**Una Gama Total de Características del Producto**

**Superior Materials of Construction:** Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

**High Efficiency Impeller:** Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

**Casing and Adapter Features:** Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

**Mechanical Seal:** Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless steel parts. Optional high temperature and chemical duty seals available.

**Motors:** NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

**Materiales Superiores de Construcción:** Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.

**Impulsor de Eficiencia Superior:** El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

**Características de la Carcasa y del Adaptador:** Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.

**Sello Mecánico:** Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.

**Motores:** Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.

**Model: 1ST1D5D4**

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

**NPE Product Line Numbering System**  
**Línea de Producto NPE Sistema de Numeración**

**Example Product Code,**  
**Ejemplo Código del Producto**

1 ST 2 C 1 A 4 F

**Seal Vent/Flush Option,**  
**Opción de Sello Válvula/Chorro Seal Ven**

**Mechanical Seal and O-ring**

4 = Pre-engineered standard  
 For optional mechanical seal modify catalog order no. with seal code listed below.

**Sello Mecánico y Anillo 'O'**

4 = Estándar aprobado  
 Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (¾" seal), Sello Mecánico John Crane Tipo 21 (sello de ¾")				
Seal Code, Código del Sello	Rotary, Rotativo	Stationary, Estacionario	Elastomers, Elastómeros	Metal Parts, Partes Metálicas
4	Carbon	Silicon Carbide	Viton	316 SS
6	Carbide		Viton	

**Impeller Option . . . No Adder Required**

For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

**Código del Impulsor Opcional**

Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impulsor con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, Código del Impulsor	Pump Size, Tamaño de la Bomba		
	1 x 1¼ - 6 Diameter	1¼ x 1½ - 6 Diameter	1½ x 2 - 6 Diameter
K	-	6½	-
G	-	5½	5½
H	-	5½	5
A	6½	5¼	4¾
B	5¾	5½	4¾
D	4¾		
F	4¾	3¾	-

**Driver, Conductor**

- 1 = 1 PH, ODP
- 2 = 3 PH, ODP
- 3 = 575 V, ODP
- 5 = 3 PH, TEFC
- 6 = 575 V, TEFC
- 7 = 3 PH, XP
- 8 = 575 V, XP
- 9 = 3 PH, TEFC

**HP Rating, HP Potencia**

- D = ¾ HP

**Driver: Hertz/Pole/RPM,**  
**Conductor: Hercios/Polo/RPM**

- 1 = 60 Hz, 2 pole, 3500 RPM
- 3 = 60 Hz, 6 pole, 1150 RPM
- 4 = 50 Hz, 2 pole, 2900 RPM
- 5 = 50 Hz, 4 pole, 1450 RPM

**Material**

- ST = Stainless steel, Acero inoxidable

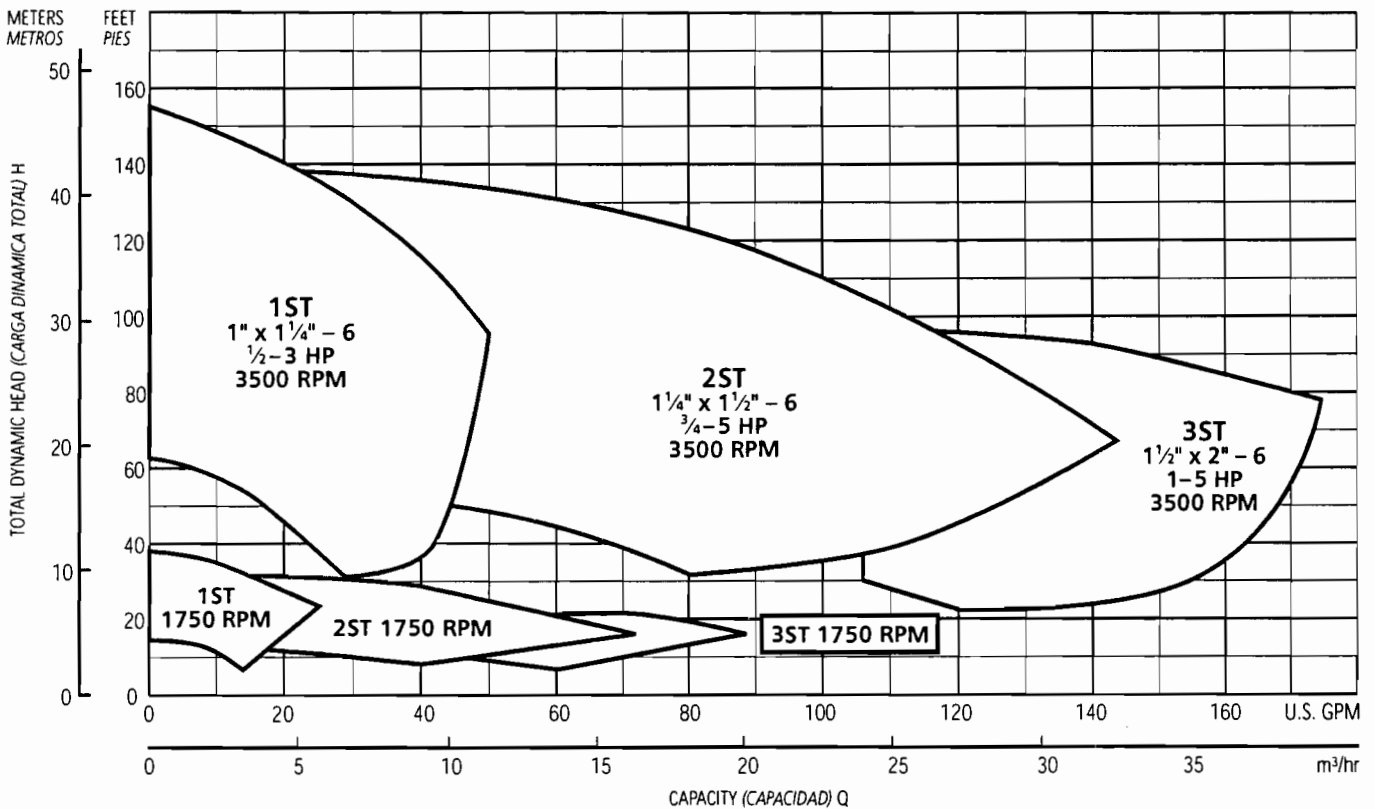
**Pump Size, Tamaño de la Bomba**

- 1 = 1 x 1¼ - 6

For frame mounted version, substitute the letters "FRM" in these positions.

Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

**Performance Coverage (60 Hz)**  
**Alcance de Funcionamiento (60 Hz)**



**NOTES:**

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds check available service factor.

**NOTAS:**

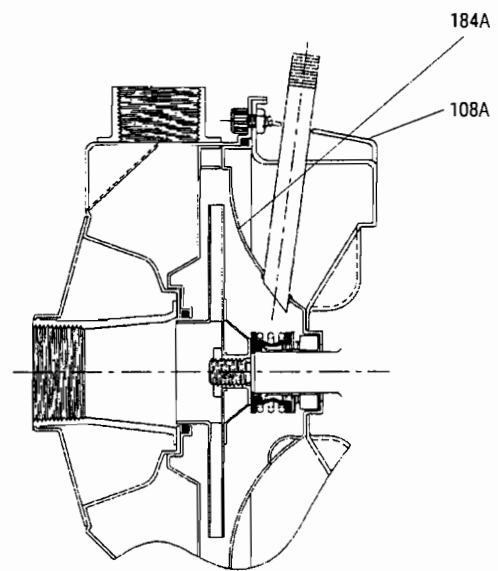
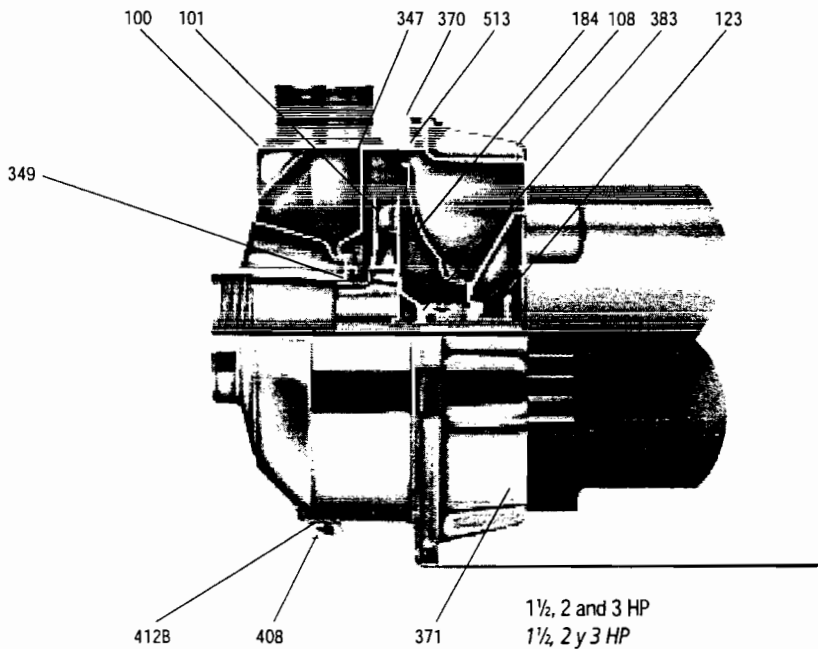
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds.

**NPE Close Coupled Pump Major Components: Materials of Construction**  
**Bomba Cerrada Acoplada NPE Componentes Principales: Materiales de Construcción**



Seal Face Vent/Flush Option,  
Opción Cara del Sello Válvula/Chorro



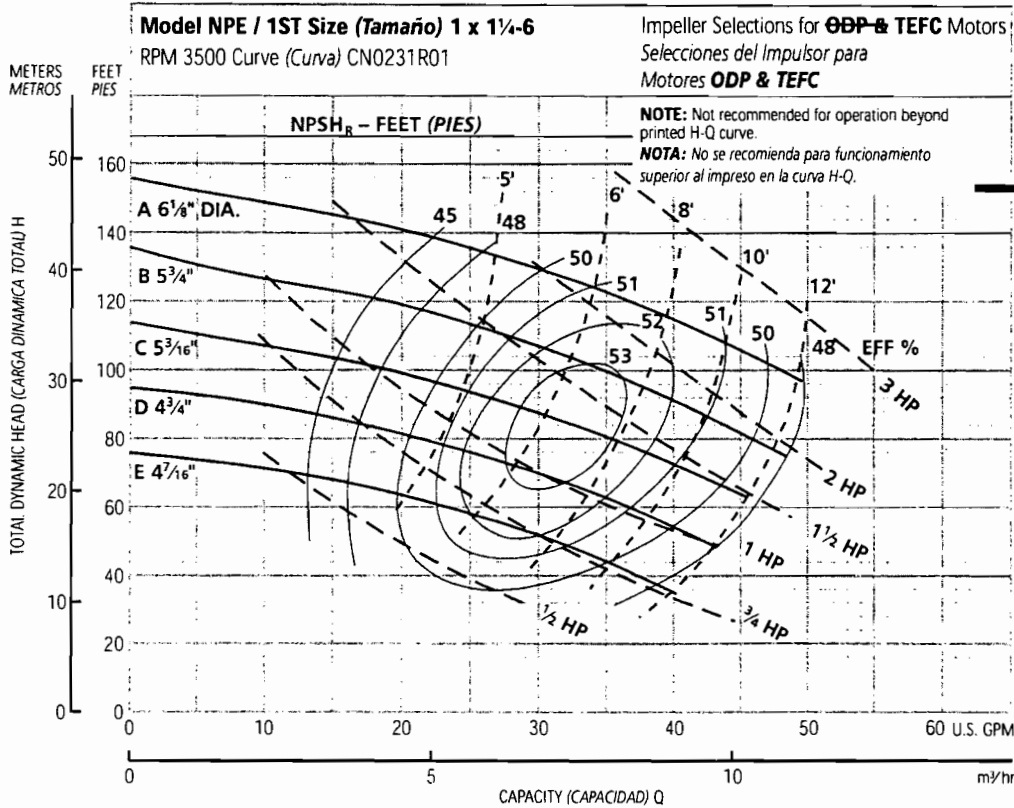
1/2, 3/4 and 1 HP  
1/2, 3/4 y 1 HP

Footed motor for 1750 RPM and 5 HP ODP and TEFC, all explosion proof see page 13.

Motor con pie para 1750 RPM, 5 HP ODP y TEFC, a prueba de explosiones en la página 13.

Item No., Parte No.	Description, Descripción	Materials, Materiales
100	Casing, Carcasa	
101	Impeller, Impulsor	
108	Motor adapter, Adaptador del motor	AISI 316L SS, AISI 316L Acero inoxidable
108A	Motor adapter seal vent/flush, Sello válvula/chorro del adaptador del motor	
123	Deflector, Deflector	BUNA-N
184	Seal housing, Alojamiento del sello	
184 A	Seal housing seal vent/flush, Sello válvula/chorro del alojamiento del sello	AISI 316L SS, AISI 316L Acero inoxidable
347	Guidevane, Difusor	
349	Seal ring, guidevane; Anillo del sello, difusor	Viton
370	Socket head screws, casing; Encajes cabezas de tornillos, carcasa	AISI 410 SS, AISI 410 Acero inoxidable
371	Bolts, motor; Tornillos, motor	Plated steel, Acero chapeado
383	Mechanical seal, Sello mecánico	**see chart, ver tabla
408	Drain and vent plug, casing; Enchufes de drenaje y válvula, carcasa	AISI 316L SS, AISI 316L Acero inoxidable
412B	O-ring, drain and vent plug; Anillo 'O', enchufe de drenaje y válvula	Viton
513	O-ring, casing; Anillo 'O', carcasa	
Motor Motor	NEMA standard, 56J flange; NEMA estándar, brida 56J	

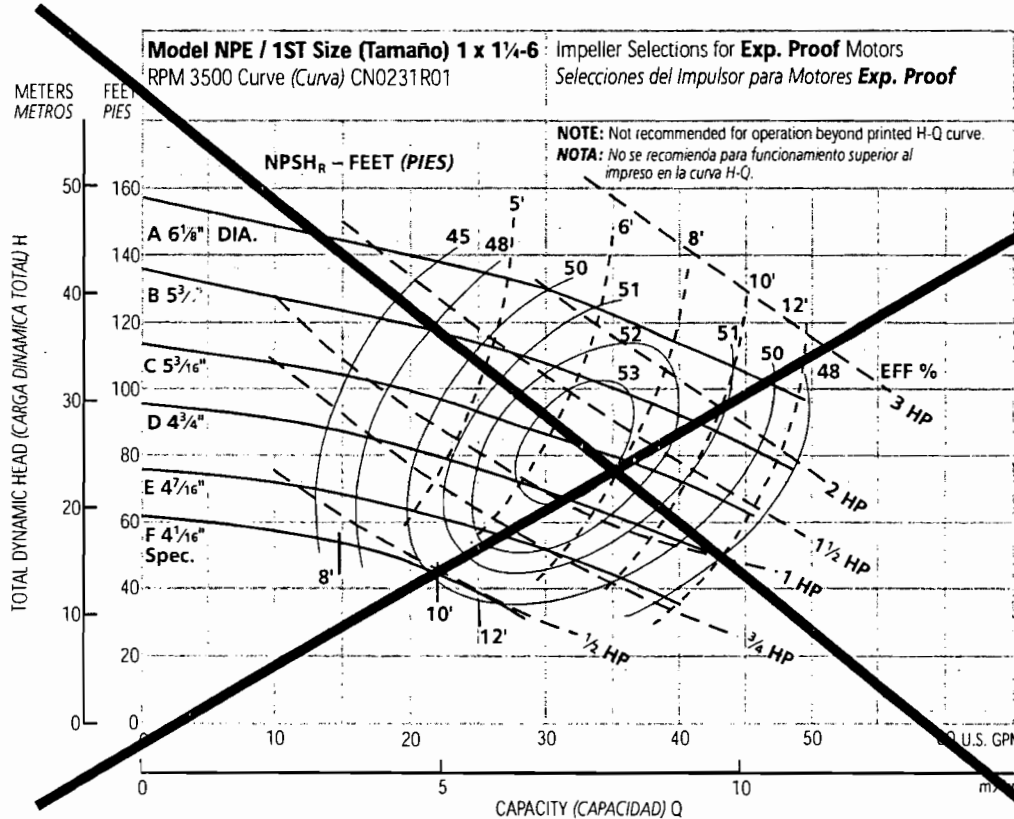
**Performance Curves – 60 Hz, 3500 RPM**  
**Curvas de Funcionamiento – 60 Hz, 3500 RPM**



Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
<del>E</del>	<del>1</del>	<del>4 7/16"</del>
D	¾	4 ¾"
<del>C</del>	<del>1</del>	<del>5 3/16"</del>
<del>B</del>	<del>1 ½</del>	<del>5 ¾"</del>
<del>A</del>	<del>2</del>	<del>6 1/8"</del>

**NOTE:** Although not recommended, the pump may pass a 1/16" sphere.

**NOTA:** Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".



Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
<del>F</del>	<del>½</del>	<del>4 1/16" spec.</del>
<del>E</del>	<del>¾</del>	<del>4 7/16"</del>
<del>D</del>	<del>1</del>	<del>4 ¾"</del>
<del>C</del>	<del>1 ½</del>	<del>5 3/16"</del>
<del>B</del>	<del>2</del>	<del>5 ¾"</del>
<del>A</del>	<del>3</del>	<del>6 1/8"</del>

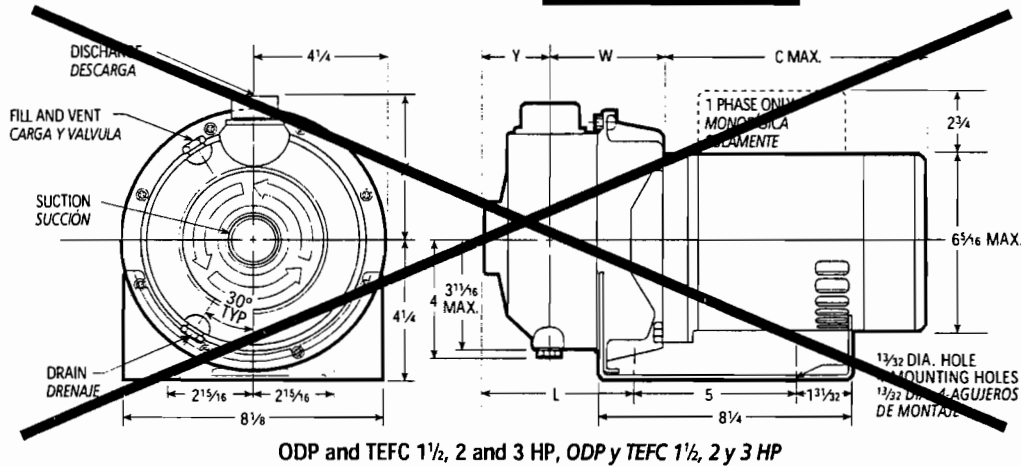
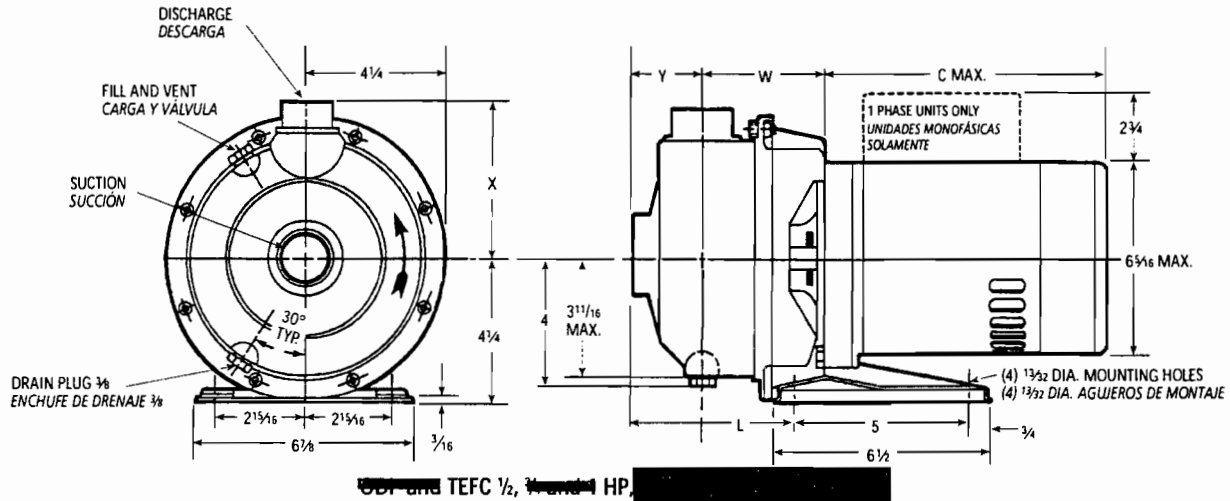
**NOTE:** Although not recommended, the pump may pass a 1/16" sphere.

**NOTA:** Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".

## NPE Close Coupled – Dimensions, Weights and Specifications

### NPE Acople Cerrado – Dimensiones, Pesos y Especificaciones

Clockwise Rotation Viewed from Drive End  
 Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



## Specifications

### Especificaciones

#### Capacities to:

75 GPM (283L/min) at 1750 RPM  
 150 GPM (550L/min) at 3500 RPM

#### Heads to:

39 feet (12 m) at 1750 RPM  
 150 feet (46 m) at 3500 RPM

#### Working pressures to:

125 PSIG (9 bars)

#### Maximum temperatures to:

212°F (100°C) with standard seal or  
 250°F (121°C) with optional high  
 temperature seal.

#### Direction of rotation:

Clockwise when viewed from  
 motor end.

#### Motor specifications:

NEMA 56J frame, 1750 RPM.  
 1/2 HP. 3500 RPM 1/2 through 5 HP.  
 Open drip-proof, totally enclosed  
 fan-cooled or 2 HP explosion proof  
 enclosures. Stainless steel shaft  
 with ball bearings.

**Single phase:** Voltage 115/230  
 ODP and TEFC. (3 HP model –  
 230 V only) Built-in overload with  
 auto-reset provided.

**Three phase:** Voltage 208-230/  
 460 ODP, TEFC and EX PROOF.

**NOTE:** For three phase motors,  
 overload protection must be  
 provided in starter unit. Starter and  
 heaters must be ordered separately.

#### Capacidades:

75 GPM (283L/min) a 1750 RPM  
 150 GPM (550L/min) a 3500 RPM

#### Cargas:

39 pies (12 m) a 1750 RPM  
 150 pies (46 m) a 3500 RPM

#### Presión de trabajo:

125 PSIG (9 bars)

#### Temperatura máxima:

212°F (100°C) con sello estándar o  
 250°F (121°C) con sello opcional  
 para alta temperatura.

#### Dirección de rotación:

En dirección de las agujas del reloj  
 visto desde el extremo final del  
 motor.

#### Motores:

Armazón 56J NEMA, 1750 RPM  
 1/2 HP. 3500 RPM 1/2 a 5 HP.

Cubiertas abiertas resguardadas,  
 totalmente encerradas enfriadas por  
 ventilador o a prueba de explosiones  
 de 2 HP. Eje de acero inoxidable con  
 balineras de bolas.

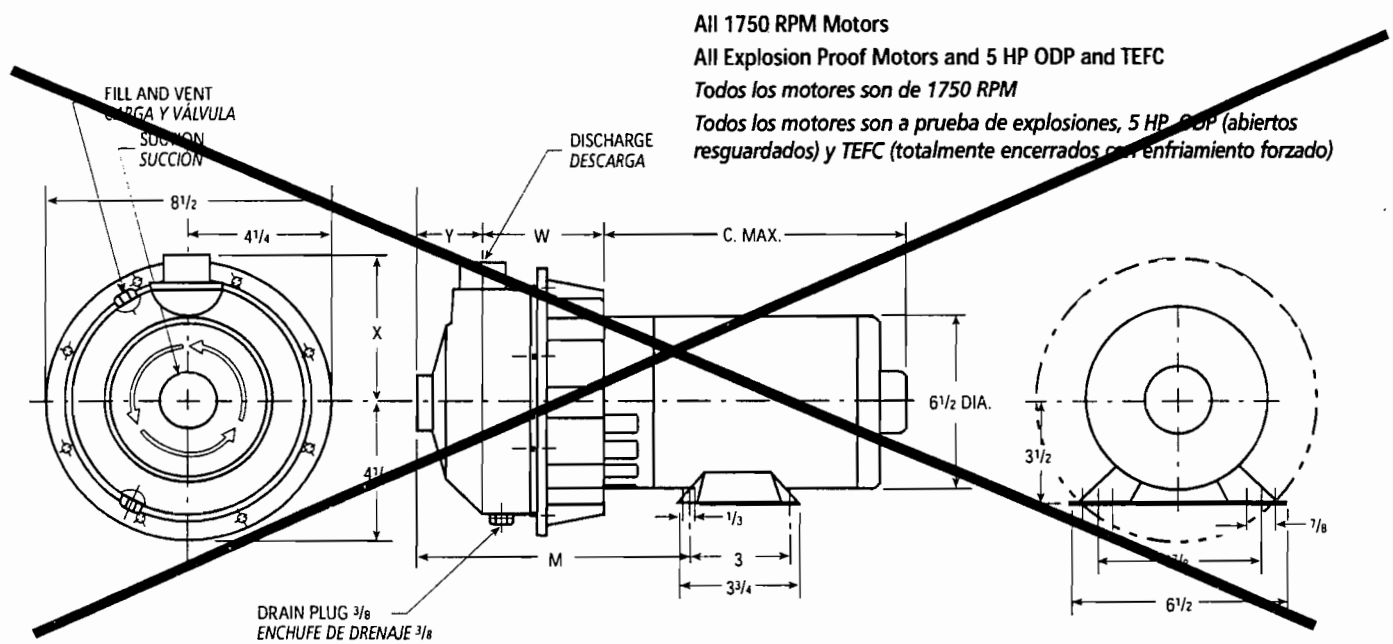
**Monofásicos:** Voltaje 115/230  
 ODP y TEFC. (modelo 3 HP – 230  
 voltios solamente) Se proporciona  
 protección térmica contra sobrecarga  
 construida con reseteo automático.

**Trifásicos:** Voltaje 208-230/460  
 ODP, TEFC y EX PROOF.

**NOTA:** Para motores trifásicos se  
 debe de proporcionar la protección  
 térmica contra sobrecarga en la  
 unidad de arranque. El arrancador y  
 los calentadores se deben pedir por  
 separado.



**NPE Close Coupled with Footed Motor, 1750 RPM and Explosion-proof Motors**  
**NPE Acople Cerrado con Motor con Patas, 1750 RPM y Motores a Prueba de Explosión**



All 1750 RPM Motors  
 All Explosion Proof Motors and 5 HP ODP and TEFC  
 Todos los motores son de 1750 RPM  
 Todos los motores son a prueba de explosiones, 5 HP ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado)

**Dimensions - Determined by Pump,**  
**Dimensiones - Determinadas por la Bomba**

Pump, Bomba	Suction, Succión	Discharge, Descarga	HP	W	X	Y	L	M
1ST	1 1/4	1	1/2 - 3	3 3/16	4 3/8	2	4 9/16	7 5/16

**Available Motor Weights and Dimensions,**  
**Pesos y Dimensiones Disponibles del Motor**

HP	Motor Weights, Pesos del Motor						C Max. Length, (Longitud)
	1 Phase, Monofásicos			3 Phase, Trifásicos			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
3/4	15	24	21	21	21	21	10 1/4
1	22	26	16	22	21	22	11
1 1/2	28	35	56	27	27	37	11 5/16
2	33	39	60	32	33	44	12 1/16
3	40	43	—	41	37	—	12 7/16
5	42	—	—	42	45	—	14 1/4

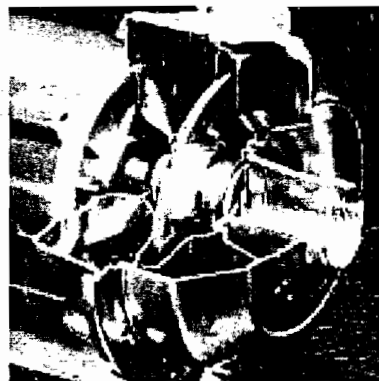
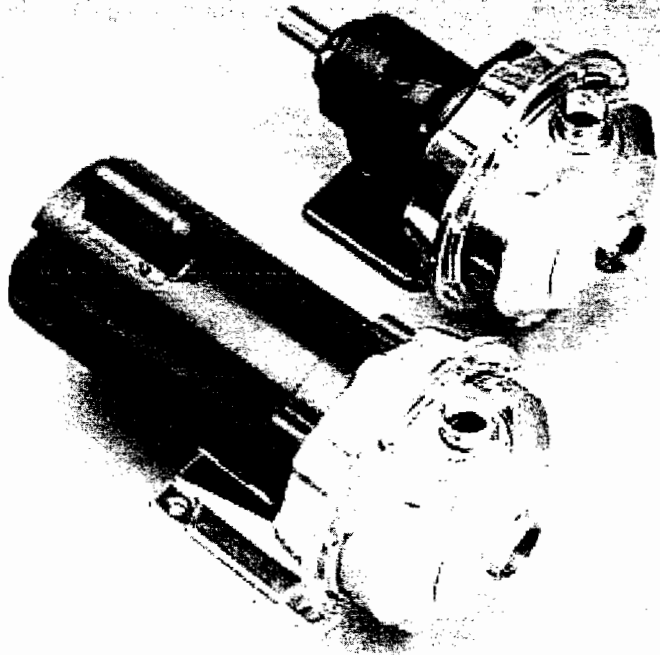
Dimensions in inches, weights in pounds.  
 Dimensiones en pulgadas, pesos en libras.

**NOTES:**

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 - 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

**NOTAS:**

1. Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 - 6 libras-pies.
2. Las dimensiones del motor puede que varíen con los fabricantes.
3. Dimensiones en pulgadas, pesos en libras.
4. Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.
5. No usar para propósitos de construcción sin certificar.



# **NPE 316L SS**

**NPE Series  
End Suction  
Centrifugal  
Pumps**

***Bombas  
Centrífugas de  
Succión Final  
Serie NPE***

**A Full Range of Product Features**  
**Una Gama Total de Características del Producto**

**Superior Materials of Construction:** Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

**High Efficiency Impeller:** Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

**Casing and Adapter Features:** Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

**Mechanical Seal:** Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

**Motors:** NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

**Materiales Superiores de Construcción:** Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.

**Impulsor de Eficiencia Superior:** El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

**Características de la Carcasa y del Adaptador:** Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.

**Sello Mecánico:** Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.

**Motores:** Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.

**Model: 1ST1E5C4**

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

**NPE Product Line Numbering System**  
**Línea de Producto NPE Sistema de Numeración**

**Example Product Code,**  
**Ejemplo Código del Producto**

1 ST 2 C 1 A 4 F

**Seal Vent/Flush Option,**  
**Opción de Sello Válvula/Chorro**

**Mechanical Seal and O-ring**

4 = Pre-engineered standard  
 For optional mechanical seal modify catalog order no. with seal code listed below.

**Sello Mecánico y Anillo 'O'**

4 = Estándar aprobado  
 Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (¼" seal), Sello Mecánico John Crane Tipo 21 (sello de ¼")				
Seal Code, Código del Sello	Rotary, Rotativo	Stationary, Estacionario	Elastomers, Elastómeros	Metal Parts, Partes Metálicas
4	Carbon	Silicon Carbide	Viton	316 SS
6	Carbide		Viton	

**Impeller Option . . . No Adder Required**

For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

**Código del Impulsor Opcional**

Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impulsor con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, Código del Impulsor	Pump Size, Tamaño de la Bomba		
	1 x 1¼ - 6 Diameter	1¼ x 1½ - 6 Diameter	1½ x 2 - 6 Diameter
K	-	6½	-
G	-	5½	5½
H	-	5½	5
A	6½	5¼	4¾
C	5½		
E	4¾	4¼	3¾
F	4¾	3¾	-

**Driver, Conductor**

1 = 1 PH, ODP      7 = 3 PH, XP  
 2 = 3 PH, ODP      8 = 575 V, XP  
 3 = 575 V, ODP      9 = 3 PH, TEFC

**HP Rating, HP Potencia**

E = 1 HP

**Driver: Hertz/Pole/RPM,  
Conductor: Hercios/Polo/RPM**

1 = 60 Hz, 2 pole, 3500 RPM  
 3 = 60 Hz, 6 pole, 1150 RPM  
 4 = 50 Hz, 2 pole, 2900 RPM  
 5 = 50 Hz, 4 pole, 1450 RPM

**Material**

ST = Stainless steel, Acero inoxidable

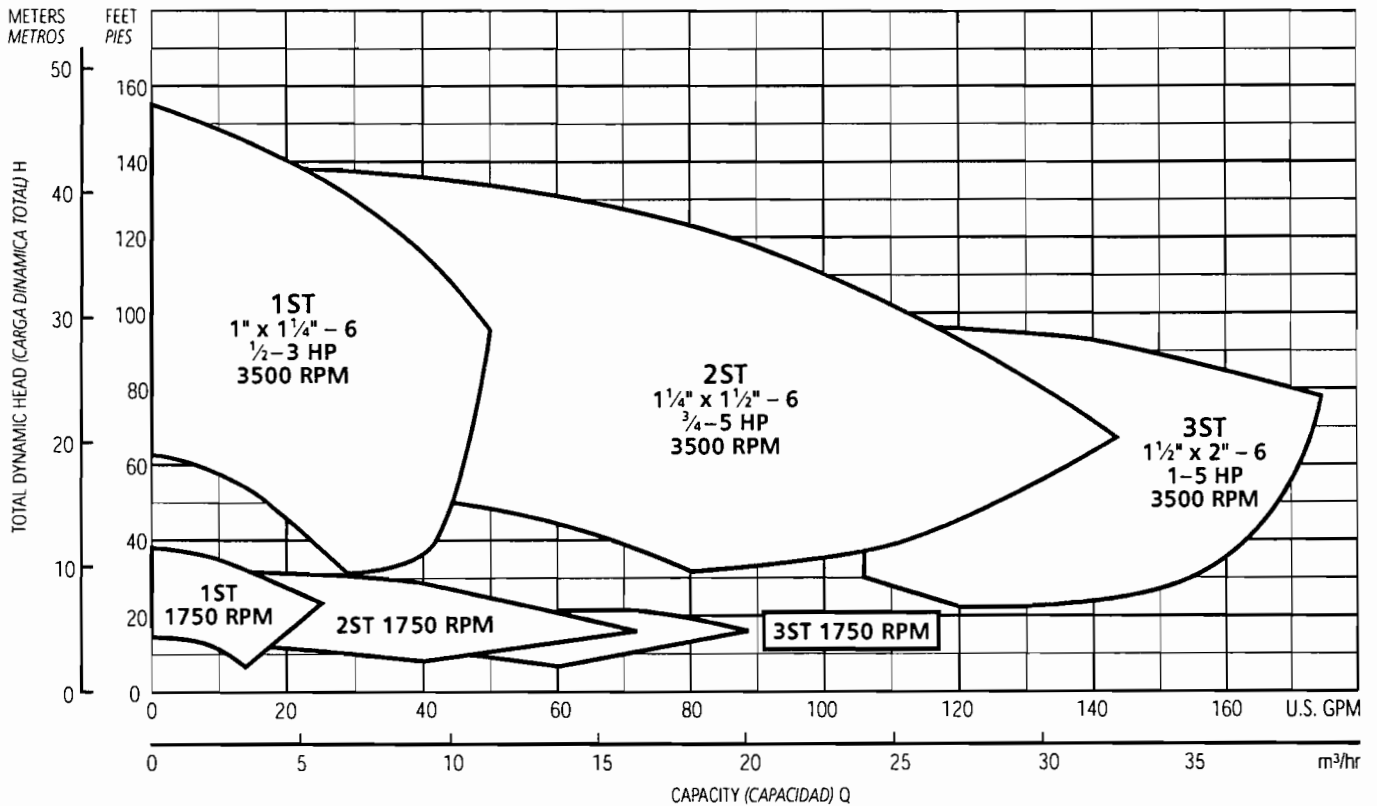
**Pump Size, Tamaño de la Bomba**

1 = 1 x 1¼ - 6

For frame mounted version, substitute the letters "FRM" in these positions.

Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

**Performance Coverage (60 Hz)**  
**Alcance de Funcionamiento (60 Hz)**



**NOTES:**

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds check available service factor.

**NOTAS:**

No se recomienda para funcionamiento superior al impreso en la curva H-Q.

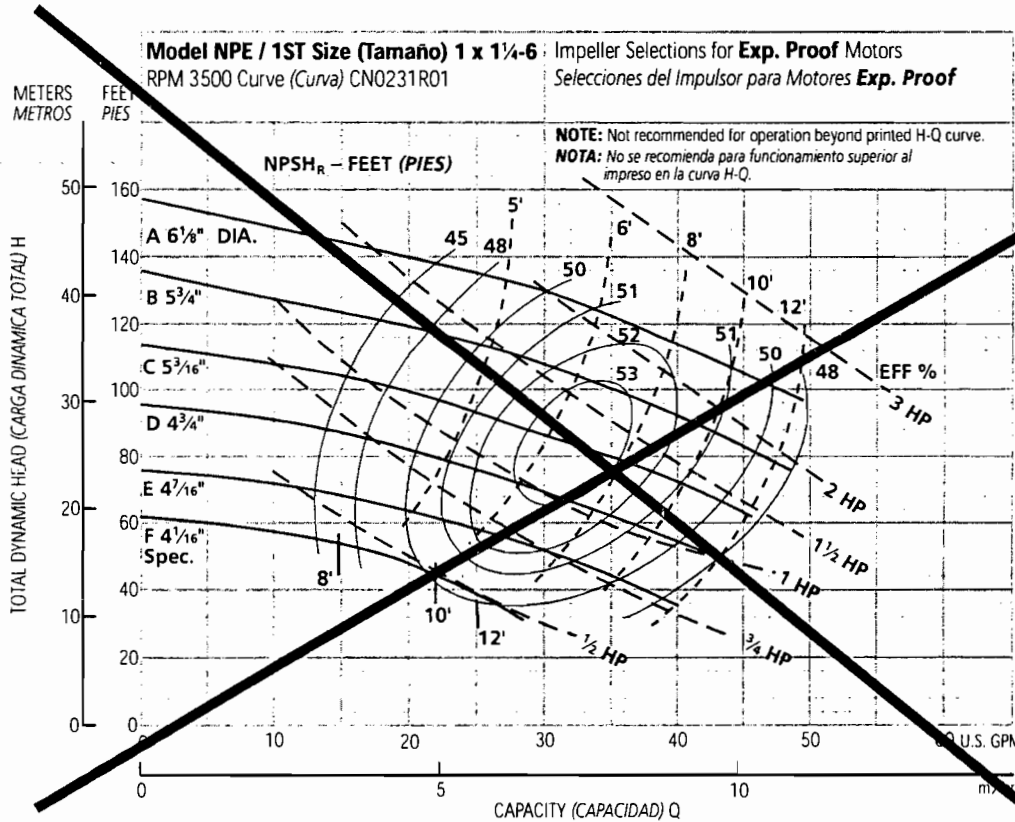
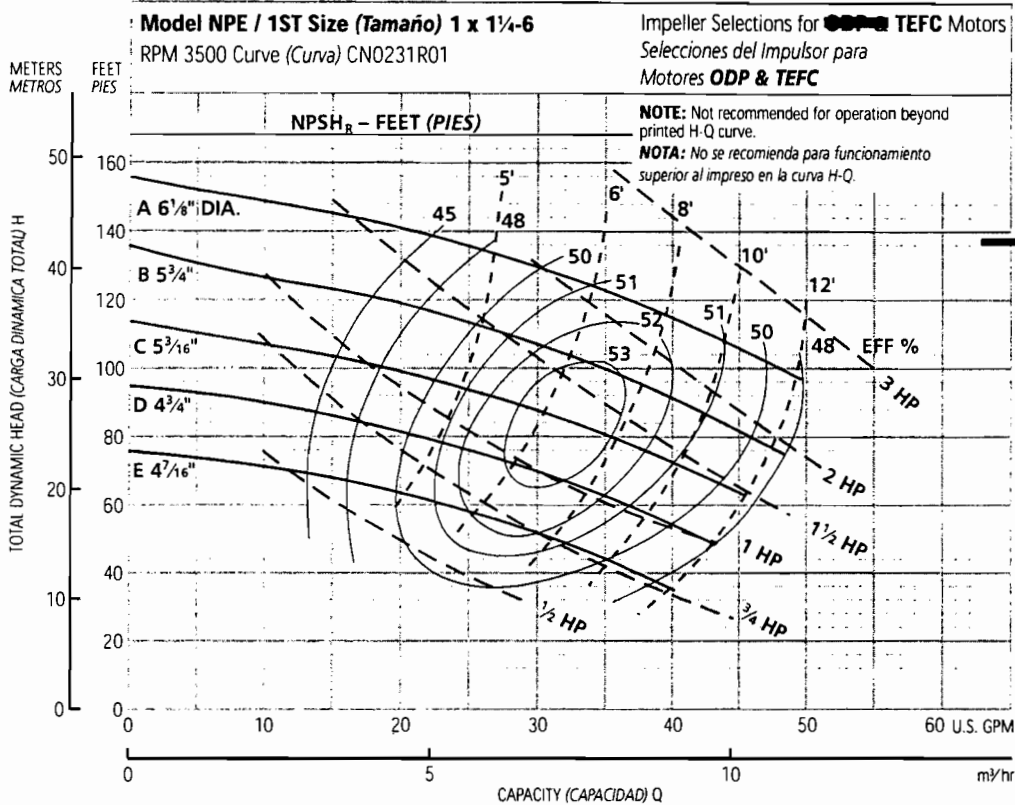
Para condiciones de aplicaciones críticas consultar con la fábrica.

No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds.

**Performance Curves – 60 Hz, 3500 RPM**

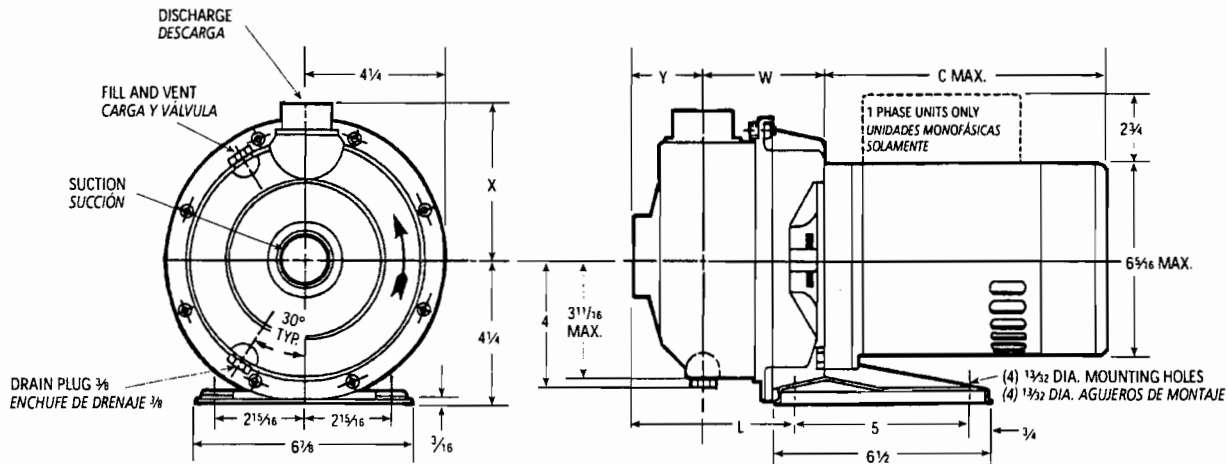
**Curvas de Funcionamiento – 60 Hz, 3500 RPM**



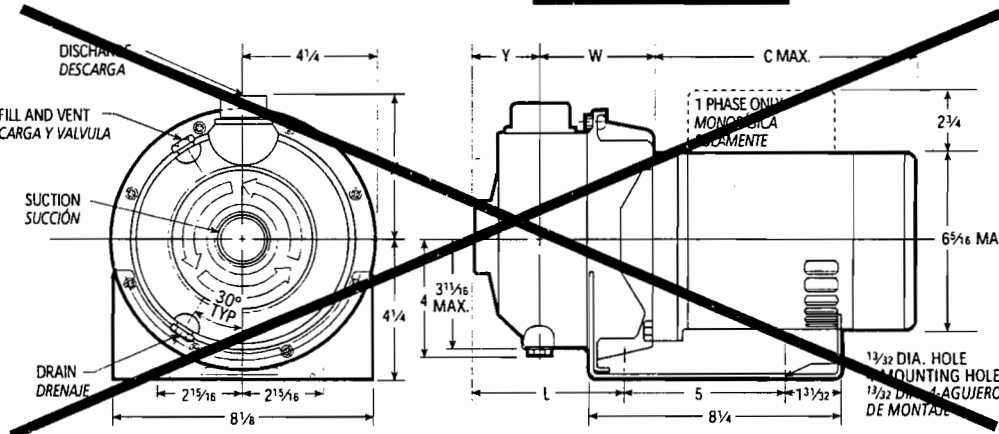
## NPE Close Coupled – Dimensions, Weights and Specifications

### NPE Acople Cerrado – Dimensiones, Pesos y Especificaciones

**Clockwise Rotation Viewed from Drive End**  
**Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor**



~~ODP and TEFC 1/2 and 1 HP~~



~~ODP and TEFC 1 1/2, 2 and 3 HP, ODP y TEFC 1 1/2, 2 y 3 HP~~

## Specifications

### Especificaciones

#### Capacities to:

75 GPM (283L/min) at 1750 RPM  
 150 GPM (550L/min) at 3500 RPM

#### Heads to:

39 feet (12 m) at 1750 RPM  
 150 feet (46 m) at 3500 RPM

#### Working pressures to:

125 PSIG (9 bars)

#### Maximum temperatures to:

212°F (100°C) with standard seal or  
 250°F (121°C) with optional high  
 temperature seal.

#### Direction of rotation:

Clockwise when viewed from  
 motor end.

#### Motor specifications:

NEMA 56J frame, 1750 RPM,  
 1/2 HP. 3500 RPM 1/2 through 5 HP.  
 Open drip-proof, totally enclosed  
 fan-cooled or 2 HP explosion proof  
 enclosures. Stainless steel shaft  
 with ball bearings.

**Single phase:** Voltage 115/230  
 ODP and TEFC. (3 HP model –  
 230 V only) Built-in overload with  
 auto-reset provided.

**Three phase:** Voltage 208-230/  
 460 ODP, TEFC and EX PROOF.

**NOTE:** For three phase motors,  
 overload protection must be  
 provided in starter unit. Starter and  
 heaters must be ordered separately.

#### Capacidades:

75 GPM (283L/min) a 1750 RPM  
 150 GPM (550L/min) a 3500 RPM

#### Cargas:

39 pies (12 m) a 1750 RPM  
 150 pies (46 m) a 3500 RPM

#### Presión de trabajo:

125 PSIG (9 bars)

#### Temperatura máxima:

212°F (100°C) con sello estándar o  
 250°F (121°C) con sello opcional  
 para alta temperatura.

#### Dirección de rotación:

En dirección de las agujas del reloj  
 visto desde el extremo final del  
 motor.

#### Motores:

Armazón 56J NEMA, 1750 RPM  
 1/2 HP. 3500 RPM 1/2 a 5 HP.

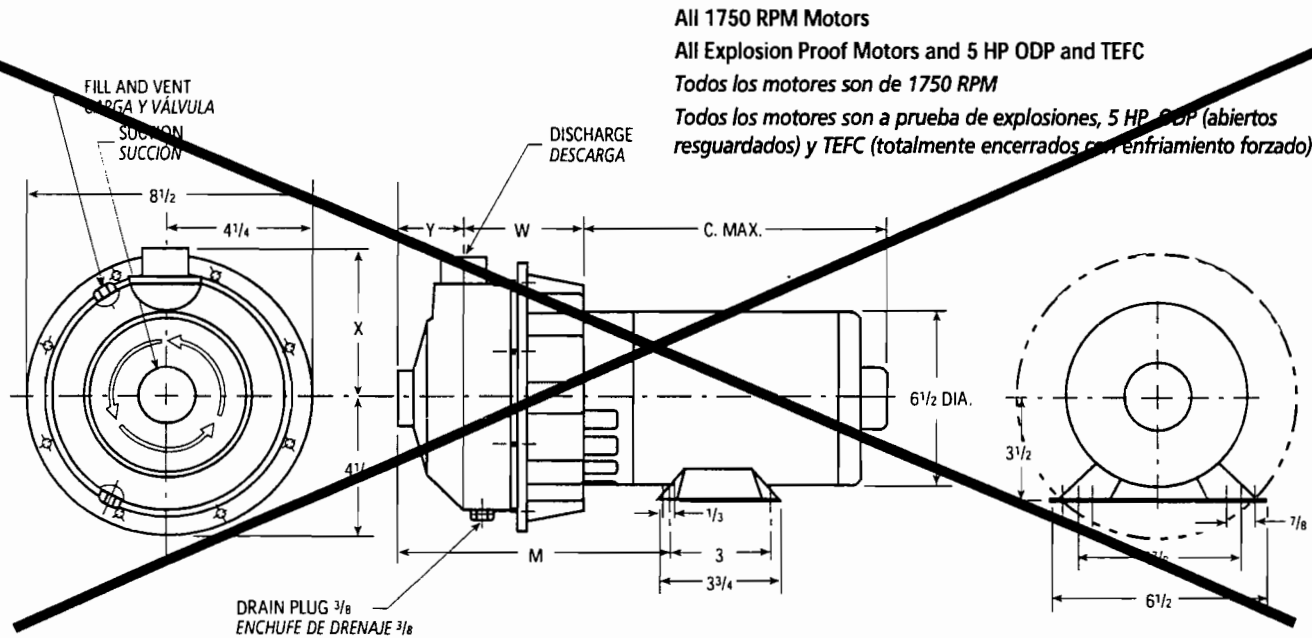
Cubiertas abiertas resguardadas,  
 totalmente encerradas enfrías por  
 ventilador o a prueba de explosiones  
 de 2 HP. Eje de acero inoxidable con  
 balineras de bolas.

**Monofásicos:** Voltaje 115/230  
 ODP y TEFC. (modelo 3 HP – 230  
 voltios solamente) Se proporciona  
 protección térmica contra sobrecarga  
 construida con reseteo automático.

**Trifásicos:** Voltaje 208-230/460  
 ODP, TEFC y EX PROOF.

**NOTA:** Para motores trifásicos se  
 debe de proporcionar la protección  
 térmica contra sobrecarga en la  
 unidad de arranque. El arranador y  
 los calentadores se deben pedir por  
 separado.

**NPE Close Coupled with Footed Motor, 1750 RPM and Explosion-proof Motors**  
**NPE Acople Cerrado con Motor con Patas, 1750 RPM y Motores a Prueba de Explosión**



All 1750 RPM Motors

All Explosion Proof Motors and 5 HP ODP and TEFC

Todos los motores son de 1750 RPM

Todos los motores son a prueba de explosiones, 5 HP ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado)

**Dimensions – Determined by Pump,**  
**Dimensiones – Determinadas por la Bomba**

Pump, Bomba	Suction, Succión	Discharge, Descarga	HP	W	X	Y	L	M
1ST	1 1/4	1	1/2 – 3	3 5/16	4 3/8	2	4 9/16	7 1/16

**Available Motor Weights and Dimensions,**  
**Pesos y Dimensiones Disponibles del Motor**

HP	Motor Weights, Pesos del Motor						C Max. Length, (Longitud)
	1 Phase, Monofásicos			3 Phase, Trifásicos			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
1/2	16	21	47	19	18	27	9 15/16
1	21	27	60	21	21	33	11
2	33	39	60	32	33	44	12 1/16
3	40	43	—	41	37	—	12 7/16
5	42	—	—	42	45	—	14 1/4

Dimensions in inches, weights in pounds.  
 Dimensiones en pulgadas, pesos en libras.

**NOTES:**

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

**NOTAS:**

1. Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.
2. Las dimensiones del motor puede que varíen con los fabricantes.
3. Dimensiones en pulgadas, pesos en libras.
4. Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.
5. No usar para propósitos de construcción sin certificar.



## SECTION 5

## BAG FILTERS



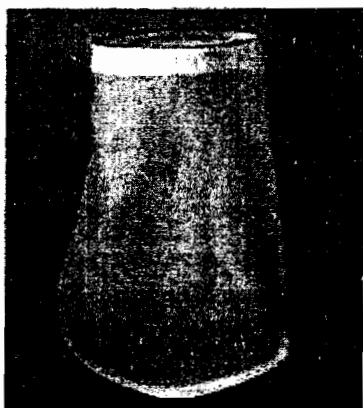
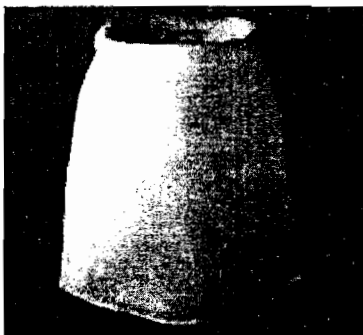
# HOW TO ORDER

Before you order any filtration product from U.F. Strainrite, please call for a price list to use as a guide. The information required to "build a part number"

is listed on each page of the Price List. The sample number below serves as a general guide for FELTS only. Mesh products as well as specialty filter bags

require additional information. Keep in mind that each order number must have a minimum of five parts.

AP	10	P	2	S	HS	*
MATERIAL	MICRON	FINISH	SIZE	RING	OPTIONS	ASTERISK
<p>This one or two letter code describes the material (fiber) used to construct the filtration product. Please see individual pages.</p> <p><b>FELTS:</b></p> <p>AP Polyester            SP Polypropylene            X Viscose            N Nylon            HT Nomex            TE Teflon</p> <p><b>MESHES:</b></p> <p>PEMU Polyester Multi            NMU Nylon Multi            NMO Nylon Mono            PEAO Poly Mono            POMO Polyp Mono</p>	<p>Please check individual material for micron availability. Need technical information to help with a decision regarding your needs, please call.</p> <p style="text-align: center; border: 1px solid black; padding: 5px;">25</p>	<p>This letter indicates either the type of finish applied to the felt or the type of cover. Again, see individual page for ordering information.</p> <p><b>FELTS:</b></p> <p>P Plain (Standard)            S Singed One Side            B Singed Both Sides            C Cerex Cover            H Nylon Cover</p> <p><b>MESHES:</b></p> <p>P Plain (Standard)</p>	<p>This number indicates the filter bag size. Most bags fit into standard categories; however, special sizes are available. Please refer to the price list for all sizes.</p> <p><b>MOST COMMON:</b></p> <p>1 7.0" x 16.0"            2 7.0" x 30.5"            3 4.08" x 8.6"            4 4.08" x 14.0"            30 4.118" x 10.0"            65 4.118" x 22.0"            612 5.5" x 13.0"            618 5.5" x 19.0"            630 5.5" x 31.0"</p>	<p>These letters describe the ring type to be used. Please read ring options on each page. All standards available.</p> <p><b>RINGS:</b></p> <p>S Carbon Steel            SS Stainless Steel            SR Seal Rite            SR-2 Seal Rite(2sides)            SR-3 Flange type            SR-5 Flange type            DS Draw String            PO Polypropylene            N No Ring</p>	<p>This item indicates a specific option choice - Handle, Multi-Column, Extended Life. Please check individual pages of Strainrite Price List for additional information or ask Customer Service.</p>	<p>This last item is added to a part number to indicate that there is additional information which <b>MUST BE</b> added to the order before it can be manufactured. As many orders require customization, the asterisk provides all of the additional specifications needed to fulfill an order.</p>



FELTS

MATERIAL/MICRON RATING	
	0.5 1 3 5 10 15 25 50 75 100 125 150 200
Viscose	X X X X X X X X
Polypropylene	X X X X X X X X
Polyester	X X X X X X X X X X X X
Nomex	X X X X X X X X

Other Materials and Microns available by special request

MESHES

MONO- and MULTIFILAMENTS	
Nylon monofilament (NMO)	5, 10, 25, 35, 50, 75, 100, 125, 150, 200, 250, 300, 400, 600, 800
Polyester monofilament (PEMO)	5, 10, 25, 35, 50, 75, 100, 150, 200, 250, 300, 400, 600, 800
Polypropylene monofilament	30, 50, 100, 150, 200, 300, 400, 600, 800
Polyester multifilament(PEMU)	100, 125, 150, 200, 250, 300, 400, 600, 800
Nylon multifilament(NMU)	100, 125, 150, 200, 250, 300, 400, 600, 800

# MEDIA INFORMATION

**S**trainrite provides the most complete range of standard liquid filter bags available in the marketplace today. High quality products for almost every application and efficiency requirement imaginable, Strainrite manufactures filter bags to fit not only their own high quality filter housings, but also those of other manufacturers. The complete line of conventional filter bags are available in a wide range of sizes and materials.

## BASIC MATERIALS:

**FELT:** A versatile fabric available in numerous micron ratings. Felt's three dimensional construction creates a fabric with low density and high permeability. These features offer longer life bags with greater flow rates and increased dirt holding capacity. Unlike woven fabrics with low permeability (only 20-30 percent useable surface area), felts provide depth for greater particle retention and generally the best cost per

gallon filter bag on the market today. Felt fabrics include: Polyester, Polypropylene, Nylon, Viscous, Teflon and Nomex.

**MULTIFILAMENT MESH:** This low cost, disposable woven material is available in a wide range of micron ratings. Good in applications where felt is not suitable.

**MONOFILAMENT MESH:** This woven material is both strong and efficient and offers many micron ranges where felt is not available.

With advanced manufacturing capabilities, U.F. Strainrite can provide the perfect replacement filter bag for your particular application. Help us build a part number for your application by picking one designation from each of the categories on previous page, or call our Customer Service department for assistance. We offer experienced technical support for all of your questions about liquid filtration.

## TYPICAL APPLICATIONS

Acids	Hydraulic liquids
Adhesives	Inks
Alkalines	Machinery cooling liquids
Alcohols	
Amines	Magnetic coatings
Beverages	Membrane protection
Beer	
Chemicals	Mineral oils
Coating Products	Oil & gas industry
Cooling Water	Paints
Cosmetics	Pharmaceuticals
Drinking Water	Photochemicals
E-coats	Process water
EDM - oils	Resins
Electroplating solutions	Semiconductors
Emulsions	Silicones
Esters	Soft drinks
Food	Sugar
Fructose	Vinegar
Glycols	Water
Glues	Well/spring water
Greases and oils	Wine
Giardia cysts	

## Properties of Filter Media

		Max. Operating Temperature	Operating Pressure	General Filtration Applications
Filter Bag Material	Rayon Viscose	250°F	*	Solvents, petroleum products, organic acids and alcohols
	Polypropylene Agents	200°F	*	Strong acids & bases, salt solutions, oxidizing & reducing
	Nylon	300°F	*	Solvents, petroleum products
	Nomex	400°F	*	Solvents, weak acids and bases
	Wool	200°F	*	Animal & vegetable oils, petroleum products, solvents
	Polyester	300°F	*	Solvents, petroleum products, weak acids & bases
Vessel	Carbon Steel	650°F	150/300	Most chemicals except dilute acids and some salt solutions
	SS 304 & 316	450°F	150/300	Superior chemical resistance to above
"O" Ring	Buna N	250°F		Animal & vegetable oils, petroleum products
	Ethylene Propylene	300°F		Strong acids and bases; animal & vegetable oils
	Neoprene	300°F		Oils, fats, greases, salt solutions
	Silicone	500°F		Animal and vegetable oils, oxidizing chemicals
	Teflon™	550°F		All applications
	Thikol	160°F		Petroleum products, animal & vegetable oils, ethers
	Viton A™	400°F		Solvents, strong acids, animal & vegetable oils

\* 75 psi ΔP for closed systems.



## SECTION 6

# AIR STRIPPER SYSTEM



**CARBONAIR**  
ENVIRONMENTAL SYSTEMS

2731 Nevada Avenue North  
New Hope, MN 55427-2806  
800-526-4999 Toll-free  
612-544-2154 Voice  
612-544-2151 Fax

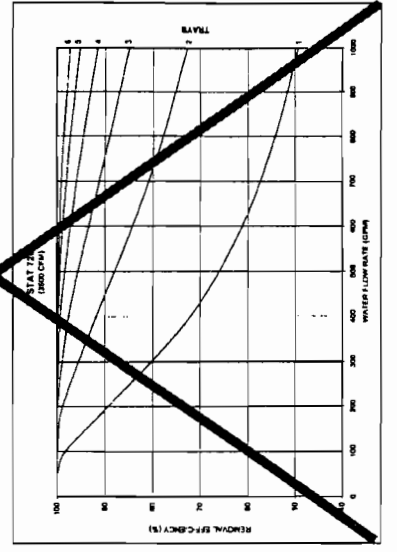
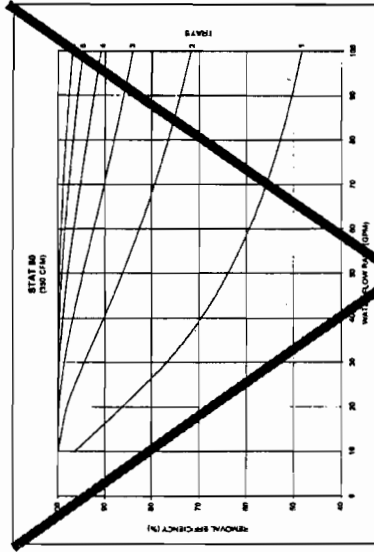
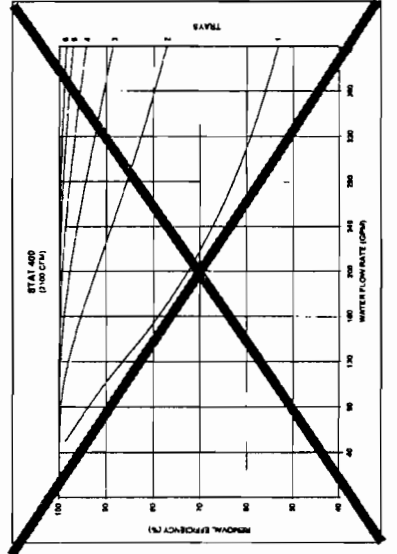
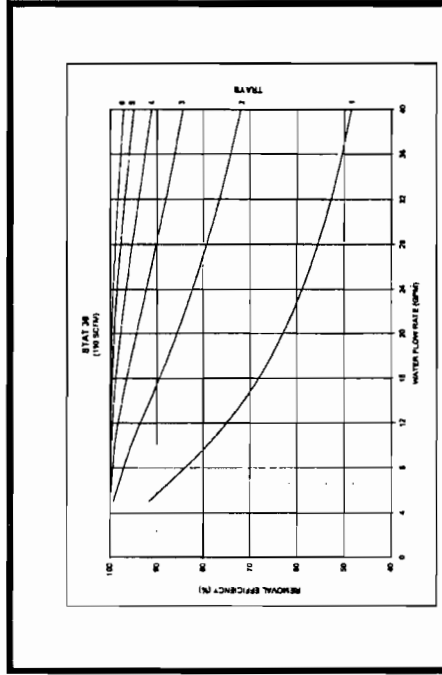
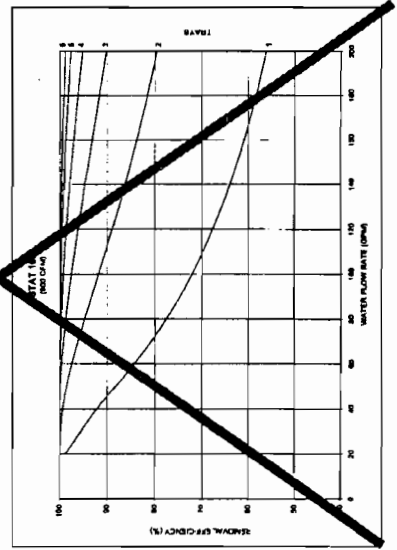
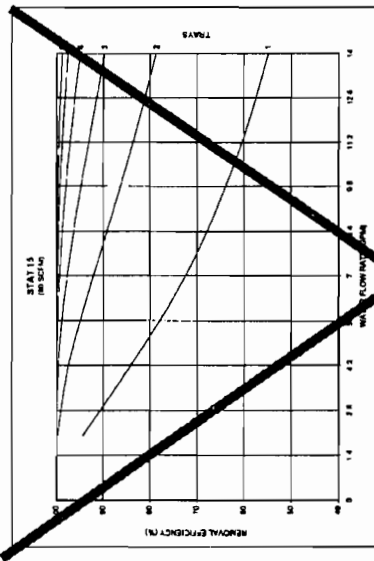
[www.carbonair.com](http://www.carbonair.com)

### Specifications

Model	STAT 30	STAT 60	STAT 100	STAT 160	STAT 260
Tray dimensions (LxWxH; inches)	36x12x10	48x24x10	72x36x12	120x48x12	144x72x12
Sump holding capacity (gallons)	30	70	250	560	1000
Maximum height (inches) *	96	97	120	122	130
Liquid flow (gpm)	0.5-1.0	5-80	10-300	20-400	40-1000
Minimum air flow (cfm)	100	300	650	1800	3000
Maximum air flow (cfm)	150	350	900	2100	4000

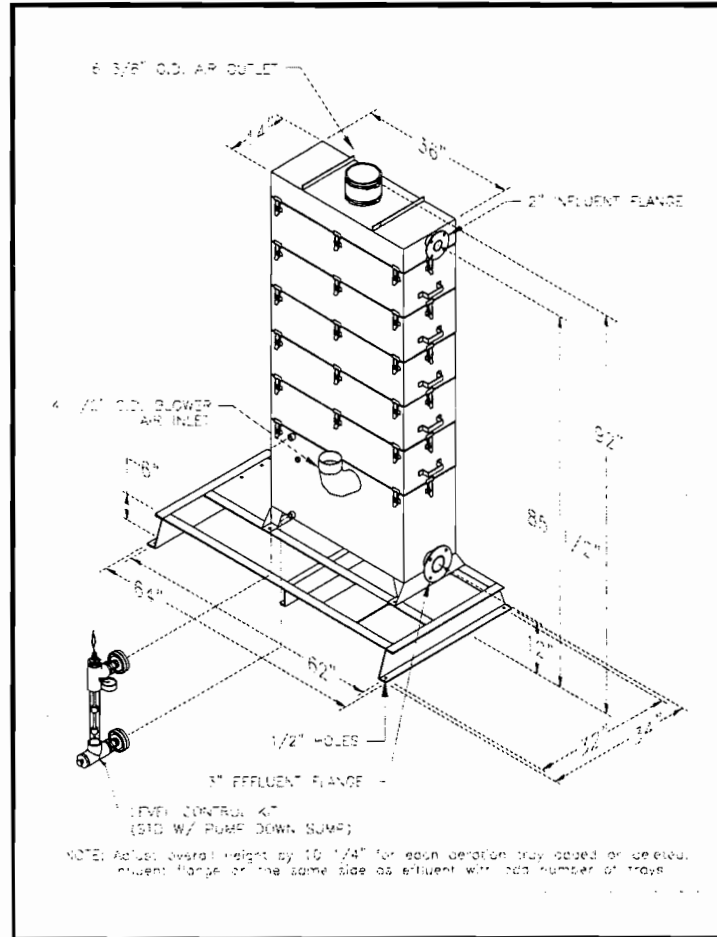
\*Six-tray STAT without skid

Benzene removal efficiency at 55° F predicted by computer modeling.



## STAT SERIES LOW PROFILE AIR STRIPPERS

### STAT 30



#### Specifications

- 6 tray
- XP pump out (single phase)
- XP blower (single phase)
- Air flow kit
- Control panel
- Skid mounted

Tray Dimensions (LxWxH; inches)	36x12x10
Sump holding capacity (gallons)	30
Maximum height (inches)*	96
Liquid flow (gpm)	1-35
Minimum air flow (cfm)	100
Maximum air flow	150

\*Six-tray STAT without skid



#### MINNESOTA: (corp hqtrtrs)

Carbonair  
2731 Nevada Ave. N.  
New Hope, MN 55427  
PH: 800-526-4999  
763-544-2154  
FAX: 763-544-2151  
Homepage: [www.carbonair.com](http://www.carbonair.com)

#### FLORIDA:

Carbonair  
2603 NW 74th Place  
Gainesville, FL 32653  
PH: 800-241-7833  
352-376-9528  
FAX: 352-373-4971

#### VIRGINIA:

Carbonair  
761 Union Street  
Salem, VA 24153  
PH: 800-204-0324  
540-387-0540  
FAX: 540-389-6860

#### TEXAS:

Carbonair  
4105 Hunter Rd. #10  
San Marcos, TX 78666  
PH: 800-893-5937  
512-392-0085  
FAX: 512-392-0066

# Twin City Fan & Blower

BULLETIN 1250

April 2001

## TURBO PRESSURE BLOWERS

100 to 1000 CFM and 10 to 100 PSIG



# TBN Turbo Pressure Blowers

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## Introduction

The TBN series of fans are low volume, high-pressure blowers designed for stable operation throughout their operating range. Multiple outlet sizes and wheel diameters allow the most efficient selections across a wide range of operating points. These units incorporate a high efficiency wheel design at an economical price.

## Typical Applications

- Pneumatic conveying
- Exhausting
- Combustion air
- Air knives
- Chemical processes
- Thermal oxidation
- Aeration
- Seal air

## Capabilities

- Static pressures to 57" w.g.
- Airflow capabilities to 5400 CFM
- High temperature applications to 600°F

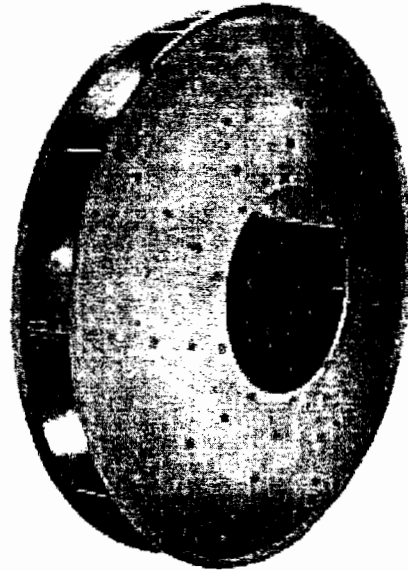
## Wheel Construction

### TBNA

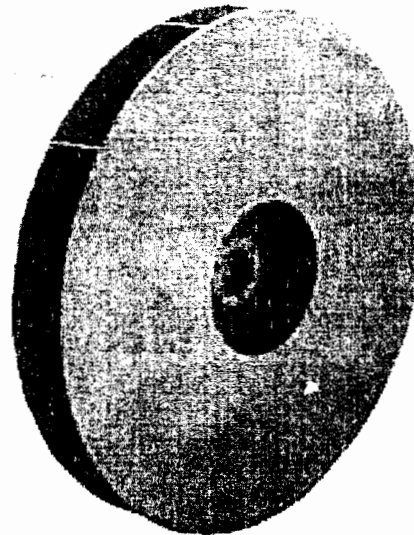
The TBNA offers a radial air handling wheel of riveted aluminum construction. A standard split taper-lock bushing allows for easy wheel removal from shaft. This wheel is available in both narrow "N" and wide "W" widths for optimum performance and high efficiency. The TBNA is designed to handle clean air applications with temperatures up to 200°F. The TBNA wheel is a non-reversible design.

### TBNS

The TBNS is an all welded radial design steel wheel that is available in a variety of special materials. The TBNS wheel is furnished with a split taper-lock bushing for easy removal and maintenance. This wheel is available in both narrow "N" and wide "W" widths to meet specific performance requirements. The TBNS is designed to handle fumes, light particulates, and temperatures up to 600°F. The TBNS design is less efficient than the TBNA and requires a BHP correction. See the table in the Engineering Data section for correction factors. The TBNS wheel is a reversible design.



*TBNA Aluminum Wheel*



*TBNS Steel Wheel*

## Housing Construction

All TBN fans come standard with heavy gauge, continuously welded steel housings and pedestals for rugged, heavy duty, long term service. All housings are reversible and rotatable. TBN fans come standard with an inlet venturi with screen and a round punched flanged outlet connection.

©2001 Twin City Fan Companies, Ltd.

Bulletin illustrations cover the general appearance of Twin City Fan & Blower products at the time of publication and we reserve the right to make changes in design and construction at any time without notice.

# Arrangements

## Arrangement 1 (Belt Driven)

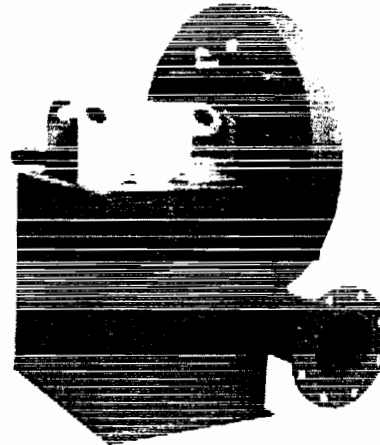
The fan wheel on an Arrangement 1 is overhung on the shaft, i.e., mounted at the end of the shaft. The motor can be mounted in any of the four AMCA standard motor positions, W, X, Y or Z. The two fan bearings are mounted on the bearing pedestal, out of the airstream.

### Maximum Temperatures:

200°F Aluminum Wheel - TBNA

300°F Steel Wheel - TBNS

600°F High Temperature Construction - TBNS



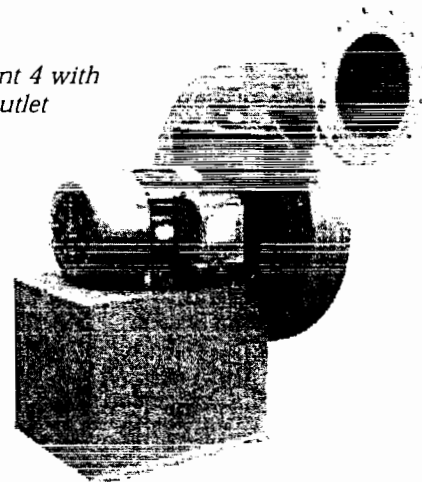
*Arrangement 1  
with Optional  
Shaft & Bearing  
Guard*

## Arrangement 4 (Direct Drive)

The fan wheel on an Arrangement 4 is mounted directly on the motor shaft with the motor mounted on a pedestal. An Arrangement 4 offers a compact, low maintenance design, as there are no fan bearings, fan shaft or drive parts to maintain.

**Maximum Temperature:** 180°F.

*Arrangement 4 with  
Punched Outlet  
Flange*



## Arrangement 8 (Direct Drive)

An Arrangement 8 is a modified version of an Arrangement 1 used for direct drive. The bearing pedestal is extended to accommodate the motor. A flexible coupling connects the fan and motor shaft.

### Maximum Temperatures:

200°F Aluminum Wheel - TBNA

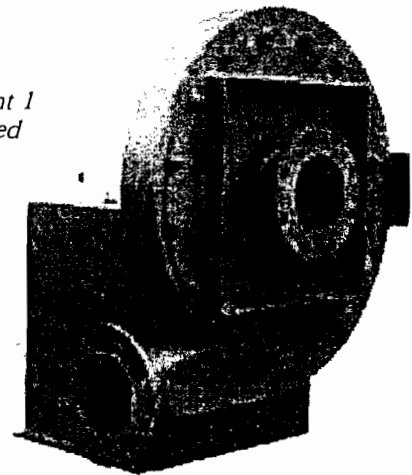
300°F Steel Wheel - TBNS

600°F High Temperature Construction - TBNS

*Arrangement 4  
with Inlet Venturi  
& Screen*



*Arrangement 1  
with Punched  
Inlet Flange*





# Inlet and Outlet Connections/Accessories

## Inlet Connections

The following inlet connections are available at no additional charge:

### Inlet Venturi with Screen

Recommended for all non-ducted inlet installations to obtain catalog performance. Unless otherwise specified, an inlet venturi with screen will be furnished.

### Flanged Inlet

For bolted pipe or duct connections. Flanged inlet is punched to ANSI 125/150 hole pattern.

### Inlet Pipe Assembly

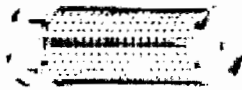
For slip-on pipe or duct connections.

## Inlet Accessories

The following optional inlet side accessories are available:

### Inlet Filter

Cleanable wire mesh filter with mounting assembly. Filter suitable for atmospheric air only and cannot be used in a ducted inlet application. Fan must be specified with flanged inlet.



### Inlet Filter With Hood

Inlet filter described above with a hood to protect against the elements.

### Inlet Silencer

Welded steel construction with acoustical absorption material to reduce noise emanating from fan inlet. Flanged connection is suggested for mounting to the inlet of the fan. The opposite end of the silencer can be furnished with an inlet venturi, inlet flange, or inlet pipe assembly. Unless otherwise specified, the silencer will be furnished with flanges (punched) at both ends.



## Outlet Connections

### Flanged Outlet

Outlet flange punched to ANSI 125/150 hole pattern for bolted connection is standard.

### Plain Pipe Outlet

An optional plain pipe outlet is available for slip type connections. Refer to the dimensional drawings.

## Outlet Accessories

The following optional outlet side accessories are available:

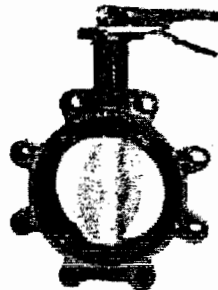
### Flexible Connector for Flanged Outlet

Companion flange with rubber sleeve and clamps offers flexible connection between the fan and outlet ductwork. Flexible rubber sleeve is good to 200°F operation.



### Flexible Connector for Plain Pipe Outlet

Rubber sleeve with clamps for fans ordered with optional plain pipe outlet.

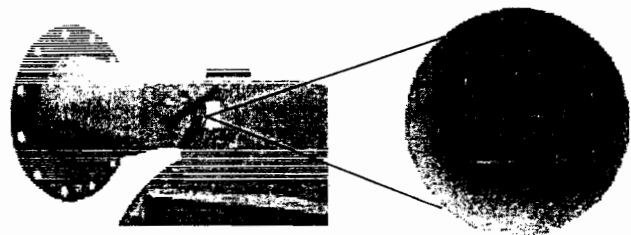


### Outlet Blast Gate

A wafer-type butterfly valve for mounting to outlet flange allows controlling flow to full shutoff. Available for automatic control. Maximum temperature 250°F.

### Built-in Outlet Damper

A low cost single blade damper installed near the discharge of the fan housing for volume control where moderate leakage can be allowed. Available for manual control only.



### Outlet Silencer

Reduces noise emanating from fan outlet. Construction similar to inlet silencer.

## Accessories

---

### Shaft Closure Plate

Aluminum plate to reduce air leakage from the fan housing.

### Shaft Seal

Standard shaft seal is a ceramic felt material sandwiched between the housing and an aluminum retaining plate. Seal is good to 600°F. Shaft seal does not make fan gas tight.



### Drain

Standard 3/4" NPT half coupling located at the lowest point of the housing. Available with or without plug.

### Inspection Port

Heavy duty bolted panel provides access for wheel inspection.

### Shaft & Bearing Guards

OSHA style to enclose the shaft and bearings. Painted safety yellow.

### Belt Guards

OSHA style to enclose the V-belt drive. Painted safety yellow.

### Coupling Guards

OSHA style to enclose the coupling. Painted safety yellow.

### Unitary Base

Steel structural base for mounting fan and motor on common structure.

### Isolation Base

Unitary base with 1" deflection isolators. Not recommended for Arr. 8.

### Inertia Base

Steel structural base complete with 1" deflection isolators and rebar. Concrete by others. Available for all arrangements.

### Vibration Rails

Available for Arrangement 4 with RIS isolators.

### Motors

Twin City Fan & Blower provides and recommends 3600 RPM motors with cast housings and cast feet or with a full length fabricated steel base for trouble-free operation.

## Optional Construction

---

### High Temperature Construction

Available for Model TBNS only.

301 to 500°F Package includes shaft seal, shaft cooler with guard, high temperature grease, and TCF blue enamel paint.

501 to 600°F Package includes shaft seal, shaft cooler with guard, high temperature grease, and high temperature aluminum paint.

Special Materials Stainless steel and other special alloys are available in the type TBNS radial design.

### Spark Resistant Construction

Available for Model TBNA only. Fan applications may involve the handling of fumes or vapors. Such applications require careful consideration by the system

designer to insure the safe handling of such gases. Twin City Fan & Blower offers the following classifications of spark resistant construction per AMCA Standard 99-0401-86. It is the specifier's or the user's responsibility to specify the type of spark resistant construction with full recognition of the potential hazards and the degree of protection required.

### Construction

Type A All parts of the fan in contact with the airstream must be made of nonferrous material — usually aluminum and limited to 200°F.

Type B The fan shall have a nonferrous wheel and nonferrous rub ring about the opening through which the shaft passes — usually aluminum wheel and rub ring and limited to 200°F.

Type C Not available.

# Engineering Data

## Steel Wheel (TBNS) Horsepower Correction Factors

(Increase BHP from curves when using steel wheel)

SIZE	BHP CORRECTION FACTOR
14N to 18N	1.03
19N to 22N	1.14
23N to 26N	1.10
23W to 26W	1.10

## Pressure Conversions

MULTIPLY	BY	TO OBTAIN
PSI	27.7123	IN. W.G.
PSI	16	OSI
OSI	1.732	IN. W.G.
OSI	0.0625	PSI
IN. W.G.	0.57737	OSI
IN. W.G.	0.03609	PSI

PSI = Pounds per square inch  
OSI = Ounces per square inch  
IN. W.G. = Inches water gauge

## Wheel Weights and $WR^2$ (moment of inertia in lb-ft<sup>2</sup>)

SIZE	WHEEL			
	TBNA (ALUMINUM)		TBNS (STEEL)	
	WT. (LB)	WR <sup>2</sup> (LB-FT <sup>2</sup> )	WT. (LB)	WR <sup>2</sup> (LB-FT <sup>2</sup> )
14N	10.5	3.3	13.1	1.9
14W	10.5	4.0	12.8	2.0
15N	10.6	3.4	14.6	2.5
15W	10.6	4.1	14.6	2.7
16N	10.7	3.5	16.5	3.2
16W	10.7	4.2	16.5	3.4
17N	10.8	3.7	18.0	4.0
17W	10.9	4.5	18.5	4.3
18N	11.0	3.9	19.8	5.0
18W	11.1	4.7	20.5	5.4
19N	14.7	8.1	21.7	6.1
19W	14.9	9.7	22.2	6.4
20N	14.8	8.4	23.7	7.4
20W	15.2	10.1	24.1	7.8
21N	15.0	8.8	25.8	9.0
21W	15.2	10.5	26.3	9.4
22N	15.2	9.3	28.0	10.7
22W	15.3	11.2	28.5	11.1
23N	19.8	16.8	43.2	19.3
23W	20.1	21.6	43.7	20.3
24N	20.1	17.5	46.8	22.7
24W	21.5	21.5	47.8	24.1
25N	20.3	18.2	50.6	26.6
25W	21.9	23.4	51.0	28.2
26N	20.5	19.0	54.5	31.0
26W	22.3	24.4	56.1	32.2

## Material Specifications

SIZE	HOUSING			MOTOR BASE	SHAFT DIA. ARR. 1 & 8	BEARING CODE ARR. 1 & 8	MAX. RPM	
	SIDES	SCROLL	FRAME				TBNA	TBNS ①
19 to 22	10 GA.	10 GA.	0.25" x 2"	0.25"	1 7/16	RB	3900	3900

Due to speed and load ratings, bearing substitution is not permitted.  
XHDB = Extra heavy duty ball bearings such as Link Belt P-U319  
RB = Roller bearings such as Link Belt PB22423

① Derating of speed is not required for stainless steel or high temperature construction.

## Bare Fan Weights (Lbs.)

SIZE	ARRANGEMENT 1		ARRANGEMENT 4		ARRANGEMENT 8	
	TBNA	TBNS	TBNA	TBNS	TBNA	TBNS
14N to 18N	202	212	185	195	282	292
19N to 22N	278	292	252	266	395	409
23N to 26N	392	432	366	406	524	564
23W to 26W	445	473	419	447	577	605

## Inlet Suction Pressure Correction

If the inlet pressure is suction or negative, the static pressure required must be corrected by the inlet density ratio.

**Example:** Operating conditions: 70°F at sea level. System resistance at the inlet of the fan is 40".

The correction factor from the table at right is 0.902, or it can be calculated as follows:

$$(407.5 - 40") \div 407.5 = 0.902$$

Equivalent static pressure to be used for selection from the standard performance curves:

$$40" \div 0.902 = 44.36"$$

Actual air density at the inlet of the fan:

$$0.075 \text{ lb/ft}^3 \times 0.902 = 0.0676 \text{ lb/ft}^3$$

### Inlet Suction Pressure Correction Factors

INLET SUCTION PRESSURE (IN. W.G.)	CORRECTION FACTOR
5	0.988
10	0.975
15	0.963
20	0.951
25	0.939
30	0.926

INLET SUCTION PRESSURE (IN. W.G.)	CORRECTION FACTOR
35	0.914
40	0.902
45	0.890
50	0.877
55	0.865
60	0.853

$$\text{Correction Factor} = (407.5 - \text{Inlet Suction Pressure}) \div 407.5$$

# Performance Data

## Selection

The performance curves shown are for type TBNA and are based on standard air density: 70°F at sea level (0.075 lb/ft<sup>3</sup>). A brake horsepower correction factor must be applied for type TBNS (see page 6).

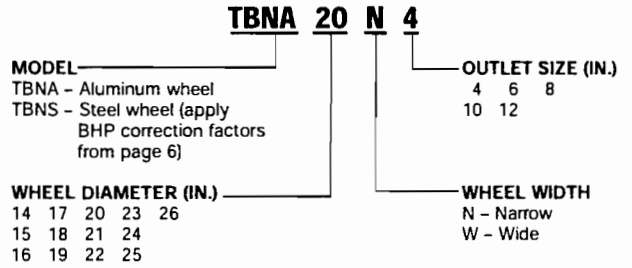
## Selection Steps

1. Locate the CFM required on the horizontal axis.
2. Follow a vertical line up to the fan curve closest to the required SP. This will determine the fan size. The dotted lines represent system characteristic curves.
3. Interpolate BHP.

## Selection Example:

Size = 22N4      RPM = 3500  
 Density = 0.075 lb/ft<sup>3</sup>      Outlet Velocity = 5727 FPM  
 CFM = 500      BHP (TBNA) = 4.85  
 SP = 33.8"      BHP (TBNS) = 4.85 x 1.14 = 5.53

## Model Nomenclature

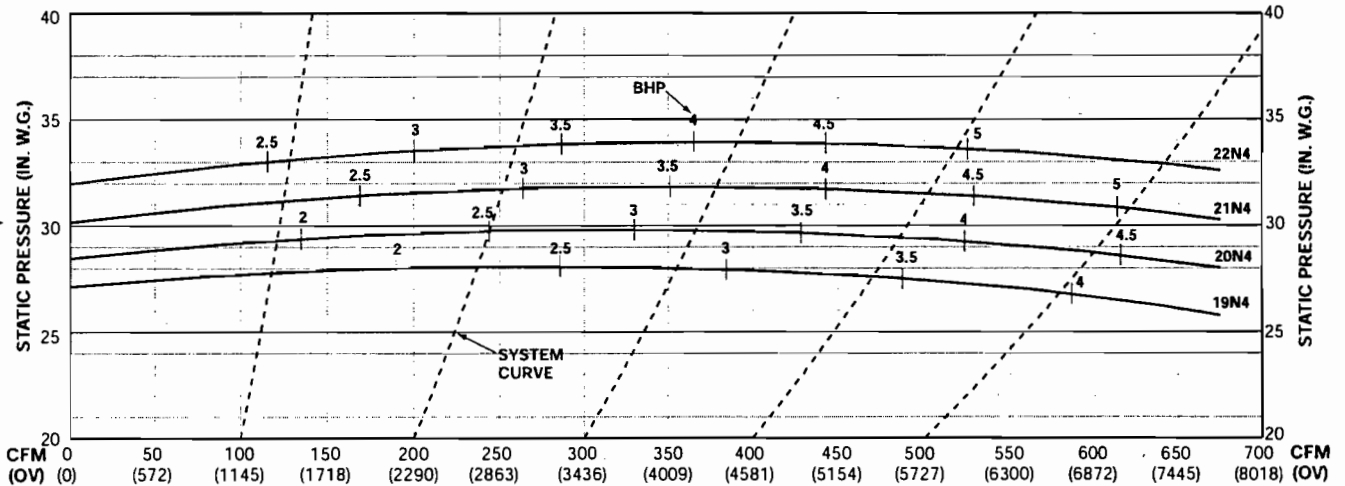


## 4 In. Outlet

Outlet Area: 0.09 ft<sup>2</sup>

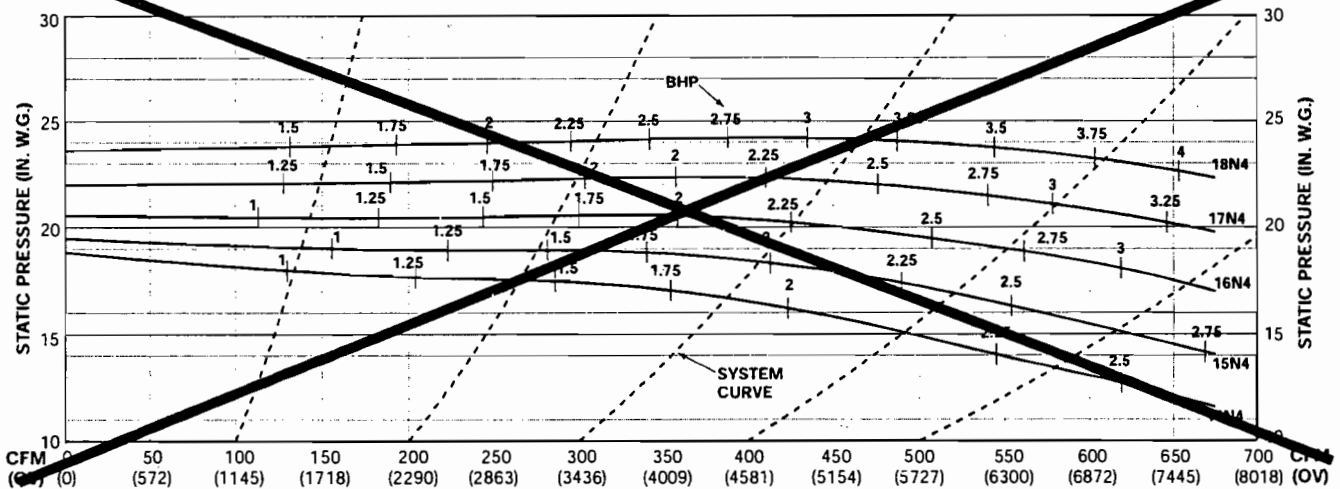
~~19N4, 20N4, 21N4, 22N4~~

3500 RPM



~~14N4, 15N4, 16N4, 17N4, 18N4~~

3500 RPM



Performance shown is with a ducted outlet, and a ducted inlet or inlet with venturi.

# Typical Specifications

---

Fans shall be Type TBNA or TBNS Turbo Pressure Blowers as manufactured by Twin City Fan & Blower, Minneapolis, Minnesota.

**PERFORMANCE** – Fans shall be tested and rated in accordance with industry accepted test codes and shall be guaranteed by the manufacturer to deliver rated published performance levels.

**HOUSING** – Fan housings shall be constructed of continuously welded heavy gauge steel and shall be rotatable and reversible. A choice of inlet connections at no additional charge shall include an inlet venturi with screen, an inlet pipe assembly and a punched flange to ANSI 125/150. The outlet connection shall be flanged and punched to ANSI 125/150 with the option of a plain pipe assembly.

**WHEEL** – Type TBNA wheels shall be constructed of aluminum alloy with riveted construction. Type TBNS wheels shall be constructed of continuously welded heavy gauge steel or from a variety of special materials. Wheels shall be available in narrow and wide widths to meet specific performance requirements. Wheels shall be statically and dynamically balanced. The complete fan assembly shall be test balanced at the operating speed prior to shipment.

**SHAFT (ARR. 1 & 8 ONLY)** – Shafts shall be AISI 1040 or 1045 hot rolled steel, accurately turned, ground, polished, and ring gauged for accuracy. Shafts shall be sized for the first critical speed of at least 1.43 times the maximum speed.

**BEARINGS (ARR 1, 8 ONLY)** – Bearings shall be heavy duty, grease lubricated, anti-friction ball or roller, self-aligning, pillow block type and selected for a minimum average bearing life (AFBMA L-50) in excess of 200,000 hours at the maximum fan RPM.

**FINISH AND COATING** – The entire fan assembly, excluding the shaft, shall be thoroughly degreased and deburred before application of a rust-preventative primer. After the fan is completely assembled, a finish coat of paint shall be applied to the entire assembly. The fan shaft shall be coated with a petroleum-based rust protectant. Aluminum components shall be unpainted.

**ACCESSORIES** – When specified, accessories such as inlet filters, inlet filters with hoods, inlet and outlet silencers, flexible connectors for flanged outlet and plain pipe outlets, outlet blast gates, built-in outlet dampers, shaft closure plates, shaft seals, drains, inspection ports, shaft and bearing guards, belt guards, couplings, coupling guards, unitary bases, isolation bases, inertia bases, and vibration rails shall be provided by Twin City Fan & Blower to maintain one source responsibility.

**FACTORY RUN TEST** – All fans prior to shipment shall be completely assembled and test run as a unit at operating speed or maximum RPM allowed for the particular construction type. Each wheel shall be statically and dynamically balanced to in accordance with ANSI/AMCA 204-96 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. Balance readings shall be taken by electronic type equipment in the axial, vertical, and horizontal directions on each of the bearings. Records shall be maintained and a written copy shall be available upon request.

**GUARANTEE** – Manufacturer shall guarantee the workmanship and materials for its Turbo Pressure Blowers for at least one (1) year from startup or eighteen (18) months from shipment, whichever occurs first.



# SMALL COMPACT FILTER SILENCERS WITH STANDARD FILTER DESIGN

"FS" Series 1/2" - 3" MPT

## APPLICATIONS

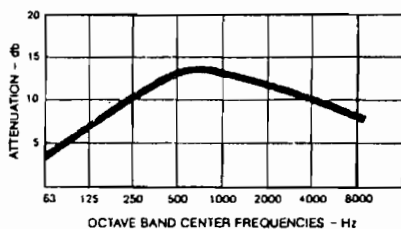
- Industrial & Severe Duty
- Piston Compressors
- Screw Compressors
- Blowers - Side Channel & PD Type
- Hydraulic Breathers - fine filtration
- Engines
- Construction/Contractor Industry
- Workshop
- Medical/Dental Industry
- Pneumatic Conveying
- Waste Water Aeration
- Sparging

## FEATURES & SPECIFICATIONS

- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron
- Fully drawn weatherhood - no welds to rust or vibrate apart
- Tubular silencing design - tube is positioned to maximize attenuation and air flow while minimizing pressure drop
- Durable carbon steel construction with baked enamel finish and powder coated weatherhood
- Interchangeable elements: Polyester, Paper
- Low pressure drop center bracket and outlet pipe design
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 10"-15" H<sub>2</sub>O Over Initial Delta P
- Pressure drop graphs available upon request

FILTER SILENCERS  
FS, MBFS, QB, 2G, SLGR Series

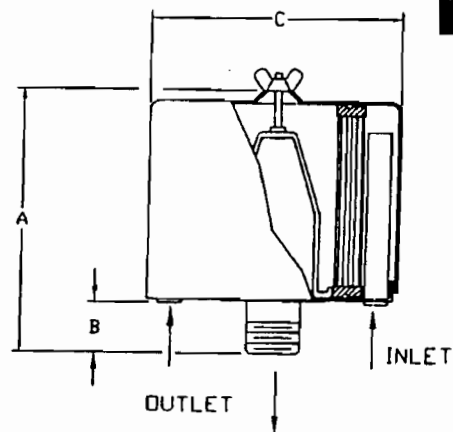
TYPICAL NOISE ATTENUATION - FS SERIES



• Noise attenuation may vary due to the wide range of applications and machines

## OPTIONS (Inquiries Encouraged)

- Various media available
- 1/8" & 1/4" tap holes
- Pressure Drop Indicator
- Available in **Stainless Steel**
- Epoxy coated housings
- Hot dipped galvanized housings
- Special connections, NPT



Dimension tolerance  $\pm 1/8"$

**I = Industrial Duty S = Severe Duty**

	with Polyester Element	with Paper Element	MPT Outlet	DIMENSIONS - inches			Rated Flow SCFM			No. of Tubes	Approx. Wt. lbs
				A	B	C	Piston	Screw, Blower, Fan	Element Rating		
I	FS-15-050	FS-14-050	1/2"	4	1 1/2	6	10	10	35	1	2
I	FS-15-075	FS-14-075	3/4"	4	1 1/2	6	20	25	35	2	2
I	FS-15-100	FS-14-100	1"	4	1 1/2	6	25	35	35	3	2
S	FS-19P-100	FS-18P-100	1"	6 5/8	1 5/8	6	35	55	100	3	3
I	FS-19P-125	FS-18P-125	1 1/4"	6 5/8	1 5/8	6	55	70	100	5	3
I	FS-19P-150	FS-18P-150	1 1/2"	6 5/8	1 5/8	6	70	85	100	5	4
I	FS-31P-200	FS-30P-200	2"	7 1/4	2 1/4	10	85	135	195	5	8
<del>I</del>	<del>FS-231P-200</del>	<del>FS-230P-200</del>	<del>2"</del>	<del>12 1/4</del>	<del>2 1/4</del>	<del>10</del>	<del>105</del>	<del>105</del>	<del>300</del>	<del>7</del>	<del>11</del>
I	FS-31P-250	FS-30P-250	2 1/2"	7 1/4	2 1/2	10	100	195	195	5	8
<del>I</del>	<del>FS-231P-250</del>	<del>FS-230P-250</del>	<del>2 1/2"</del>	<del>12 1/2</del>	<del>2 1/2</del>	<del>10</del>	<del>105</del>	<del>105</del>	<del>300</del>	<del>8</del>	<del>15</del>
I	FS-231P-300	FS-230P-300	3"	13	3	10	200	300	300	9	15

Solberg - Where the Best is in Store for You!

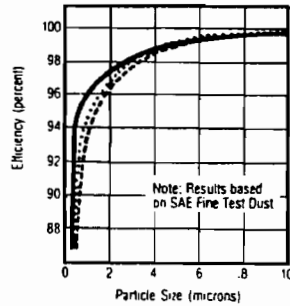


# REPLACEMENT ELEMENTS

## POLYESTER ELEMENTS

Particle Size vs. Filter Efficiency on polyester media at indicated face velocity:

- 15 cfm/ft<sup>2</sup> media —————
- 30 cfm/ft<sup>2</sup> media ..... (dotted)
- 45 cfm/ft<sup>2</sup> media - - - - - (dashed)



- 99+% removal efficiency to 5 micron
- Reinforced with epoxy coated steel wire on both sides of cloth
- Washable - lukewarm water & mild detergent
- Dust loading capacity is increased 40 - 50% with polyurethane prefilter
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Optimal sealing surface & design

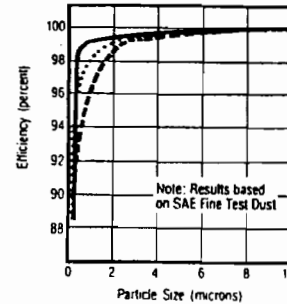
### ADVANTAGES

- Less maintenance
- More durable
- Moisture resistant
- Handles hot air and oil mist from unload cycle of reciprocating/piston compressor

## PAPER ELEMENTS

Particle Size vs. Filter Efficiency on paper media at indicated face velocity:

- 10 cfm/ft<sup>2</sup> media —————
- 15 cfm/ft<sup>2</sup> media ..... (dotted)
- 20 cfm/ft<sup>2</sup> media - - - - - (dashed)



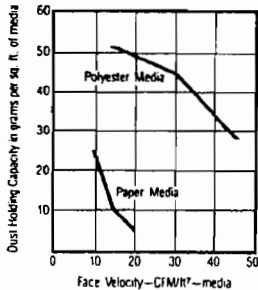
- 99+% removal efficiency to 2 micron
- Heavy duty industrial strength paper surrounded by heavy gauge galvanized expanded metal
- Dust loading capacity is increased 40 - 50% with polyurethane prefilter
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Optimal sealing surface & design

### ADVANTAGES

- Optimal surface area per given size
- Higher efficiency than many alternative media
- Cost Effective

**FILTER SILENCERS**  
FS, MBFS, QB, 2G, SLGR Series

Face Velocity vs. Dust Holding Capacity



#### Legend

- B= Closed one end w/ Bolt hole, open on other end
- C= Closed one end, open on other end
- F= Felt gaskets on open end(s)
- G= Galvanized metal endcaps
- I= Injection molded santoprene
- M= Molded plastisol
- N= Neoprene gaskets on open end(s)
- R= Mixed Rubber/cork gasket on open ends
- T= Tin plated metal endcaps

Polyester	Paper	STD Endcap Features	DIMENSIONS - inches			Polyester Surface Area ft <sup>2</sup>	Paper Surface Area ft <sup>2</sup>	Rated Flow SCFM
			ID	OD	HT			
05	04	I	---	2 1/4	1	0.2	0.2	8
07	06	I	---	3	1 3/8	0.58	0.58	12
11	10	I	---	4	1 3/8	1.1	1.1	35
15	14	M	3	4 3/8	2 5/16	0.50	1.12	35
18P	18P	M	3	4 3/8	4 3/4	1.5	3.0	100
31P	30P	M	3 5/8	5 3/4	4 3/4	2.3	3.0	195
307P	307P	M	3 5/8	5 3/4	4 1/2	1.8	1.8	200
825	824	TC	1 1/2	2 1/2	2 1/2	0.38	0.92	25
843	842	T	2 3/8	3 7/8	2 3/4	0.60	1.7	55
849	848	T	2 9/16	5	4 7/8	2.0	5.0	115
851	850	TR	3 1/2	5 7/8	8 3/4	4.5	14.0	290
879	878	TB	2 9/16	5	4 7/8	2.0	5.0	115
239	238	GBN	4 7/8	9 1/4	10	11.5	52	570
35P	34P	M	4 3/4	7 7/8	4 13/16	4.0	11	275
235P	234P	M	4 3/4	7 7/8	9 5/8	8.3	22.8	570
335P	334P	M	4 3/4	7 7/8	14 1/2	12	34	800
245P	244P	GN   M	6	9 3/4	9 5/8	14	35.5	880
345P	344P	GN	6	9 3/4	14 1/2	22.1	57	1100
275P	274P	GN	8	11 3/4	9 5/8	19	45.4	1100
375P	374P	GN	8	11 3/4	14 1/2	28	68.1	1500
377P	376P	GN	9	14 5/8	14 1/2	50	125	1825
385P	384P	GN	14	19 5/8	14 1/2	50	140	3300
485P	484P	GN	14	19 5/8	21 1/2	75	200	4705
685P	---	GN	14	19 5/8	28 1/2	100	---	6600

P= Polyurethane Prefilter

Dimension tolerance ± 1/8"

*Solberg - Where the Best is in Store for You!*



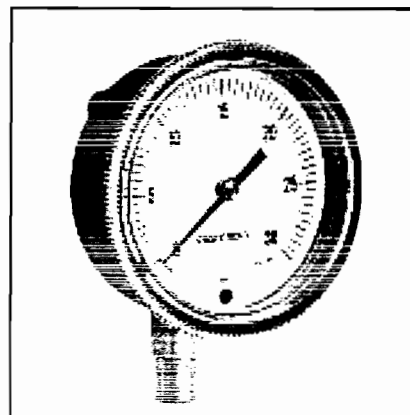
## SECTION 7

# INSTRUMENTATION



- 2½" and 3½" dial size
- Glass-filled polysulfone case material, won't rust or dent
- Beryllium copper diaphragm
- Brass socket
- Wetted materials of beryllium copper, brass, polysulfone and RTV silicone
- Exclusive autoclavable feature

This gauge uses a very sensitive diaphragm capsule to measure low pressure and vacuum. The gauge is specifically designed for use whenever the pressure medium is a gas that is not corrosive to beryllium copper, brass, polysulfone and RTV silicone. The polysulfone case is suitable for intermittent or continuous service on natural gas provided a .013" throttle plug is installed in the socket. Typical applications are, but not limited to, vacuum pumps, gas leak detectors, air compressors, air filters, gas burners, gas measurement, vacuum ovens, suction regulators and respirators.



The Ashcroft® Type 1490 low pressure diaphragm gauge is designed to measure pressure from 10 in. H<sub>2</sub>O to 15 psi, both positive and negative pres-

### SELECTION TABLE

DIAL SIZE		TYPE		WETTED MATERIAL		CONN. SIZE & TYPE		CONNECTION LOCATION		RANGES		OPTIONAL FEATURES	
Code	! Desc.	Code	Description	Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
25	2½"	1490	Low Pressure Diaphragm Gauge	A	Beryllium Copper	01	¼ NPT	L	Lower	10 IW	0 to 10 H <sub>2</sub> O	XAK	Autoclavable
35	3½"				Brass Socket	02	¼ NPT	B	Center Back			XAN	1% Opt. Accuracy
					Polysulfone	HD	⅜" I.D. Tubing Hose Barb <sup>(2,3)</sup>	T	Top		See Chart for Entire List of Ranges	XDA	Dial Marking
					RTV Silicone	HE	⅜" I.D. Tubing Hose Barb <sup>(2,3)</sup>	D	3 O'Clock			XNH	Stain. Steel Tag
						HF	¼" I.D. Tubing Hose Barb <sup>(2,3)</sup>	E	9 O'Clock			XNN	Paper Tag
						HG	¼" O.D. Polytube Hose Barb <sup>(2,3)</sup>					XTU <sup>(1,3)</sup>	Throttle Plug
						HH	10-32-2B Female Thread <sup>(2,3)</sup>					XUC <sup>(2)</sup>	U-clamp
												XZY	FlutterGuard™

- (1) A throttle plug must be installed in the socket whenever the gauge is used for intermittent or continuous service on natural gas.  
 (2) U-clamp furnished when hose barb or female thread is specified. **EXAMPLES: 25 1490A 02L 10 IW XNH**  
 (3) Throttle plug not available with hose barb or female thread connections.

### STANDARD RANGES

Pressure	Figure Intervals	Minor Graduation
0/10 in. H <sub>2</sub> O	1	0.1
0/30 in. H <sub>2</sub> O	5	0.5
0/100 in. H <sub>2</sub> O	10	1
0/160 in. H <sub>2</sub> O	20	2
0/200 in. H <sub>2</sub> O	20	2
0/300 in. H <sub>2</sub> O	50	5
0/10 oz./in. <sup>2</sup>	1	0.1
0/15 oz./in. <sup>2</sup>	5	0.2
0/30 oz./in. <sup>2</sup>	5	0.5
0/60 oz./in. <sup>2</sup>	10	1
0/100 oz./in. <sup>2</sup>	10	1
0/160 oz./in. <sup>2</sup>	20	2
0/250 oz./in. <sup>2</sup>	50	5
0/3 psi	0.5	0.05
0/5 psi	1	0.1
0/10 psi	1	0.1
0/15 psi	5	0.2

### STANDARD RANGES (Cont.)

Vacuum	Figure Intervals	Minor Graduation	
15/0 in. H <sub>2</sub> O	5	0.2	
30/0 in. H <sub>2</sub> O	5	0.5	
60/0 in. H <sub>2</sub> O	10	1	
100/0 in. H <sub>2</sub> O	10	1	
200/0 in. H <sub>2</sub> O	20	2	
15/0 oz./in. <sup>2</sup>	5	0.2	
30/0 oz./in. <sup>2</sup>	5	0.5	
60/0 oz./in. <sup>2</sup>	10	1	
100/0 oz./in. <sup>2</sup>	10	1	
<b>Compound</b>			
-30/30 in. H <sub>2</sub> O	10	1	
-30/30 in. oz./in. <sup>2</sup>	10	1	
-10/10 in. H <sub>2</sub> O	2	0.2	
<b>Dual Scale</b>			
Graduations			
Range		Inner Scale	Outer Scale
Inner Scale	Outer Scale	Figure Intervals	Minor Grad.
Figure Intervals	Minor Grad.	Figure Intervals	Minor Grad.
0/9 oz./in. <sup>2</sup>	0/15 in. H <sub>2</sub> O	1	0.2
0/20 oz./in. <sup>2</sup>	0/35 in. H <sub>2</sub> O	5	0.5
0/35 oz./in. <sup>2</sup>	0/60 in. H <sub>2</sub> O	5	0.5
0/60 oz./in. <sup>2</sup>	0/100 in. H <sub>2</sub> O	10	1

Other ranges available on request. Consult factory.

### STANDARD METRIC RANGES

Pressure	Figure Intervals	Minor Graduation
0/60 cm. H <sub>2</sub> O	10	1
0/2.5 kPa	0.5	0.05
0/4 kPa	1	0.1
0/10 kPa	10	0.1
0/16 kPa	2	0.2
0/25 kPa	5	0.5
0/40 kPa	10	1
0/100 kPa	10	1
<b>Vacuum</b>		
2.5/0 kPa	0.5	0.05
4/0 kPa	1	0.1
6/0 kPa	1	0.1
16/0 kPa	2	0.2
25/0 kPa	5	0.5
40/0 kPa	10	1
100/0 kPa	10	1
<b>Compound</b>		
-10/60 cm H <sub>2</sub> O	10	1
-10/80 cm H <sub>2</sub> O	10	1
-20/40 cm H <sub>2</sub> O	10	1
-10/100 cm H <sub>2</sub> O	10	1
-10/120 cm H <sub>2</sub> O	20	2

### TO ORDER THESE LOW PRESSURE DIAPHRAGM GAUGES:

Select: 25 1490 A 02L XXX 10 H<sub>2</sub>O

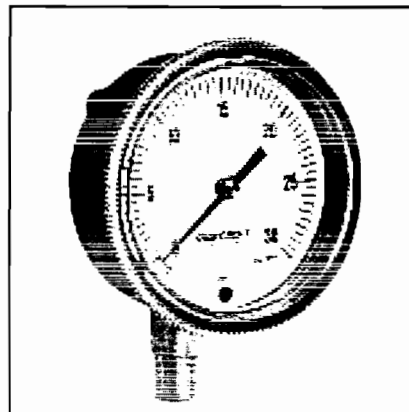
- Dial size - 2½ (25), 3½ (35) \_\_\_\_\_
- Case type \_\_\_\_\_
- Wetted material \_\_\_\_\_
- Connection size - ¼ (02), ½ (01) \_\_\_\_\_
- Connection location - Lower (L), Back (B) \_\_\_\_\_
- Optional features - see page 108 \_\_\_\_\_
- Standard pressure range - 10 H<sub>2</sub>O \_\_\_\_\_



**Low Pressure Diaphragm Gauge Series 1490, Grade A (2-1-2%)**

- 2½" and 3½" dial size
- Glass-filled polysulfone case material, won't rust or dent
- Beryllium copper diaphragm
- Brass socket
- Wetted materials of beryllium copper, brass, polysulfone and RTV silicone
- Exclusive autoclavable feature

ures. This gauge uses a very sensitive diaphragm capsule to measure low pressure and vacuum. The gauge is specifically designed for use whenever the pressure medium is a gas that is not corrosive to beryllium copper, brass, polysulfone and RTV silicone. The polysulfone case is suitable for intermittent or continuous service on natural gas provided a .013" throttle plug is installed in the socket. Typical applications are, but not limited to, vacuum pumps, gas leak detectors, air compressors, air filters, gas burners, gas measurement, vacuum ovens, suction regulators and respirators.



The Ashcroft® Type 1490 low pressure diaphragm gauge is designed to measure pressure from 10 in.H<sub>2</sub>O to 15 psi, both positive and negative pres-

SELECTION TABLE													
DIAL SIZE		TYPE		WETTED MATERIAL		CONN. SIZE & TYPE		CONNECTION LOCATION		RANGES		OPTIONAL FEATURES	
Code	Desc.	Code	Description	Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
25	2½"	1490	Low Pressure Diaphragm Gauge	A	Beryllium Copper	01	½ NPT	L	Lower	10 IW	0 to 10 H <sub>2</sub> O	XAK	Autoclavable
35	3½"				Brass Socket	02	¼ NPT	B	Center Back			XAN	1% Opt. Accuracy
					Polysulfone	HD	⅜" I.D. Tubing Hose Barb <sup>(2,3)</sup>	T	Top		See Chart for Entire List of Ranges	XDA	Dial Marking
					RTV Silicone	HE	⅜" I.D. Tubing Hose Barb <sup>(2,3)</sup>	D	3 O'Clock			XNH	Stain, Steel Tag
						HF	¼" I.D. Tubing Hose Barb <sup>(2,3)</sup>	E	9 O'Clock			XNN	Paper Tag
						HG	¼" O.D. Polytube Hose Barb <sup>(2,3)</sup>					XTU <sup>(1,2)</sup>	Throttle Plug
						HH	10-32-2B Female Thread <sup>(2,3)</sup>					XUC <sup>(2)</sup>	U-clamp
												XZY	FlutterGuard™

- (1) A throttle plug must be installed in the socket whenever the gauge is used for intermittent or continuous service on natural gas.  
 (2) U-clamp furnished when hose barb or female thread is specified. **EXAMPLES: 25 1490A 02L 10 IW XNH**  
 (3) Throttle plug not available with hose barb or female thread connections.

STANDARD RANGES		
Pressure	Figure Intervals	Minor Graduation
0/10 in. H <sub>2</sub> O	1	0.1
0/15 in. H <sub>2</sub> O	5	0.2
0/60 in. H <sub>2</sub> O	10	1
0/160 in. H <sub>2</sub> O	20	2
0/200 in. H <sub>2</sub> O	20	2
0/300 in. H <sub>2</sub> O	50	5
0/10 oz./in. <sup>2</sup>	1	0.1
0/15 oz./in. <sup>2</sup>	5	0.2
0/30 oz./in. <sup>2</sup>	5	0.5
0/60 oz./in. <sup>2</sup>	10	1
0/100 oz./in. <sup>2</sup>	10	1
0/160 oz./in. <sup>2</sup>	20	2
0/250 oz./in. <sup>2</sup>	50	5
0/3 psi	0.5	0.05
0/5 psi	1	0.1
0/10 psi	1	0.1
0/15 psi	5	0.2

STANDARD RANGES (Cont.)		
Pressure	Figure Intervals	Minor Graduation
15/0 in. H <sub>2</sub> O	5	0.2
30/0 in. H <sub>2</sub> O	5	0.5
60/0 in. H <sub>2</sub> O	10	1
100/0 in. H <sub>2</sub> O	10	1
200/0 in. H <sub>2</sub> O	20	2
15/0 oz./in. <sup>2</sup>	5	0.2
30/0 oz./in. <sup>2</sup>	5	0.5
60/0 oz./in. <sup>2</sup>	10	1
100/0 oz./in. <sup>2</sup>	10	1
<b>Compound</b>		
-30/30 in. H <sub>2</sub> O	10	1
-30/30 in. oz./in. <sup>2</sup>	10	1
-10/10 in. H <sub>2</sub> O	2	0.2
<b>Dual Scale</b>		
Range		
Inner Scale		
Outer Scale		
Figure Intervals		
Minor Grad.		
Figure Intervals		
Minor Grad.		
0/9 oz./in. <sup>2</sup>	15 in. H <sub>2</sub> O	1 0.2 5 0.2
0/20 oz./in. <sup>2</sup>	0/35 in. H <sub>2</sub> O	5 0.5 5 0.5
0/35 oz./in. <sup>2</sup>	0/60 in. H <sub>2</sub> O	5 0.5 10 1
0/60 oz./in. <sup>2</sup>	0/100 in. H <sub>2</sub> O	10 1 10 1

STANDARD METRIC RANGES		
Pressure	Figure Intervals	Minor Graduation
0/60 cm. H <sub>2</sub> O	10	1
0/2.5 kPa	0.5	0.05
0/4 kPa	1	0.1
0/10 kPa	1	0.1
0/16 kPa	2	0.2
0/25 kPa	5	0.5
0/40 kPa	10	1
0/100 kPa	10	1
0/100 kPa	10	1
0/2.5 kPa	0.5	0.05
4/0 kPa	1	0.1
10/0 kPa	1	0.1
16/0 kPa	2	0.2
25/0 kPa	5	0.5
40/0 kPa	10	1
100/0 kPa	10	1
<b>Compound</b>		
-10/60 cm H <sub>2</sub> O	10	1
-10/80 cm H <sub>2</sub> O	10	1
-20/40 cm H <sub>2</sub> O	10	1
-10/100 cm H <sub>2</sub> O	10	1
-10/120 cm H <sub>2</sub> O	20	2

Other ranges available on request. Consult factory.

**TO ORDER THESE LOW PRESSURE DIAPHRAGM GAUGES:**

Select: 25 1490 A 02L XXX 10 H<sub>2</sub>O

- Dial size - 2½ (25), 3½ (35) \_\_\_\_\_
- Case type \_\_\_\_\_
- Wetted material \_\_\_\_\_
- Connection size - ¼ (02), ½ (01) \_\_\_\_\_
- Connection location - Lower (L), Back (B) \_\_\_\_\_
- Optional features - see page 108 \_\_\_\_\_
- Standard pressure range - 10" H<sub>2</sub>O \_\_\_\_\_

Series 7211



# Liquid filled pressure gauges

ENFM liquid filled pressure gauges are suitable for a medium, which does not clog connection port or corrode copper alloy. These gauges are commonly used on heavy-duty service in industrial environments.

**Standard gauge specification**

Case:	Stainless steel aisi 304 with filling plug
Bezel:	Crimped stainless steel aisi 304
Dial:	White aluminum with black and blue lettering, with pointerstop
Pointer:	Black aluminum
Window:	Acrylic
Bourdon tube:	phosphor bronze: ≤ 600 psi 'C' shaped > 600 psi helical
Connection:	stainless steel 316: > 6000 psi helical ( 1.4571 ) Brass with field removable .012 threaded snubber
Movement:	Brass
Liquid filling:	Glycerin
Weather protection:	IP 65
Accuracy:	1.6 % of span
Case size:	2½" ( 63 mm )
Connection:	1/4" NPT bottom connection
Scale:	psi/bar/kPa

Sizes and weights

<u>Pressure range</u>	<u>Article number</u>	<u>Description</u>
-30"HG / 0	RV132A3N000KG	7211 2½" 1/4"NPT -30/0"HG
-30"HG / 0 / 15 psi	RV132A3N201KG	7211 2½" 1/4"NPT -30/15 PSI/BAR
-30"HG / 0 / 30 psi	RV132A3N203KG	7211 2½" 1/4"NPT -30/30 PSI/BAR
-30"HG / 0 / 60 psi	RV132A3N205KG	7211 2½" 1/4"NPT -30/60 PSI/BAR
-30"HG / 0 / 100 psi	RV132A3N208KG	7211 2½" 1/4"NPT -30/100 PSI/BAR
-30"HG / 0 / 150 psi	RV132A3N210KG	7211 2½" 1/4"NPT -30/150 PSI/BAR
-30"HG / 0 / 200 psi	RV132A3N212KG	7211 2½" 1/4"NPT -30/200 PSI/BAR
0 - 15 psi	RV132A3N301KG	7211 2½" 1/4"NPT 0/15 PSI/BAR
0 - 60 psi	RV132A3N306KG	7211 2½" 1/4"NPT 0/60 PSI/BAR
0 - 160 psi	RV132A3N312KG	7211 2½" 1/4"NPT 0/160 PSI/BAR
0 - 200 psi	RV132A3N314KG	7211 2½" 1/4"NPT 0/200 PSI/BAR
0 - 300 psi	RV132A3N317KG	7211 2½" 1/4"NPT 0/300 PSI/BAR
0 - 400 psi	RV132A3N319KG	7211 2½" 1/4"NPT 0/400 PSI/BAR
0 - 500 psi	RV132A3N320KG	7211 2½" 1/4"NPT 0/500 PSI/BAR
0 - 600 psi	RV132A3N321KG	7211 2½" 1/4"NPT 0/600 PSI/BAR
0 - 1000 psi	RV132A3N323KG	7211 2½" 1/4"NPT 0/1000 PSI/BAR
0 - 1500 psi	RV132A3N324KG	7211 2½" 1/4"NPT 0/1500 PSI/BAR
0 - 2000 psi	RV132A3N325KG	7211 2½" 1/4"NPT 0/2000 PSI/BAR
0 - 3000 psi	RV132A3N327KG	7211 2½" 1/4"NPT 0/3000 PSI/BAR
0 - 4000 psi	RV132A3N329KG	7211 2½" 1/4"NPT 0/4000 PSI/BAR
0 - 5000 psi	RV132A3N331KG	7211 2½" 1/4"NPT 0/5000 PSI/BAR
0 - 6000 psi	RV132A3N332KG	7211 2½" 1/4"NPT 0/6000 PSI/BAR
0 - 10000 psi	RV132A3N334KG	7211 2½" 1/4"NPT 0/10000 PSI/BAR
0 - 15000 psi	RV132A3N335KG	7211 2½" 1/4"NPT 0/15000 PSI/BAR



Series 7211



**Standard gauge specification**

Case: Stainless steel aisi 304 with filling plug  
 Bezel: Crimped stainless steel aisi 304  
 Dial: White aluminum with black and blue lettering, with pointerstop  
 Pointer: Black aluminum  
 Window: Acrylic  
 Bourdon tube: phosphor bronze: ≤ 600 psi 'C' shaped  
 > 600 psi helical  
 stainless steel 316: > 6000 psi helical ( 1.4571 )  
 Connection: Brass with field removable .012 threaded snubber  
 Movement: Brass  
 Liquid filling: Glycerin  
 Weather protection: IP 65  
 Accuracy: 1.6 % of span  
 Case size: 2½" ( 63 mm )  
 Connection: 1/4" NPT bottom connection  
 Scale: psi/bar/kPa

Sizes and weights

<u>Pressure range</u>	<u>Article number</u>	<u>Description</u>
-30"HG / 0	RV132A3N000KG	7211 2½" 1/4"NPT -30/0"HG
-30"HG / 0 / 15 psi	RV132A3N201KG	7211 2½" 1/4"NPT -30/15 PSI/BAR
-30"HG / 0 / 30 psi	RV132A3N203KG	7211 2½" 1/4"NPT -30/30 PSI/BAR
-30"HG / 0 / 60 psi	RV132A3N205KG	7211 2½" 1/4"NPT -30/60 PSI/BAR
-30"HG / 0 / 100 psi	RV132A3N208KG	7211 2½" 1/4"NPT -30/100 PSI/BAR
-30"HG / 0 / 150 psi	RV132A3N210KG	7211 2½" 1/4"NPT -30/150 PSI/BAR
-30"HG / 0 / 200 psi	RV132A3N212KG	7211 2½" 1/4"NPT -30/200 PSI/BAR
0 - 15 psi	RV132A3N301KG	7211 2½" 1/4"NPT 0/15 PSI/BAR
0 - 30 psi	RV132A3N303KG	7211 2½" 1/4"NPT 0/30 PSI/BAR
<del>0 - 50 psi</del>	<del>RV132A3N305KG</del>	<del>7211 2½" 1/4"NPT 0/50 PSI/BAR</del>
0 - 100 psi	RV132A3N309KG	7211 2½" 1/4"NPT 0/100 PSI/BAR
<del>0 - 150 psi</del>	<del>RV132A3N311KG</del>	<del>7211 2½" 1/4"NPT 0/150 PSI/BAR</del>
0 - 200 psi	RV132A3N314KG	7211 2½" 1/4"NPT 0/200 PSI/BAR
0 - 300 psi	RV132A3N317KG	7211 2½" 1/4"NPT 0/300 PSI/BAR
0 - 400 psi	RV132A3N319KG	7211 2½" 1/4"NPT 0/400 PSI/BAR
0 - 500 psi	RV132A3N320KG	7211 2½" 1/4"NPT 0/500 PSI/BAR
0 - 600 psi	RV132A3N321KG	7211 2½" 1/4"NPT 0/600 PSI/BAR
0 - 1000 psi	RV132A3N323KG	7211 2½" 1/4"NPT 0/1000 PSI/BAR
0 - 1500 psi	RV132A3N324KG	7211 2½" 1/4"NPT 0/1500 PSI/BAR
0 - 2000 psi	RV132A3N325KG	7211 2½" 1/4"NPT 0/2000 PSI/BAR
0 - 3000 psi	RV132A3N327KG	7211 2½" 1/4"NPT 0/3000 PSI/BAR
0 - 4000 psi	RV132A3N329KG	7211 2½" 1/4"NPT 0/4000 PSI/BAR
0 - 5000 psi	RV132A3N331KG	7211 2½" 1/4"NPT 0/5000 PSI/BAR
0 - 6000 psi	RV132A3N332KG	7211 2½" 1/4"NPT 0/6000 PSI/BAR
0 - 10000 psi	RV132A3N334KG	7211 2½" 1/4"NPT 0/10000 PSI/BAR
0 - 15000 psi	RV132A3N335KG	7211 2½" 1/4"NPT 0/15000 PSI/BAR

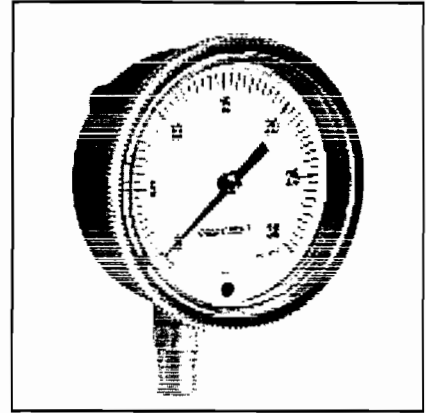




**Low Pressure Diaphragm Gauge Series 1490, Grade A (2-1-2%)**

- 2½" and 3½" dial size
- Glass-filled polysulfone case material, won't rust or dent
- Beryllium copper diaphragm
- Brass socket
- Wetted materials of beryllium copper, brass, polysulfone and RTV silicone
- Exclusive autoclavable feature

ures. This gauge uses a very sensitive diaphragm capsule to measure low pressure and vacuum. The gauge is specifically designed for use whenever the pressure medium is a gas that is not corrosive to beryllium copper, brass, polysulfone and RTV silicone. The polysulfone case is suitable for intermittent or continuous service on natural gas provided a .013" throttle plug is installed in the socket. Typical applications are, but not limited to, vacuum pumps, gas leak detectors, air compressors, air filters, gas burners, gas measurement, vacuum ovens, suction regulators and respirators.



The Ashcroft® Type 1490 low pressure diaphragm gauge is designed to measure pressure from 10 in.H<sub>2</sub>O to 15 psi, both positive and negative pres-

**SELECTION TABLE**

DIAL SIZE		TYPE		WETTED MATERIAL			CONN. SIZE & TYPE		CONNECTION LOCATION		RANGES		OPTIONAL FEATURES	
Code	Desc.	Code	Description	Code	Description	Code	Description	Code	Description	Code	Description	Code	Description	
25	2½"	1490	Low Pressure Diaphragm Gauge	A	Beryllium Copper	01	1/8 NPT	L	Lower	10 IW	0 to 10" H <sub>2</sub> O	XAK	Autoclavable	
35	3½"				HD	Polysulfone	02	1/4 NPT	B	Center Back		See Chart for Entire List of Ranges	XAN	1% Opt. Accuracy
					HE	RTV Silicone	HD	1/8" I.D. Tubing Hose Barb <sup>(2,3)</sup>	T	Top			XDA	Dial Marking
					HF		HE	3/16" I.D. Tubing Hose Barb <sup>(2,3)</sup>	D	3 O'Clock			XNH	Stain. Steel Tag
					HG		HF	1/4" I.D. Tubing Hose Barb <sup>(2,3)</sup>	E	9 O'Clock			XNN	Paper Tag
					HH		HG	1/4" D.D. Polytube Hose Barb <sup>(2,3)</sup>					XTU <sup>(1,2)</sup>	Throttle Plug
							HH	10-32-2B Female Thread <sup>(2,3)</sup>					XUC <sup>(2)</sup>	U-clamp
													XZY	FlutterGuard™

- (1) A throttle plug must be installed in the socket whenever the gauge is used for intermittent or continuous service on natural gas.  
 (2) U-clamp furnished when hose barb or female thread is specified. **EXAMPLES: 25 1490A 02L 10 IW XNH**  
 (3) Throttle plug not available with hose barb or female thread connections.

**STANDARD RANGES**

Pressure	Figure Intervals	Minor Graduation
0/10 in. H <sub>2</sub> O	1	0
0/15 in. H <sub>2</sub> O	5	0.2
0/30 in. H <sub>2</sub> O	5	0.5
0/60 in. H <sub>2</sub> O	10	1
0/100 in. H <sub>2</sub> O	10	2
0/160 in. H <sub>2</sub> O	20	2
0/200 in. H <sub>2</sub> O	20	2
0/300 in. H <sub>2</sub> O	30	5
0/10 oz./in. <sup>2</sup>	2	0.1
0/15 oz./in. <sup>2</sup>	5	0.2
0/30 oz./in. <sup>2</sup>	5	0.5
0/60 oz./in. <sup>2</sup>	10	1
0/100 oz./in. <sup>2</sup>	10	1
0/160 oz./in. <sup>2</sup>	20	2
0/250 oz./in. <sup>2</sup>	50	5
0/3 psi	0.5	0.05
0/5 psi	1	0.1
0/10 psi	1	0.1
0/15 psi	5	0.2

**STANDARD RANGES (Cont.)**

Vacuum	Figure Intervals	Minor Graduation				
15/0 in. H <sub>2</sub> O	5	0.2				
30/0 in. H <sub>2</sub> O	5	0.5				
60/0 in. H <sub>2</sub> O	10	1				
200/0 in. H <sub>2</sub> O	20	2				
30/0 oz./in. <sup>2</sup>	5	0.5				
60/0 oz./in. <sup>2</sup>	10	1				
100/0 oz./in. <sup>2</sup>	10	1				
Compound						
-30/30 in. H <sub>2</sub> O	10	1				
-30/30 in. oz./in. <sup>2</sup>	10	1				
-10/10 in. H <sub>2</sub> O	2	0.2				
Dual Scale						
		Graduations				
	Range	Inner Scale	Outer Scale			
	Inner Scale	Outer Scale	Figure Intervals	Minor Grad.	Figure Intervals	Minor Grad.
	0/9 oz./in. <sup>2</sup>	0/15 in. H <sub>2</sub> O	1	0.2	5	0.2
	0/20 oz./in. <sup>2</sup>	0/35 in. H <sub>2</sub> O	5	0.5	5	0.5
	0/35 oz./in. <sup>2</sup>	0/60 in. H <sub>2</sub> O	5	0.5	10	1
	0/60 oz./in. <sup>2</sup>	0/100 in. H <sub>2</sub> O	10	1	10	1

**STANDARD METRIC RANGES**

Pressure	Figure Intervals	Minor Graduation
0/60 cm. H <sub>2</sub> O	10	1
0/2.5 kPa	0.5	0.05
0/4 kPa	1	0.1
0/10 kPa	1	0.1
0/16 kPa	2	0.2
0/25 kPa	5	0.5
0/40 kPa	10	1
0/100 kPa	10	1
Vacuum		
2.5/0 kPa	0.5	0.05
4/0 kPa	1	0.1
10/0 kPa	1	0.1
16/0 kPa	2	0.2
25/0 kPa	5	0.5
40/0 kPa	10	1
100/0 kPa	10	1
Compound		
-10/60 cm H <sub>2</sub> O	10	1
-10/8 cm H <sub>2</sub> O	10	1
-20/10 cm H <sub>2</sub> O	10	1
0/100 cm H <sub>2</sub> O	10	1
-10/120 cm H <sub>2</sub> O	20	2

Other ranges available on request. Consult factory.

**TO ORDER THESE LOW PRESSURE DIAPHRAGM GAUGES:**

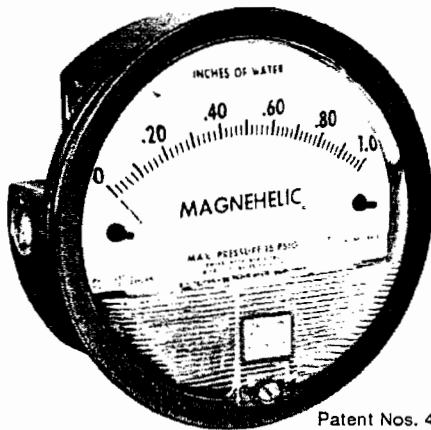
Select: 25 1490 A 02L XXX 10" H<sub>2</sub>O

- Dial size - 2½ (25), 3½ (35) \_\_\_\_\_
- Case type \_\_\_\_\_
- Wetted material \_\_\_\_\_
- Connection size - 1/4 (02), 1/8 (01) \_\_\_\_\_
- Connection location - Lower (L), Back (B) \_\_\_\_\_
- Optional features - see page 108 \_\_\_\_\_
- Standard pressure range - 10" H<sub>2</sub>O \_\_\_\_\_

Series  
2000

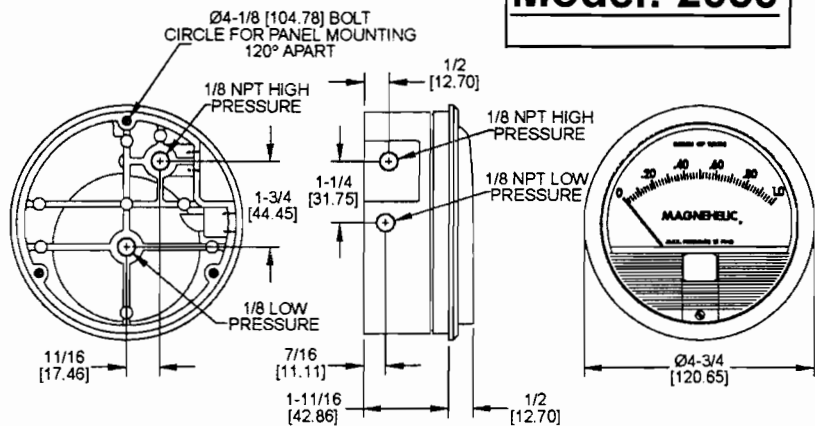
# Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%

**Model: 2030**


Patent Nos. 4,030,365  
5,012,678

Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.



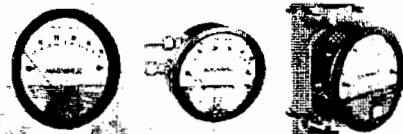
Dimensions, Standard Series 2000 Magnehelic® Pressure Gages.  
(Slightly different on medium and high pressure models)

Select the Dwyer Magnehelic® gage for high accuracy — guaranteed within 2% of full scale — and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures — either positive, negative (vacuum) or differential. The design resists shock, vibration and overpressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

**NOTE: Do Not use with Hydrogen gas. Dangerous reactions will occur.**

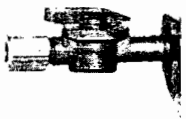
**MOUNTING.** A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1/2" - 2" pipe. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4/16" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.



Flush ...Surface...or Pipe Mounted

## VENT VALVES

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.



## HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4/16" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.



## SPECIFICATIONS

**Service:** Air and non-combustible, compatible gases. (Natural Gas option available.)

**Wetted Materials:** Consult Factory.

**Housing:** Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.

**Accuracy:** ±2% of full scale (±3% on -0 and ±4% on -00 ranges), throughout range at 70°F (21.1°C).

**Pressure Limits:** -20" Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).

**Overpressure:** Relief plug opens at approximately 25 psig (1.72 kPa), standard gages only.

**Temperature Limits:** 20 to 140°F\* (-6.67 to 60°C).

**Size:** 4" (101.6 mm) Diameter dial face.

**Mounting Orientation:** Diaphragm in vertical position. Consult factory for other position orientations.

**Process Connections:** 1/8" female NPT duplicate high and low pressure taps - one pair side and one pair back.

**Weight:** 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).

**Standard Accessories:** Two 1/8" NPT plugs for duplicate pressure taps, two 1/8" pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)

\*Low temperature models available as special option.

†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

## OPTIONS AND ACCESSORIES

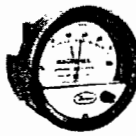
### Transparent Overlays

Furnished in red and green to highlight and emphasize critical pressures.



### Adjustable Signal Flag

Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.



### LED Setpoint Indicator

Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.



### Portable Units

Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft. (2.7 m) of 3/8" I.D. rubber tubing, standhang bracket and terminal tube with holder.



### Air Filter Gage Accessory Package

Adapts any standard Magnehelic® for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of 1/2" aluminum tubing two static pressure taps and two molded plastic vent valves, integral compression fittings on both tips and valves.

# Quality design and construction features

**Bezel** provides flange for flush mounting in panel.

**Clear plastic face** is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

**Precision litho-printed scale** is accurate and easy to read.

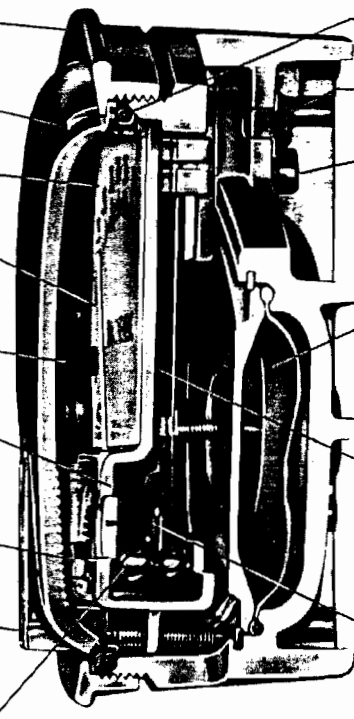
**Red tipped pointer** of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

**Pointer stops** of molded rubber prevent pointer over-travel without damage.

**"Wishbone" assembly** provides mounting for helix, helix bearings and pointer shaft.

**Jeweled bearings** are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

**Zero adjustment screw** is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.



**O-ring seal** for cover assures pressure integrity of case.

**Blowout plug** of silicone rubber protects against overpressure on 15 PSIG rated models. Opens at approximately 25 PSIG.

**Die cast aluminum case** is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

**Silicone rubber diaphragm** with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

**Calibrated range spring** is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

**Samarium Cobalt magnet** mounted at one end of range spring rotates helix without mechanical linkages.

**Helix** is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

## SERIES 2000 MAGNEHELIC® — MODELS AND RANGES

### STOCKED MODELS in bold

The models below will fulfill most requirements. Page 5 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

### STOCKED MODELS

Dual Scale English/Metric Models		
Model Number	Range, In. W.C.	Range, Pa or kPa
<b>2000-00</b>	0-0.5	0-125 Pa
<b>2001D</b>	0-1.0	0-250 Pa
<b>2002D</b>	0-2.0	0-500 Pa
<b>2003D</b>	0-3.0	0-700 Pa
<b>2004D</b>	0-4.0	0-1.0 kPa
<b>2006D</b>	0-6.0	0-1.5 kPa
<b>2008D</b>	0-8.0	0-2.0 kPa
<b>2100D</b>	0-10	0-2.5 kPa

Model Number	Range Inches of Water	Range Zero Center Inches of Water		Dual Scale Air Velocity Units		Model Number	Range, CM of Water	Model Number	Range, Pascals
		Model Number	Range	Model Number	Range in W.C.   Velocity, F.P.M.				
<b>2000-00†</b>	0-.25	<b>2300-0†</b>	.25-0-.25	<b>2000-00AV†</b>	0-.25/300-2000	<b>2000-15CM</b>	0-15	<b>2000-60 Pa†</b>	0-60
<b>2000-0†</b>	0-.50	<b>2301</b>	.5-0-.5	<b>2000-0AV†</b>	0-.50/500-2800	<b>2000-20CM</b>	0-20	<b>2000-100 Pa</b>	0-100
<b>2001</b>	0-1.0	<b>2302</b>	1-0-1	<b>2001AV</b>	0-1.0/500-4000	<b>2000-25CM</b>	0-25	<b>2000-125 Pa†</b>	0-125
<b>2002</b>	0-2.0	<b>2304</b>	2-0-2	<b>2002AV</b>	0-2.0/1000-5600	<b>2000-50CM</b>	0-50	<b>2000-250 Pa</b>	0-250
<b>2003</b>	0-3.0	<b>2310</b>	5-0-5	<b>2010AV</b>	0-10/2000-12500	<b>2000-80CM</b>	0-80	<b>2000-300 Pa</b>	0-300
<b>2004</b>	0-4.0	<b>2320</b>	10-0-10	For use with pitot tube.		<b>2000-100CM</b>	0-100	<b>2000-500 Pa</b>	0-500
<b>2005</b>	0-5.0	<b>2330</b>	15-0-15			<b>2000-150CM</b>	0-150	<b>2000-750 Pa</b>	0-750
<b>2006</b>	0-6.0					<b>2000-200CM</b>	0-200	Zero Center Ranges	
<b>2008</b>	0-8.0					<b>2000-250CM</b>	0-250	<b>2300-250 Pa</b>	125-0-125
<b>2010</b>	0-10					<b>2000-300CM</b>	0-300	<b>2300-500 Pa</b>	250-0-250
<b>2015</b>	0-15	<b>Model Number</b>	<b>Range PSI</b>	<b>Model Number</b>	<b>Range MM of Water</b>	Zero Center Ranges		<b>Model Number</b>	<b>Range, Kilopascals</b>
<b>2020</b>	0-20	<b>2201</b>	0-1	<b>2000-6MM†</b>	0-6	<b>2300-10CM</b>	2-0-2	<b>2000-1 kPa</b>	0-1
<b>2030</b>	0-30	<b>2202</b>	0-2	<b>2000-10MM</b>	0-10	<b>2300-100CM</b>	5-0-5	<b>2000-1.5 kPa</b>	0-1.5
<b>2050</b>	0-50	<b>2203</b>	0-3	<b>2000-25MM</b>	0-25	<b>2300-30CM</b>	15-0-15	<b>2000-2 kPa</b>	0-2
<b>2060</b>	0-60	<b>2204</b>	0-4	<b>2000-50MM</b>	0-50	†These ranges calibrated to vertical scale position.		<b>2000-3 kPa</b>	0-3
<b>2080</b>	0-80	<b>2205</b>	0-5	<b>2000-100MM</b>	0-80			<b>2000-4 kPa</b>	0-4
<b>2100</b>	0-100	<b>2210*</b>	0-10	Zero Center Ranges				<b>2000-5 kPa</b>	0-5
<b>2150</b>	0-150	<b>2215*</b>	0-15	<b>2300-20MM†</b>	10-0-10			<b>2000-8 kPa</b>	0-8
		<b>2220*</b>	0-20					<b>2000-10 kPa</b>	0-10
		<b>2230**</b>	0-30					<b>2000-15 kPa</b>	0-15
		*MP option standard **HP option standard						<b>2000-20 kPa</b>	0-20
<b>Accessories</b>		<b>Options — To order, add suffix: I.E. 2001-ASF</b>				<b>Special Purpose Ranges</b>		<b>2000-25 kPa</b>	0-25
A-310A, 3-Way Vent Valve		ASF (Adjustable Signal Flag)				Scale No. 2401 Scale No. 2402		<b>2000-30 kPa</b>	0-30
A-321, Safety Relief Valve		HP (High Pressure Option)				Square Root Blank Scale		Zero Center Ranges	
A-432, Portable Kit		LT (Low Temperatures to -20°F)				Specify Range Specify Range		<b>2300-1 kPa</b>	0-1
A-605, Air Filter Kit		MP (Med. Pressure Option)						<b>2300-3 kPa</b>	1.5-0-1.5
A-610, Flush Mount Kit		SP (Setpoint Indicator)							
Scale Overlays — Red, Green, Mirrored or Combination, Specify Locations									

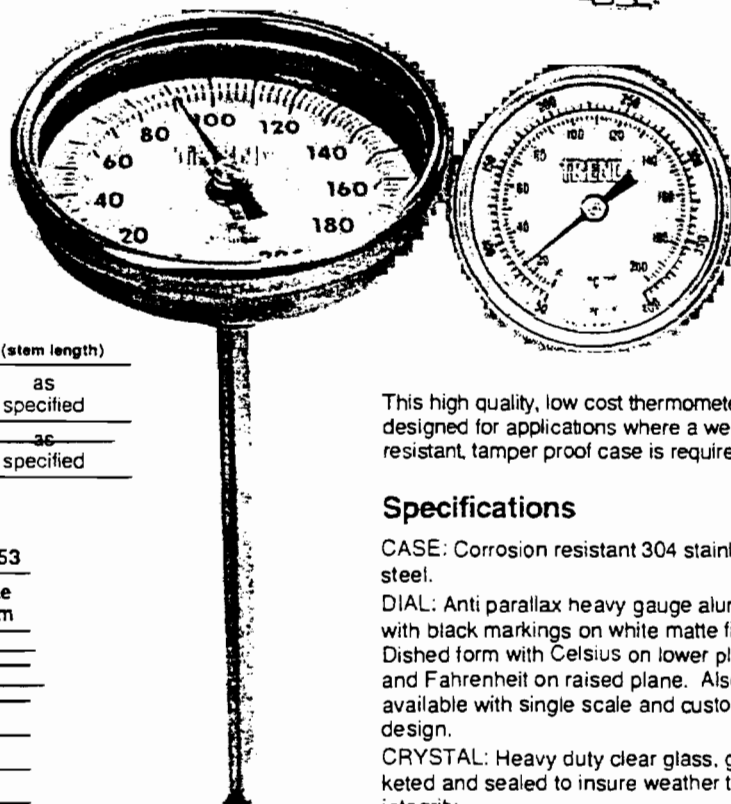
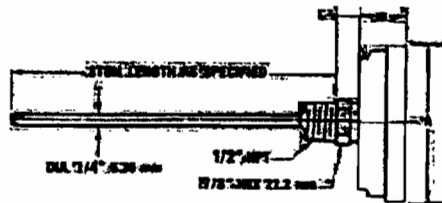
# INDUSTRIAL THERMOMETERS

## DIAL SIZES: 3" - 5"

### 90° BACK ANGLE FORM

### Model 33 & 53

### Bi-Metal Thermometers



This high quality, low cost thermometer is designed for applications where a weather resistant, tamper proof case is required.

### Specifications

**CASE:** Corrosion resistant 304 stainless steel.

**DIAL:** Anti parallax heavy gauge aluminum with black markings on white matte finish. Dished form with Celsius on lower plane and Fahrenheit on raised plane. Also available with single scale and custom design.

**CRYSTAL:** Heavy duty clear glass, gasketed and sealed to insure weather tight integrity.

**HERMETIC SEAL:** Per ASME B40.3.

**STEM/CONNECTION:** Type 304 stainless steel, 1/4 inch (6.35 millimeter) diameter with standard lengths to 24 inches (609 millimeters). 1/2 inch NPT connection is standard.

**BI-METAL ELEMENT:** An extremely responsive temperature sensing helix which has been carefully sized and tested, heat treated and aged to relieve inherent stresses and insure continued accuracy.

**ACCURACY:** One percent full scale (Grade A per ASME B40.3).

**OPTIONS:** Special ranges, dial layouts, accuracies, stems, connections and windows

### How to Order

The catalog number shown indicates only the dial size, angle form and stem length. For complete, descriptive part number please use the tables listed on page 13.

See General Specifications on this page for construction features and for available accessories and options.

Dial Size	A	B	C	S (stem length)
→ 3"	3 1/4"	1 1/16"	1/4"	as specified
76.2 mm	82.55 mm	17.38 mm	6.35 mm	
5"	5 1/4"	1 5/16"	7/16"	as specified
127 mm	133.35 mm	23.81 mm	11.11 mm	

ALL DIMENSIONS ± 1/16" (1.58 mm)

Catalog Numbers	MODEL 33		MODEL 53
	Stem Length Inches	Dial Size 3" 76.2 mm	Dial Size 5" 127 mm
→ 2 1/2	63.5	33025	<del>53025</del>
4	101.6	33040	53040
6	152.4	33060	53060
9	228.6	33090	53090
12	304.8	33120	53120
15	381.0	33150	53150
18	457.2	33180	53180
24	609.6	33240	53240

### Standard Ranges — Dual Scale (Other Ranges Available)

Fahrenheit (outer scale)			Celsius (inner scale)		
Range	Fig. Interval	Div.	Range	Fig. Interval	Div.
-100 to 150°	20°	2°	-70 to 70°	10°	1°
-40 to 120°	20°	2°	-40 to 50°	10°	1°
25 to 125°	10°	1°	-5 to 50°	5°	1/2°
0 to 140°	10°	1°	-20 to 60°	5°	1/2°
0 to 200°	20°	2°	-15 to 90°	10°	1°
0 to 250°	20°	2°	-20 to 120°	10°	1°
20 to 240°	20°	2°	-5 to 115°	10°	1°
→ 50 to 300°	20°	2°	10 to 150°	10°	1°
50 to 400°	50°	5°	10 to 200°	20°	2°
50 to 500°	50°	5°	10 to 260°	20°	2°
150 to 750°	100°	10°	65 to 400°	50°	5°
00 to 1000°	100°	10°	00 to 540°	50°	5°

\*Not recommended for continuous use over 800°F or 425°C

For complete list of available ranges, including Celsius only and Fahrenheit only, please see page 13.

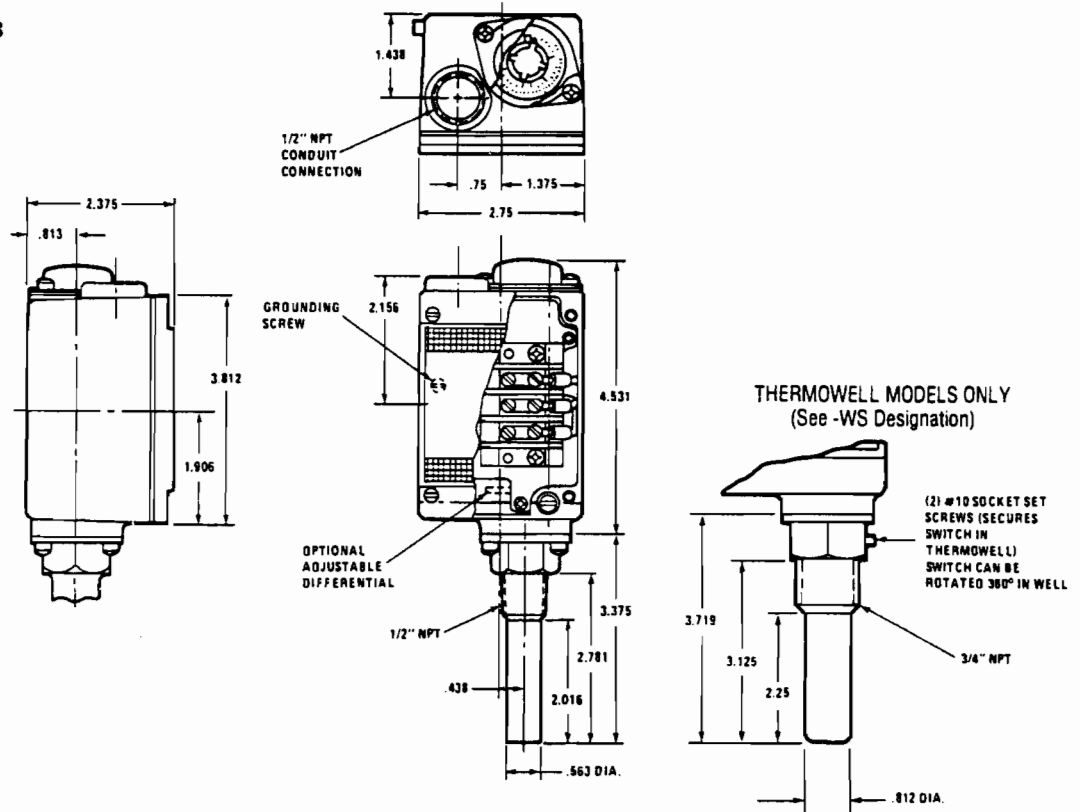
**TREND** instruments, inc.



## Barksdale Temperature Switches

### ML1H Description:

- Single Setting
- Local Mount
- Watertight and Dusttight—  
Indoor and Outdoor (NEMA 4)
- Oiltight and Dusttight—  
Indoor (NEMA 13)
- Enclosed Terminal Strip
- Tamperproof External Adjustment



### Operating Characteristics • Ordering Data

	Media Temperature Limits (Proof)				Adjustable Range				Differential (Approx.) Liquid*		Catalog Numbers		
	°F		°C		°F		°C		°F	°C	Brass Sensor	304 Stainless Steel Sensor	304 Stainless Steel Sensor W/316SS Thermowell
Calibrated Dial Adjustment 2° Subdivision 125° Span	-100	+250	-73	+121	-50	+75	-45	+24	1 to 3	.5 to 1.6	ML1H-H201	ML1H-H201S	ML1H-H201S-WS
	-100	+250	-73	+121	+75	+200	+24	+93	1 to 3	.5 to 1.6	ML1H-H203	ML1H-H203S	ML1H-H203S-WS
	-100	+400	-73	+205	+165	+290	+74	+143	1 to 3	.5 to 1.6	ML1H-H352	ML1H-H352S	ML1H-H352S-WS
Calibrated 5° Subdivision 250° Span	-100	+400	-73	+205	+225	+350	+107	+177	1 to 3	.5 to 1.6	ML1H-H353	ML1H-H353S	ML1H-H353S-WS
	-100	+250	-73	+121	-50	+200	-45	+93	1 to 3	.5 to 1.6	ML1H-H204	ML1H-H204S	ML1H-H204S-WS
Calibrated 5° Subdivision 150° Span	-100	+400	-73	+205	+100	+350	+38	+177	1 to 3	.5 to 1.6	ML1H-H354	ML1H-H354S	ML1H-H354S-WS
	0	+500	-18	+260	+150	+300	+66	+149	3 to 6	1.6 to 3.3	ML1H-H451	ML1H-H451S	ML1H-H451S-WS
	0	+500	-18	+260	+230	+380	+110	+193	3 to 6	1.6 to 3.3	ML1H-H452	ML1H-H452S	ML1H-H452S-WS
Calibrated 10° Subdivision 300° Span	0	+500	-18	+260	+300	+450	+149	+232	3 to 6	1.6 to 3.3	ML1H-H453	ML1H-H453S	ML1H-H453S-WS
	0	+500	-18	+260	+150	+450	+66	+232	3 to 6	1.6 to 3.3	ML1H-H454	ML1H-H454S	ML1H-H454S-WS

\*Test conditions and media used could affect differential.

Approx. Shipping Weight 1½ lbs.

### Detail Data

**Electrical Characteristics:** All models incorporate Underwriters' Laboratories, Inc. listed single pole double throw snap-action switching elements. Electrical rating (continuous inductive) 10 amps 125 or 250 volts AC, 3 amps 480 volts AC. Automatically reset by snap-action of switch. For more details and other switch classes, see page 14.

**Electrical Connection:** Screw terminals on covered terminal strip through 1/2" npt conduit connection.

**Terminals Identified:** C (Common), N.C. (Normally Closed), N.O. (Normally Open).

**Wire Coding:** Purple (Common), Blue (Normally Closed), Red (Normally Open).

**Adjustment Instructions:** Turn adjustment knob clockwise to increase actuation point (switch setting).

### Optional Modifications

MANUAL RESET AVAILABLE. Consult factory for price and delivery.

Nema 4X is available with green polyurethane paint and stainless steel fasteners.

All models on this page have the following U.L. and C.S.A. listings:



Underwriters' Laboratories, Inc.  
Temperature indicating and regulating equipment. File No. E56247, Guide No. XAPX.



Canadian Standards Association listed for temperature indicating and regulating equipment. File No. LR34555, Guide NO. 400-E-0. Class 4813.

Hersey Meters - 10210 Statesville Boulevard - Cleveland - NC 27013 - Tel: 800.323.8584 or 704-278-2221 - Fax: 704.278.9616

**Hersey-Meters**

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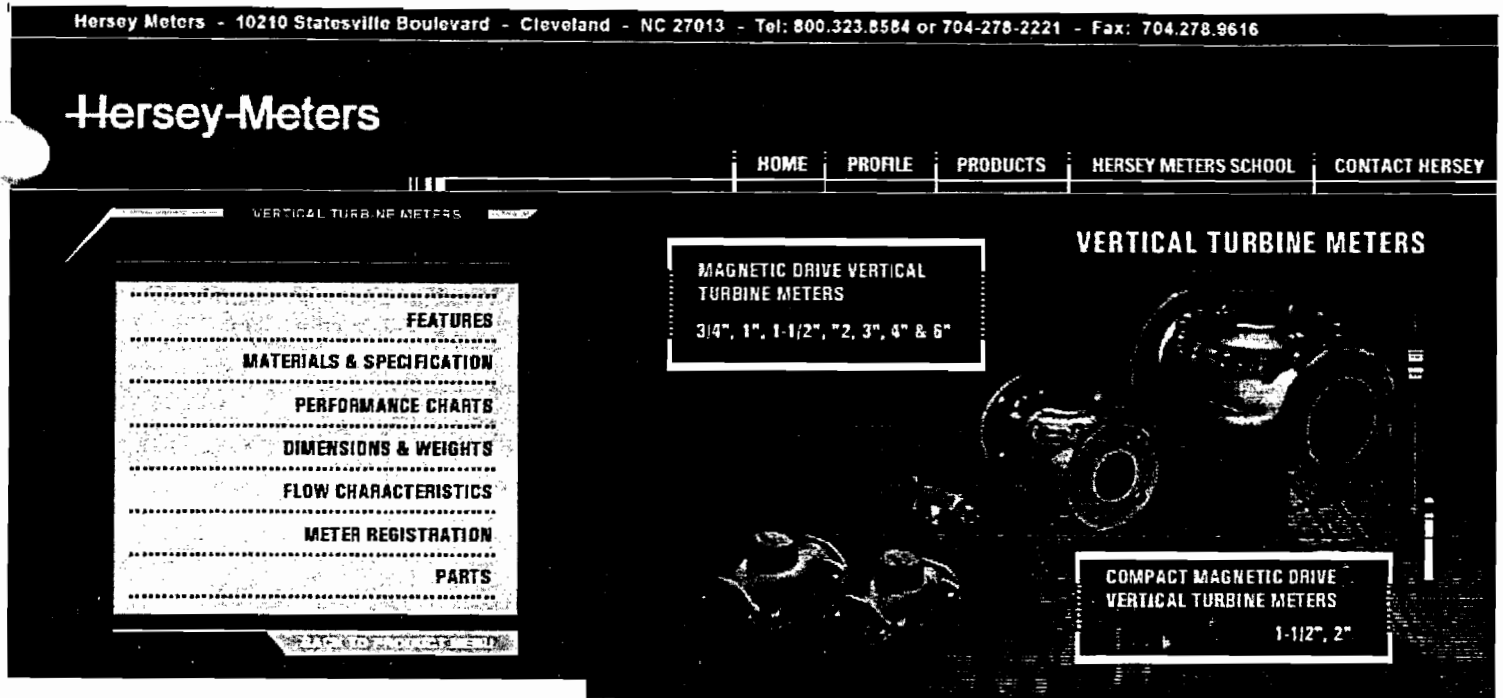
VERTICAL TURBINE METERS

**MAGNETIC DRIVE VERTICAL TURBINE METERS**  
3/4", 1", 1-1/2", 2", 3", 4" & 6"

**VERTICAL TURBINE METERS**

**COMPACT MAGNETIC DRIVE VERTICAL TURBINE METERS**  
1-1/2", 2"

**FEATURES**  
**MATERIALS & SPECIFICATION**  
**PERFORMANCE CHARTS**  
**DIMENSIONS & WEIGHTS**  
**FLOW CHARACTERISTICS**  
**METER REGISTRATION**  
**PARTS**



## Model: MVR-30

### FEATURES - MODEL MVR

**APPLICATIONS:** Measurement of water for residential, commercial and industrial applications where sensitivity to low flow is also important. Hersey MVR meters are among the most sensitive vertical turbine meters available and may be used in place of compound meters in some applications. The compact design and integral strainer (separate external strainer is not needed) of Model MVR meters facilitate installation in tight spaces. They are ideal where flexibility is needed to meet wider flow ranges, where water temperatures are elevated between 80F and 130F, or where sand particles or other small debris may be encountered. May be installed vertically or horizontally for greater installation flexibility.

**CONFORMANCE TO STANDARDS:** Hersey Model MVR Water Meters comply with ANSI/AWWA Standard C701 Class I. Each meter is tested to ensure compliance.

**CONSTRUCTION:** Hersey Model MVR Water Meters consist of three basic parts: maincase; rotor assembly; and a permanently sealed register. Maincases are made of bronze for long life. Rotor assemblies are thermoplastic, which is dimensionally stable and will not corrode. Retro Thrust rotor design extends the life of the meter by dividing wear between two points: during low flow the tungsten carbide thrust bearing floats against a sapphire bearing surface; during high flow the stainless steel shaft gently contacts a second sapphire bearing. During medium flow, the rotor floats between the thrust bearings without contact. Optional test ports are available on all sizes 1-1/2" and larger. The measuring chamber is protected by an internal strainer. No external strainer is required.

**REGISTER:** Permanently sealed register has a unique seal and heat-treated glass to eliminate dirt, moisture infiltration and lens fogging. The totalizing register has a straight-reading odometer type display, a 360° test circle with center sweep hand and a low flow (leak) detector.

All Hersey meter Models have electronic meter reading systems available for increased reading efficiency (see Meter Reading Systems.)

**OPERATION:** Water flows through the integral strainer and into the vertical turbine assembly. There the direction of the water flow is directed by the hub into the rotor at the precise angle necessary for accurate measurement over the full range of flow rates. The turbine turns freely and rotates in direct proportion to the volume of water passing through the meter.

The Model MVR turbine operates more quietly than conventional disc or piston meters.

**MAINTENANCE:** The Hersey Model MVR Water Meters are designed and manufactured to provide long service life. The register on all sizes, and meter interior and strainer on sizes 3" and larger, can be replaced without removing the meter from the line. Modular design and economical internal parts allow for inexpensive, speedy rebuilds. Optional built-in test ports make field testing easy and convenient.

**CONNECTIONS:** Available with external (N.P.S.M.) straight pipe threads (ANSI B1.20.1) on 3/4" and 1" sizes; integral two-bolt oval flanges or internal (NPT) pipe threads (ANSI B1.20.1) on 1-1/2" and 2" sizes. ANSI class 150 flanges on 3" through 6" sizes (class 125 cast iron or class 150 bronze companion flanges available on request).

■

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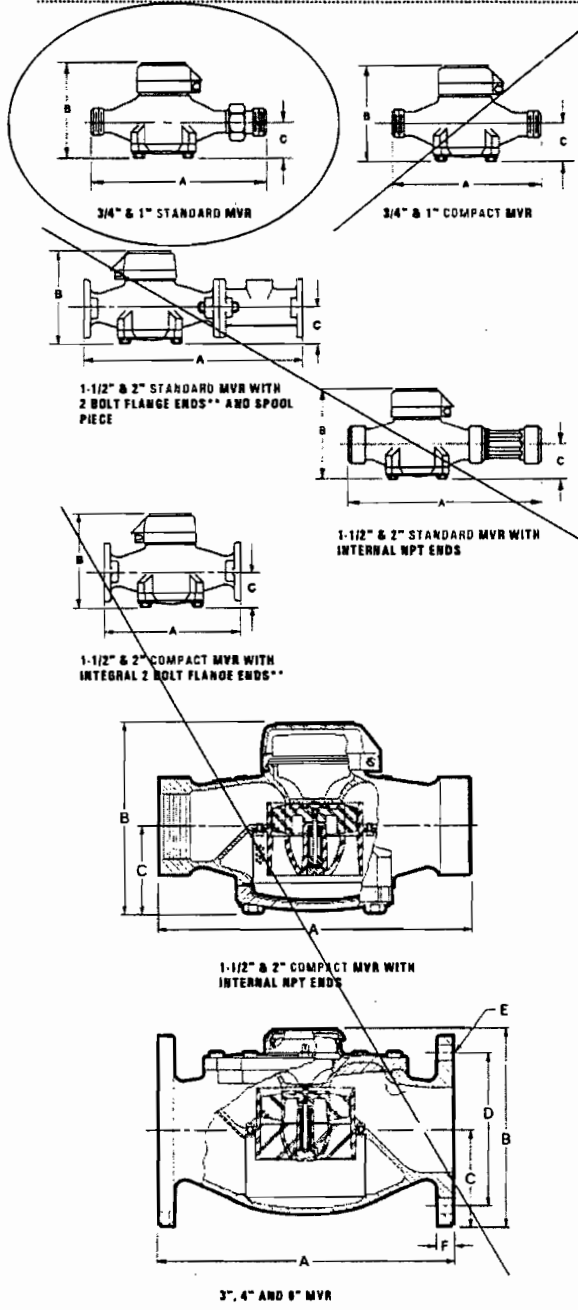
# Hersey-Meters

HOME PROFILE PRODUCTS HERSEY METERS SCHOOL CONTACT HERSEY

VERTICAL TO RADING METERS

FEATURES
MATERIALS & SPECIFICATION
PERFORMANCE CHARTS
DIMENSIONS & WEIGHTS
FLOW CHARACTERISTICS
METER REGISTRATION
PARTS

## DIMENSIONS & WEIGHTS - MODEL MVR



Meter Size	3/4"	1"	1-1/2"	2"	3"	4"	8"
Ends	Threaded (screwed)						
Model	MVR30	MVR30A	MVR30B	MVR50	MVR100	MVR150	MVR300
Dimension							
A	5"	9"	9"	10-3/4"	12-5/8"	15-1/4"	15-1/4"
AA "	7-1/2"	7-1/2"	7-1/2"	9"	9"	10-1/2"	10-1/2"
B	5"	5"	5"	5-1/2"	5-3/4"	6-1/4"	6-1/4"
C	1-13/16"	1-13/16"	1-13/16"	2"	2-3/8"	3"	3"
D	N/A	N/A	N/A	N/A	N/A	N/A	N/A
E	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max. Width	3-3/4"	3-3/4"	3-3/4"	4-1/4"	4-3/8"	5"	8"
Net weight	6 (5*)	5 (5*)	6 (5*)	8 (7*)	11 (9*)	15 (11*)	15 (11*)

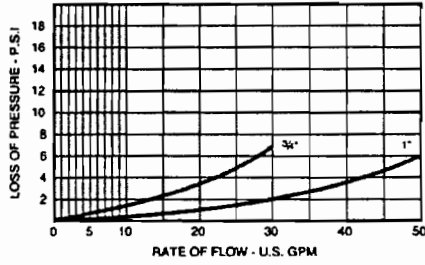
# Hersey-Meters

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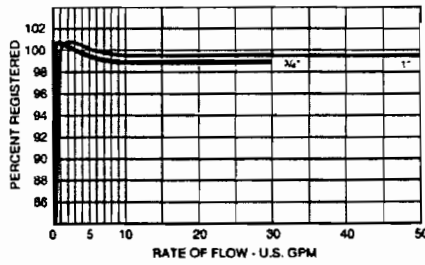
## PERFORMANCE CHARTS - MODEL MVR

FEATURES
MATERIALS & SPECIFICATION
PERFORMANCE CHARTS
DIMENSIONS & WEIGHTS
FLOW CHARACTERISTICS
METER REGISTRATION
PARTS

### HEAD LOSS - 3/4 & 1"



### ACCURACY - 3/4 & 1"





- HOME
- PROFILE
- PRODUCTS
- HERSEY METERS SCHOOL
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VERTICAL TURBINE METERS

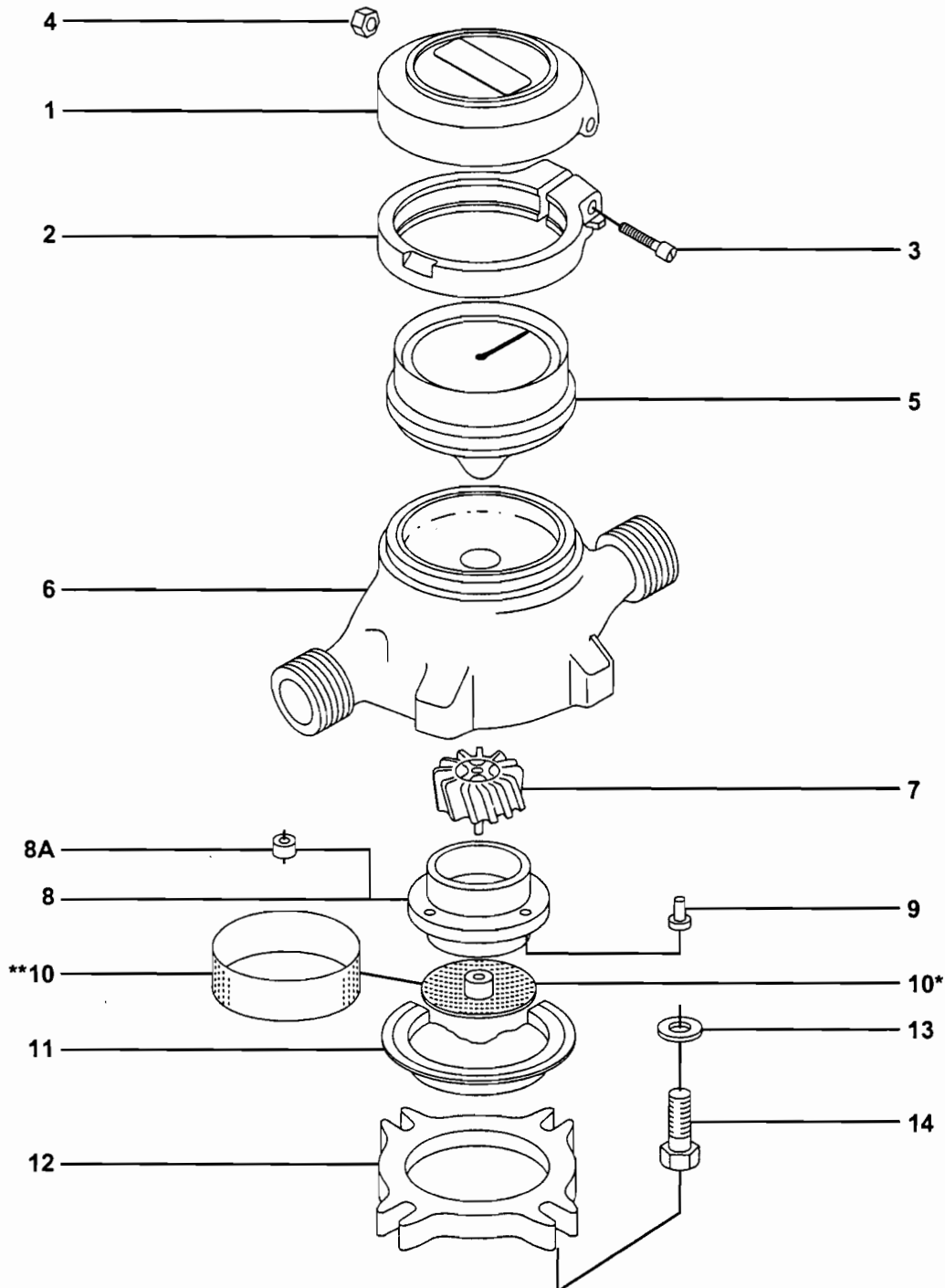
<b>FEATURES</b>
<b>MATERIALS &amp; SPECIFICATION</b>
<b>PERFORMANCE CHARTS</b>
<b>DIMENSIONS &amp; WEIGHTS</b>
<b>FLOW CHARACTERISTICS</b>
<b>METER REGISTRATION</b>
<b>PARTS</b>

**MATERIALS & SPECIFICATIONS - MODEL MVR**

- Model Designation MVR 30,
- Sizes 3/4"x1/2", 3/4", 3/4"x1", 1", 1-1/2", 2", 3", 4" and 6"
- Standards Manufactured and tested to meet or exceed all applicable parts of ANSI/AWWA C701 Class I Standard
- Service cold water measurement with flow in only one direction
- Operating Flow Range See Performance Charts page
- Accuracy See Performance Charts page
- Pressure Loss See Performance Charts page
- Maximum Working Pressure 150 PSI
- Temperature Range 33F to 100F  
Hot water up to 180° available upon request.
- Measuring Element Rotor
- Register Type Straight reading, permanently sealed, magnetic drive with low flow indicator. Remote reading units optional.
- Meter Connections 1/2", 3/4" and 1" external (NPSM) straight pipe threads, 1-1/2 size and 2" size available with either two bolt flanged ends or internal thread (NPT) ends same nominal size as size of meter, 3" thru 6" ANSI class 150 flanges.
- Materials Maincase - bronze UNSC84400; 3/4"- 1-1/2" Bottom cover - cast iron ASTM A126 CL. B enamel painted; 2" Bottom cover - bronze UNSC84400; Rotor assembly - thermoplastic; Strainer - thermoplastic std. in 3/4" thru 1-1/2"; or stainless steel (2" - 6"); Casing bolts - stainless steel ANSI B18.
- Options Meter case - EnviroBrass ® UNSC89520. Stainless steel ring strainer is available on 3/4", 1" and 1-1/2" meters.

Magnetic Drive Vertical Turbine Meters  
 Sizes 3/4", 1", 1-1/2", 2"

## Models MVR-30,



Model MVR Parts

\* Disc Strainer - standard on MVR 30, 50, 100.

\*\* Ring Strainer - optional (in addition to) disc strainer on MVR 30, 50, 100.  
 Standard on MVR 160.

# Model MVR Parts

# Hersey® Meters

**Magnetic Drive Vertical Turbine Meters**  
**Sizes 3/4", 1", 1-1/2", 2"**

## Models MVR-30

**Model MVR Parts**

Ref. No.	Description	Model MVR-30	Model MVR-50	Model MVR-100	Model MVR-160
1	Lid (Plastic)	50377	50377	50377	50377
	Lid (Bronze)	50390	50390	50390	50390
2	Clamp Band	50379	50379	50379	50379
3	Lid Seal Screw	19945	19945	19945	19945
4	Lid Nut	19999	19999	19999	19999
5	Sealed Registers (Specify unit of measurement)	See pages 3.8-3.9			
6	MVR 30 Top Case (7-1/2" length):				
	1/2" M.I.P. Ends	50452	-	-	-
	3/4" M.I.P. Ends	50466 (A)	-	-	-
	1" M.I.P. Ends	50476 (B)	-	-	-
6	MVR 50 Top Case (9" length):				
	1" M.I.P. Ends	-	50566 (C)	-	-
	1-1/4" M.I.P. Ends	-	50576 (D)	-	-
6	MVR 100 Top Case (9" length):				
	1-1/2" F.I.P. Ends	-	-	50776 (E)	-
	1-1/2" Bronze 2-Bolt Flange Assembly	-	-	50784 (F)	-
6	MVR 160 Top Case (10-1/2" length):				
	2" F.I.P. Ends	-	-	-	50866 (G)
	2" Bronze 2-Bolt Flange Assembly (10" length)	-	-	-	50884 (H)
7	Rotor	50471	50571	50771	50871
8	Inlet Hub	50468	50568	50768	50867
8A	Lower Bushing	50374 (2)	50574 (2)	50574 (2)	-
9	Interior Screw	98394 (4)	98394 (4)	98394 (4)	98394 (4)
10	Strainer (Plastic)	50469	50569	50769	-
10A	Strainer (Metal Ring)**	50480	50580	50780	50880
11	Liner	50365	50565	50765	50865
12	Bottom (Bronze)	50363	50563	50763	50863
	Bottom (Cast Iron)	50364	50564	50764	-
13	Case Washer	AS7792 (4)	AS7792 (4)	98378 (4)	98378 (4)
14	Case Bolt	90026 (4)	90026 (4)	90073 (4)	90073 (4)
	Inlet Hub Assembly	-	-	-	50862
	Bushing Spacer	-	-	-	53114
	Bushing	-	-	-	54915 (2)
	Inlet Plug Assembly	-	-	-	53125
	Sapphire Thrust Bearing (Case)	98371	98371	98371	98371
	Complete Interior	50477	50577	50777	50872
	Bearing Adhesive *	-	-	-	-
	Adapters:				
	3/4" Adapter	95046	-	-	-
	3/4" Adapter Washer	95014	-	-	-
	1" Adapter	95011	95063	-	-
	1" Adapter Washer	95064	95064	-	-
	1-1/4" Adapter	-	95086	-	-
	1-1/4" Adapter Washer	-	95007	-	-
	1-1/2" Female Adapter	-	-	95095	-
	2" Female Adapter	-	-	-	95195

- A: Order 3/4" Adapter 95046 and Adapter Washer 95014 to replace standard 3/4" disc meter, 9" long.
  - B: Order 1" Adapter 95011 and Adapter Washer 95064 with Top Case 50476 to replace 3/4" disc meter, 9" long, installed with 1" pipe connections.
  - C: Order 1" Adapter 95063 and Adapter Washer 95064 with Top Case 50566 to replace standard 1" disc meter, 10-3/4" long.
  - D: Order 1-1/4" Adapter 95086 and Adapter Washer 95007 with Top Case 50576 to replace 1" disc meter, 10-3/4" long, installed with 1-1/4" pipe connection.
  - E: Order 1-1/2" Adapter 95095 with Top Case 50776 to replace 1-1/2" female end meter installed with union connections. Assemble to length of 12-5/8".
  - F: Order 1-1/2" Bronze Spool Piece 50783 and gasket 95102 with Top Case 50784 to replace standard 1-1/2" disc meter, 13" long.
  - G: Order 2" Adapter 95195 with Top Case 50866 to replace standard 2" Female End disc meter, 15-1/4" long.
  - H: Order (2) Bronze Spool piece 50883 and gasket 95122 with Top Case 50884 for 17" length 2-90229 Bolt 2-90260 Nut.
- \* Purchase locally. Use a cyanoacrylic adhesive, such as Loctite Super Bonder #30-13, Eastman #916, Permabond or Aron Alpha.  
 \*\*Standard on MVR 160. Optional on MVR 30, 50 100 in addition to standard plastic disc strainer.  
 Note: If more than one part is required, quantity is noted after part number (in parentheses).



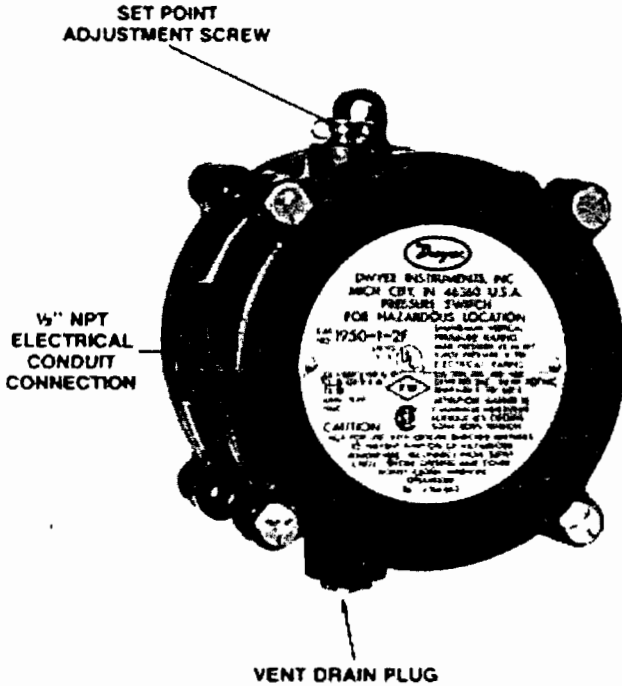


Model: 1950-20

SERIES 1950

# INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES Specifications - Installation and Operating Instructions

UL and CSA Listed, FM Approved For  
CL I GR. C,D - CL II GR. E,F,G - CL III



Model 1950 Switches: Operating ranges and dead bands.

To order specify Model Number	Operating Range Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.10	0.15
1950-1	0.4 to 1.6	0.15	0.20
1950-5	1.4 to 5.5	0.3	0.4
1950-10	3.0 to 11.0	0.4	0.6
1950-20	4.0 to 20.0	0.4	0.8

Model Number	Operating Range PSI	Approximate Dead Band	
		Min. Set Point	Max. Set Point
1950P-5	5 to 2.0	0.3 PSI	0.3 PSI
1950P-8	8 to 8.0	1.0 PSI	1.0 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	0.7 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

**PHYSICAL DATA**

**Temperature Limits:** -40° to 140°F (-40° to 60°C), 1950P-8, 15, 25 & 50: 0° to 140°F (-17.8° to 60°C), 1950-02, -30° to 130°F (-34.4° to 54.4°C)  
**Rated Pressure:** 1950 - 45 IN. W.C., 1950P - 35 PSI, 1950P-50 only - 70 PSI  
**Maximum surge pressure:** 1950 - 10 PSI, 1950P - 50 PSI, 1950P-50 only - 90 PSI  
**Pressure Connections:** 1/8" NPT.  
**Electrical Rating:** 15 amps, 125, 250, 480 volts, 60 Hz. A.C. Resistive 1/8 H.P @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C.  
**Wiring connections:** 3 screw type; common, norm. open and norm. closed  
**Conduit connections:** 1/2" NPT  
**Set point adjustment:** Screw type on top of housing, field adjustable.  
**Housing:** Anodized cast aluminum  
**Diaphragm:** Molded fluorosilicone rubber: 02 model, silicone on nylon.  
**Calibration Spring:** Stainless Steel.  
**Installation:** Mount with diaphragm in vertical position.  
**Weight:** 3 1/4 lbs. 02 model, 4 lbs., 7 oz.

**Response Time:** Because of restrictive effect of flame arrestors, switch response time may be as much as 10-15 seconds where applied pressures are near set point.

**NOTE:** The last number-letter combination in the 1950 model number identifies the switch electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In the case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC - 1/8 HP 125 VAC, 1/4 HP 250 VAC; and a number 5 or 6 rating is 1A 125 VAC. A letter B indicates a Buna-N diaphragm, N; Neoprene, S; Silicone, and V, Viton.

The New Model 1950 Explosion-Proof Switch combines the best features of the popular Dwyer Series 1900 Pressure Switch with a compact explosion-proof housing.

The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

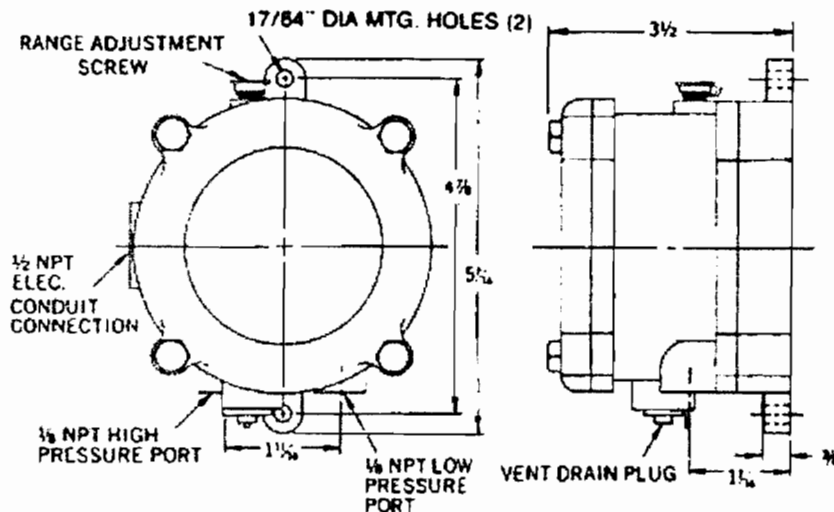
Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembly of the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

**CAUTION:** For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

# SERIES 1950

## INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

### Installation and Operating Instructions



1950-02: 7-3/4" dia. x 4-11/32" depth.  
For complete dimensions request drawing ZB-700175-00 from our Customer Service Department.

1950 SWITCH OUTLINE DIMENSIONS

#### INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Physical Data on page 1. Switch may be installed outdoors or in areas where the hazard of explosion exists. See page 1 for specific types of hazardous service.
2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical. Special units can be furnished for other than vertical mounting arrangements if required.
3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" NPT female pressure ports as noted below:
  - A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS. and from source of lower pressure to low pressure port marked LOW PRESS.
  - B. Pressure only (above atmospheric) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere. See CAUTION on page 1.
  - C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.
4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of screw terminals marked "common," "norm open," and "norm closed." The normally open contacts close and the normally closed contacts open when pressure increases beyond the setpoint. Switch loads for standard models should not

exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

#### ADJUSTMENT

To change the setpoint:

- A. Remove the plastic cap and turn the slotted Adjustment Screw at the top of the housing clockwise to raise the setpoint pressure and counter-clockwise to lower the setpoint. After calibration, replace the plastic cap and re-check the setpoint.
- B. The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the setpoint very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.
- C. For highly critical applications check the setpoint adjustment and if necessary, reset it as noted in step A.

#### MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the setpoint. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.





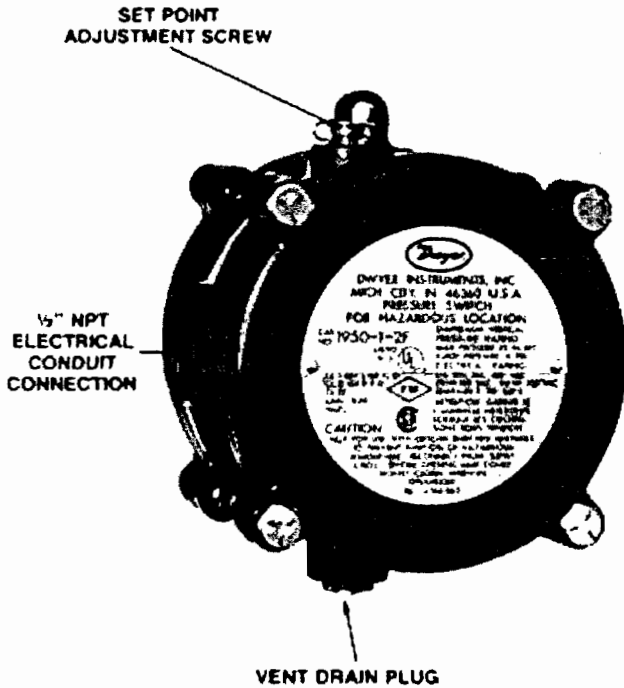
Model: 1950P-2

SERIES 1950

# INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

## Specifications - Installation and Operating Instructions

UL and CSA Listed, FM Approved For  
CL I GR. C,D - CL II GR. E,F,G - CL III



Model 1950 Switches: Operating ranges and dead bands.

To order specify Model Number	Operating Range Inches. W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.05	0.15
1950-1	0.4 to 1.5	0.15	0.20
1950-5	1.5 to 3.5	0.4	0.4
1950-10	3.0 to 11.0	0.4	0.5
1950-20	4.0 to 20.0	0.4	0.5

Model Number	Operating Range PSI	Approximate Dead Band	
		Min. Set Point	Max. Set Point
1950P-2	.5 to 2.0	0.3 PSI	0.3 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	4.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

The New Model 1950 Explosion-Proof Switch combines the best features of the popular Dwyer Series 1900 Pressure Switch with a compact explosion-proof housing.

The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembly of the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

**CAUTION:** For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

**PHYSICAL DATA**

**Temperature Limits:** -40° to 140°F (-40° to 60°C), 1950P-8, 15, 25 & 50 0° to 140°F (-17.8° to 60°C), 1950-02, -30° to 130°F (-34.4° to 54.4°C).  
**Rated Pressure:** 1950 - 45 IN. W.C., 1950P - 35 PSI, 1950P-50 only - 70 PSI  
**Maximum surge pressure:** 1950 - 10 PSI, 1950P - 50 PSI, 1950P-50 only - 90 PSI.  
**Pressure Connections:** 1/8" NPT.  
**Electrical Rating:** 15 amps, 125, 250, 480 volts, 60 Hz. A.C. Resistive 1/8 H.P @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C.  
**Wiring connections:** 3 screw type; common, norm. open and norm. closed  
**Conduit connections:** 1/2" NPT  
**Set point adjustment:** Screw type on top of housing. Field adjustable.  
**Housing:** Anodized cast aluminum  
**Diaphragm:** Molded fluorosilicone rubber 02 model, silicone on nylon  
**Calibration Spring:** Stainless Steel.  
**Installation:** Mount with diaphragm in vertical position.  
**Weight:** 3 1/4 lbs. 02 model, 4 lbs., 7 oz.

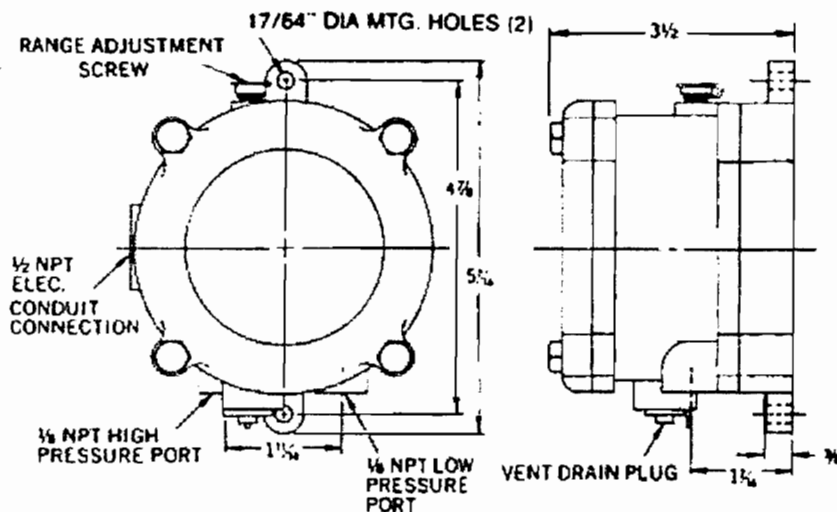
**Response Time:** Because of restrictive effect of flame arrestors, switch response time may be as much as 10-15 seconds where applied pressures are near set point.

**NOTE:** The last number-letter combination in the 1950 model number identifies the switch electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In the case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC - 1/8 HP 125 VAC, 1/4 HP 250 VAC; and a number 5 or 6 rating is 1A 125 VAC. A letter B indicates a Buna-N diaphragm. N; Neoprene, S; Silicone, and V, Viton.

# SERIES 1950

## INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

### Installation and Operating Instructions



1950-02: 7-3/4" dia. x 4-11/32" depth.  
For complete dimensions request drawing 28-700175-00 from our Customer Service Department.

1950 SWITCH OUTLINE DIMENSIONS

#### INSTALLATION

- Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Physical Data on page 1. Switch may be installed outdoors or in areas where the hazard of explosion exists. See page 1 for specific types of hazardous service.
- Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical. Special units can be furnished for other than vertical mounting arrangements if required.
- Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" NPT female pressure ports as noted below:
  - Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS. and from source of lower pressure to low pressure port marked LOW PRESS.
  - Pressure only (above atmospheric) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere. See CAUTION on page 1.
  - Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.
- To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of screw terminals marked "common," "norm open," and "norm closed." The normally open contacts close and the normally closed contacts open when pressure increases beyond the setpoint. Switch loads for standard models should not

exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

#### ADJUSTMENT

To change the setpoint:

- Remove the plastic cap and turn the slotted Adjustment Screw at the top of the housing clockwise to raise the setpoint pressure and counter-clockwise to lower the setpoint. After calibration, replace the plastic cap and re-check the setpoint.
- The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressures through the third tube. Make final approach to the setpoint very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.
- For highly critical applications check the setpoint adjustment and if necessary, reset it as noted in step A.

#### MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the setpoint. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.





Series  
A1S  
&  
A1B

# Low Cost OEM Pressure Switch

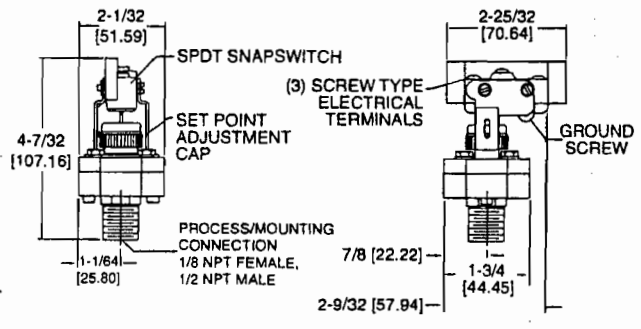
316 SS or Buna-N Diaphragm. Optional Weatherproof Enclosure.  
Ranges from 3-20 to 50-500 psig



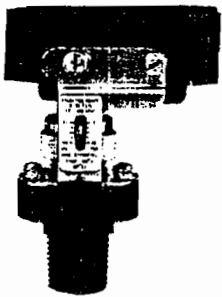
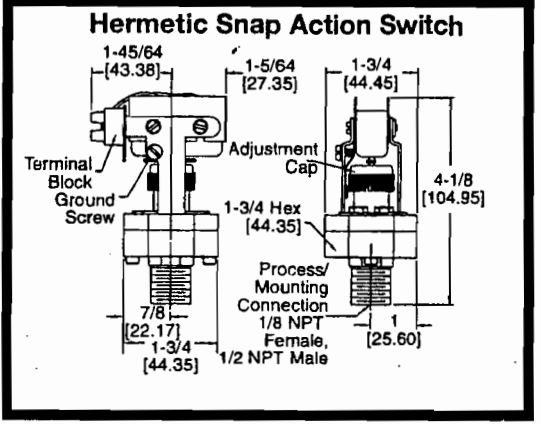
## Standard Snap Action Switch



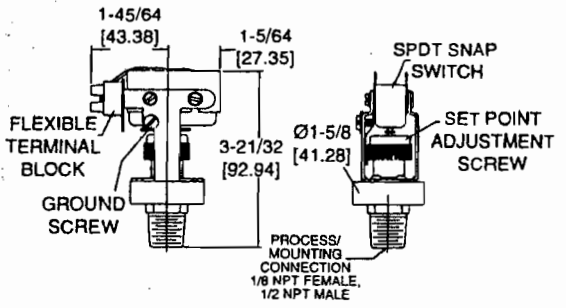
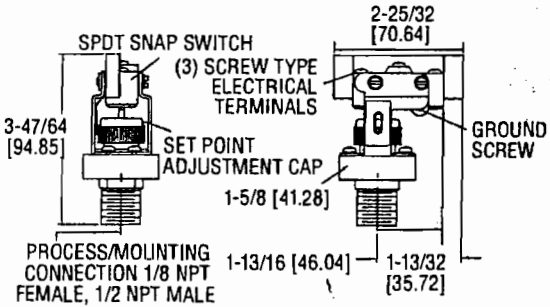
Series A1S



## Hermetic Snap Action Switch



Series A1B



**Low Cost and Precision Made.** The A1 Pressure Control provides the flexibility required for industrial applications. The A1 pressure switch is ideal for panel mounting wherever a high quality economical open case control is required. Optional weatherproof enclosure meets NEMA 4X standards. Superior 15A contact allows direct control of a motor or pump without the use of external relays - a true time and money savings. Unique features include broad temperature limits for increased application possibilities and convenient indicating scale for quick and easy field adjustment. The rugged A1S construction incorporates the features most often requested by customers; a 316 SS diaphragm pressure element for exceptional compatibility and long service life. The A1B construction offers a lower cost Buna-N diaphragm for those applications not requiring 316 SS. Pressure chambers available are: aluminum with Teflon® impregnated hard coating perfect for oil based hydraulic fluids and noncorrosive air and gases, brass for water and water based fluids, and 316 SS for harsher applications. Optional hermetically sealed snap switches are available for harsh environments.

OP enclosure and mounting configuration offers a unit that can be directly mounted through the panel wall keeping the process outside of the panel. Unit has a flush bottom and includes a gasket and mounting nut to insure a tight weatherproof seal against the panel.

**Features**

- 316 SS or Buna N diaphragm
- Aluminum, Brass, or 316 SS pressure chamber
- High current SPDT snap switch
- Weatherproof enclosure available in Polycarbonate of 316 SS
- Hermetically sealed snap switch option

**SPECIFICATIONS**

- Wetted Materials:**
- Pressure Chamber:** Aluminum with Teflon® impregnated anodized coating, brass, or 316 SS.
  - Diaphragm:** 316 SS on A1S, Buna N on A1B.
  - O-ring:** Viton® on A1S, Buna N on A1B.
- Temperature Limit:** -40 to 180°F (-40 to 82°C).
- Pressure Limits:** 750 psig (51 bar).
- Enclosure Rating:** O, and OP enclosure none. PC, PN, SC, and SN enclosures meet NEMA 4X standards.
- Switch Type:** Type 1: SPDT snap switch. Type 1HS: SPDT hermetically sealed snap switch.
- Electrical Rating:** Switch Type 1: 15A @ 120/240/480 VAC, 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC. Switch Type 1HS: 5A @ 120/240 VAC.
- Process Connection:** 1/8" female NPT and 1/2" male NPT. OP style has 1/8" female NPT and 1/2" male straight thread.
- Mounting Orientation:** Within 20° of vertical.
- Set Point Adjustment:** Knurled screw cap with indicating scale.
- Deadband:** Fixed, See deadband chart.
- Weight:** A1S: 9 oz (.25 kg), A1B: 6 oz (.17 kg).
- Electrical Connection:** Screw terminals on Type 1 switch, terminal block on Type 1HS switch.



Series  
A1S  
&  
A1B

# Low Cost OEM Pressure Switch

316 SS or Buna-N Diaphragm. Optional Weatherproof Enclosure.  
Ranges from 3-20 to 50-500 psig

essure

Example	A1	S	PC	SS	1	2	A1S-PC-SS-1-2 Pressure Control; 316 SS diaphragm and Viton® O-ring; weatherproof enclosure, NEMA-4X, polycarbonate with conduit entry; 316 SS pressure chamber; fixed deadband, automatic reset; SPDT snap acting switch; adjustable range 15-150 psig
Construction	A1						Series Designator
Diaphragm Material		S					316 SS diaphragm and Viton® O-ring
		B					Buna-N diaphragm and Buna-N O-ring
Enclosure & Mounting			O OP				Open case Open case - panel mount, has 1/2" straight thread and flush bottom, includes gasket and mounting nut (only available on A1B with brass chamber)
			PC				Weatherproof enclosure, NEMA 4X, polycarbonate with conduit entry
			SS				Weatherproof enclosure, NEMA 4X, 316 SS with conduit entry
Pressure Chamber Material				AL			Aluminum with Teflon® impregnated anodized coating
				BR			Brass
				SS			316 SS
Circuit (Switch) Type					1		SPDT snap action switch, rated 15A @ 120/240/480 VAC, 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC
						1HS	SPDT hermetically sealed snap switch rated 5A @ 120/240 VAC
Adjustable Pressure Range						1	3-20 psig (.21-1.4 bar)
						2	15-150 psig (1.0-10.3 bar)
						3	25-250 psig (1.7-17.2 bar)
						4	50-500 psig (3.4-34.5 bar)

## Optional Enclosures & Mounting:

### Weatherproof



### Open Case-Panel Mount



## Series A1S and A1B Deadband Chart - psig (bar)

Model	Range	Deadband at Minimum Range	Deadband at Maximum Range
A1S or A1B with Type 1 Switch	3-20 (.21-1.4)	1 (.07)	3 (.21)
	15-150 (1.0-10.3)	5 (.34)	15 (1.0)
	25-250 (1.7-17.2)	8 (.55)	25 (1.7)
	50-500 (3.4-34.5)	15 (1.0)	50 (3.5)
A1S with Type 1HS Switch	3-20 (.21-1.4)	1.5 (.10)	4 (.28)
	15-150 (1.0-10.3)	10.5 (.72)	40 (2.8)
	25-250 (1.7-17.2)	9 (.62)	30 (2.1)
	50-500 (3.4-34.5)	14.5 (.99)	42 (2.9)
A1B with Type 1HS Switch	3-20 (.21-1.4)	2 (.14)	6 (.41)
	15-150 (1.0-10.3)	6 (.41)	25 (1.7)
	25-250 (1.7-17.2)	17 (1.17)	50 (3.5)
	50-500 (3.4-34.5)	12.5 (.86)	44 (3.0)

## PRICES

Series A1S - Type O enclosure and Type 1 switch

AL chamber models base price .....  
BR chamber models base price .....  
SS chamber models base price .....

Series A1B - Type O enclosure and Type 1 switch

AL chamber models base price .....  
BR chamber models base price .....  
SS chamber models base price .....

## Enclosures:

PN, PC .....

SN, SC .....

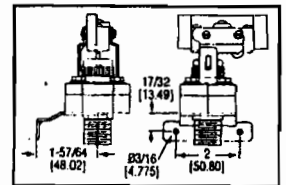
Switches:

1HS .....

## Accessories:

### A-613 Mounting Bracket

Optional accessory is formed from 14 ga. steel, zinc plated for corrosion resistance. Provides rugged permanent mounting and speeds installation. Two 1/4" 6-32 mounting screws are included to attach switch to bracket.



## STOCKED MODELS in bold

Model Number	Range psig (bar)
<b>A1S-O-AL-1-1</b>	3-20 (.21-1.4)
<b>A1S-O-AL-1-2</b>	15-150 (1.0-10.3)
<b>A1S-O-AL-1-3</b>	25-250 (1.7-17.2)
A1S-O-AL-1-4	50-500 (3.4-34.5)
<b>A1S-O-AL-1HS-2</b>	15-150 (1.0-10.3)
<b>A1S-O-SS-1HS-1</b>	3-20 (.21-1.4)
<b>A1S-O-SS-1HS-2</b>	15-150 (1.0-10.3)
A1S-PC-SS-1HS-1	3-20 (.21-1.4)
<b>A1S-PC-SS-1HS-2</b>	15-150 (1.0-10.3)
<b>A1S-PC-AL-1HS-2</b>	15-150 (1.0-10.3)
<b>A1B-O-AL-1-1</b>	3-20 (.21-1.4)
<b>A1B-O-AL-1-2</b>	15-150 (1.0-10.3)
<b>A1B-O-AL-1-3</b>	25-250 (1.7-17.2)
<b>A1B-OP-BR-1-2</b>	15-150 (1.0-10.3)
<b>A1B-O-AL-1HS-1</b>	3-20 (.21-1.4)
<b>A1B-O-AL-1HS-2</b>	15-150 (1.0-10.3)



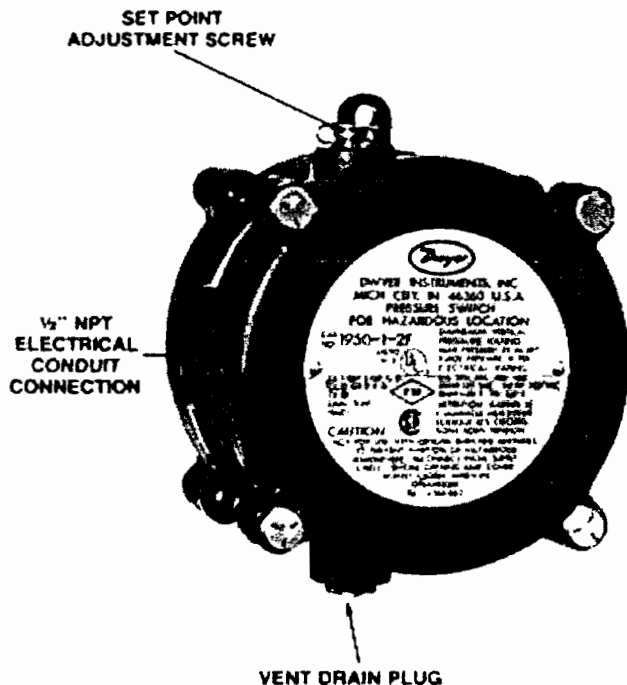
Model: 1950P-8

SERIES 1950

# INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

## Specifications - Installation and Operating Instructions

UL and CSA Listed, FM Approved For  
CL I GR. C,D - CL II GR. E, F, G - CL III



Model 1950 Switches: Operating ranges and dead bands.

To order specify Model Number	Operating Range Inches. W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.10 to 0.5	0.05	0.15
1950-1	0.4 to 1.5	0.15	0.20
1950-5	1.4 to 3.5	0.4	0.4
1950-10	3.0 to 11.0	0.4	0.5
1950-20	4.0 to 20.0	0.4	0.5

Model Number	Operating Range PSI	Approximate Dead Band	
		Min. Set Point	Max. Set Point
1950P-8	1.5 to 8.0	1.0 PSI	1.0 PSI
1950P-25	4.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

**PHYSICAL DATA**

Temperature Limits: -40° to 140°F (-40° to 60°C), 1950P-8, 15, 25 & 50; 0° to 140°F (-17.8° to 60°C), 1950-02, -30° to 130°F (-34.4° to 54.4°C).

Rated Pressure: 1950 - 45 IN. W.C., 1950P - 35 PSI, 1950P-50 only - 70 PSI

Maximum surge pressure: 1950 - 10 PSI, 1950P - 50 PSI, 1950P-50 only - 90 PSI.

Pressure Connections: 1/8" NPT.

Electrical Rating: 15 amps, 125, 250, 480 volts, 60 Hz. A.C. Resistive 1/8 H.P @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C.

Wiring connections: 3 screw type; common, norm. open and norm. closed

Conduit connections: 1/2" NPT

Set point adjustment: Screw type on top of housing. Field adjustable.

Housing: Anodized cast aluminum

Diaphragm: Molded fluorosilicone rubber 02 model, silicone on nylon

Calibration Spring: Stainless Steel.

Installation: Mount with diaphragm in vertical position.

Weight: 3 1/4 lbs. 02 model, 4 lbs., 7 cc

**Response Time:** Because of restrictive effect of flame arrestors, switch response time may be as much as 10-15 seconds where applied pressures are near set point.

**NOTE:** The last number-letter combination in the 1950 model number identifies the switch electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In the case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC - 1/2 HP 125 VAC, 1/4 HP 250 VAC; and a number 5 or 8 rating is 1A 125 VAC. A letter B indicates a Buna-N diaphragm, N; Neoprene, S; Silicone, and V, Viton.

The New Model 1950 Explosion-Proof Switch combines the best features of the popular Dwyer Series 1900 Pressure Switch with a compact explosion-proof housing.

The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembly of the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

**CAUTION:** For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

**DWYER INSTRUMENTS, INC.**

P. O. BOX 373 • MICHIGAN CITY, INDIANA 46360 U.S.A.

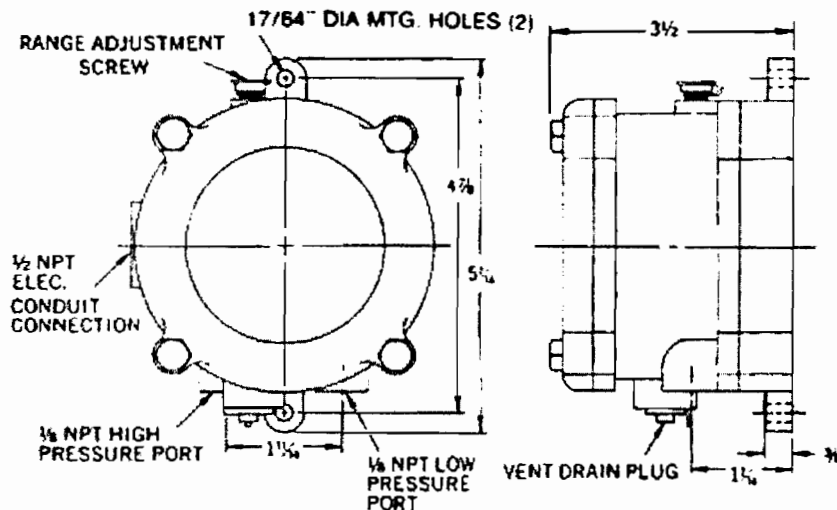
Telephone 219/878-8000

Fax 219/872-9057

# SERIES 1950

## INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

### Installation and Operating Instructions



1950-02: 7-3/4" dia. x 4-11/32" depth.  
For complete dimensions request  
drawing 28-700178-00 from our  
Customer Service Department

1950 SWITCH OUTLINE DIMENSIONS

#### INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Physical Data on page 1. Switch may be installed outdoors or in areas where the hazard of explosion exists. See page 1 for specific types of hazardous service.
2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical. Special units can be furnished for other than vertical mounting arrangements if required.
3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" NPT female pressure ports as noted below:
  - A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS. and from source of lower pressure to low pressure port marked LOW PRESS.
  - B. Pressure only (above atmospheric) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere. See CAUTION on page 1.
  - C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.
4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of screw terminals marked "common," "norm open," and "norm closed." The normally open contacts close and the normally closed contacts open when pressure increases beyond the setpoint. Switch loads for standard models should not

exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

#### ADJUSTMENT

To change the setpoint:

- A. Remove the plastic cap and turn the slotted Adjustment Screw at the top of the housing clockwise to raise the setpoint pressure and counter-clockwise to lower the setpoint. After calibration, replace the plastic cap and re-check the setpoint.
- B. The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the setpoint very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.
- C. For highly critical applications check the setpoint adjustment and if necessary, reset it as noted in step A.

#### MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the setpoint. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.







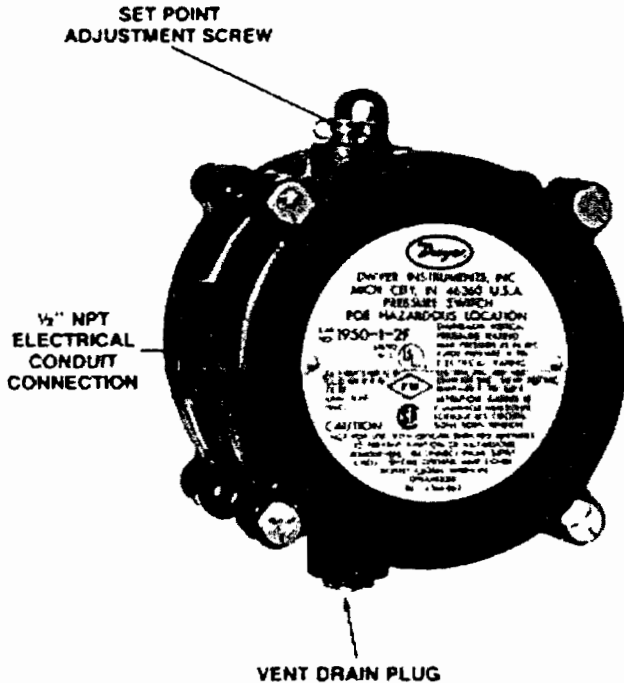
Model: 1950-20

SERIES 1950

# INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

## Specifications - Installation and Operating Instructions

UL and CSA Listed, FM Approved For  
CL I GR. C.D - CL II GR. E.F.G - CL III



Model 1950 Switches: Operating ranges and dead bands.

To order specify Model Number	Operating Range Inches. W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.10	0.15
1950-1	0.4 to 1.6	0.15	0.20
1950-5	1.4 to 5.5	0.3	0.4
1950-10	3.0 to 11.0	0.4	0.6
1950-20	4.0 to 20.0	0.4	0.6

Model Number	Operating Range PSI	Approximate Dead Band	
		Min. Set Point	Max. Set Point
1950P-5	.5 to 2.0	0.3 PSI	0.3 PSI
1950P-8	1.5 to 8.0	1.0 PSI	1.0 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	6.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

The New Model 1950 Explosion-Proof Switch combines the best features of the popular Dwyer Series 1900 Pressure Switch with a compact explosion-proof housing.

The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

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**PHYSICAL DATA**

- Temperature Limits: -40° to 140°F (-40° to 60°C), 1950P-8, 15, 25 & 50: 0° to 140°F (-17.8° to 60°C), 1950-02, -30° to 130°F (-34.4° to 54.4°C).
- Rated Pressure: 1950 - 45 IN. W.C., 1950P - 35 PSI, 1950P-50 only - 70 PSI
- Maximum surge pressure: 1950 - 10 PSI, 1950P - 50 PSI, 1950P-50 only - 90 PSI
- Pressure Connections: 1/8" NPT
- Electrical Rating: 15 amps, 125, 250, 480 volts, 60 Hz. A.C. Resistive 1/8 H.P @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C.
- Wiring connections: 3 screw type; common, norm. open and norm. closed
- Conduit connections: 1/2" NPT
- Set point adjustment: Screw type on top of housing. Field adjustable.
- Housing: Anodized cast aluminum
- Diaphragm: Molded fluorosilicone rubber 02 model, silicone on nylon
- Calibration Spring: Stainless Steel.
- Installation: Mount with diaphragm in vertical position.
- Weight: 3 1/4 lbs. 02 model, 4 lbs. 7 oz.

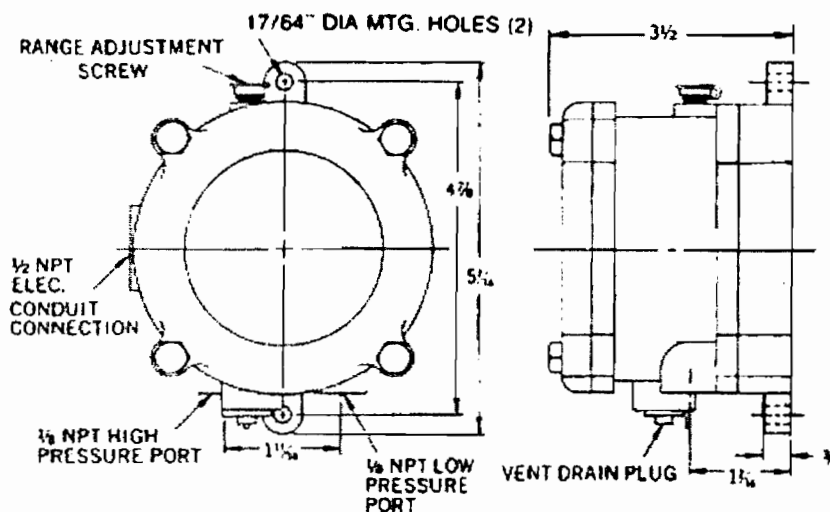
**Response Time:** Because of restrictive effect of flame arrestors, switch response time may be as much as 10-15 seconds where applied pressures are near set point.

**NOTE:** The last number-letter combination in the 1950 model number identifies the switch electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In the case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC - 1/8 HP 125 VAC, 1/4 HP 250 VAC; and a number 5 or 6 rating is 1A 125 VAC. A letter B indicates a Buna-N diaphragm, N; Neoprene, S; Silicone, and V, Viton.

# SERIES 1950

## INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

### Installation and Operating Instructions



1950-02: 7-3/4" dia. x 4-11/32" depth.  
For complete dimensions request  
drawing 28-700175-00 from our  
Customer Service Department

1950 SWITCH OUTLINE DIMENSIONS

#### INSTALLATION

- Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Physical Data on page 1. Switch may be installed outdoors or in areas where the hazard of explosion exists. See page 1 for specific types of hazardous service.
- Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical. Special units can be furnished for other than vertical mounting arrangements if required.
- Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" NPT female pressure ports as noted below:
  - Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS. and from source of lower pressure to low pressure port marked LOW PRESS.
  - Pressure only (above atmospheric) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere. See CAUTION on page 1.
  - Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.
- To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of screw terminals marked "common," "norm open," and "norm closed." The normally open contacts close and the normally closed contacts open when pressure increases beyond the setpoint. Switch leads for standard models should not

exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

#### ADJUSTMENT

To change the setpoint:

- Remove the plastic cap and turn the slotted Adjustment Screw at the top of the housing clockwise to raise the setpoint pressure and counter-clockwise to lower the setpoint. After calibration, replace the plastic cap and re-check the setpoint.
- The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the setpoint very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.
- For highly critical applications check the setpoint adjustment and if necessary, reset it as noted in step A.

#### MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the setpoint. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.





# Multiple-Stage Switches: **Vertical Mount**

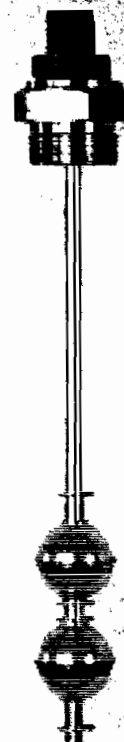
**Innovative Solutions**



## **L500 Series Custom Switches with a Maximum Length of 11'**

The L500 series level switches are individually designed from over 1,400 component parts to create a custom switch available in lengths from six inches (152 mm) to 11 feet (3.3 meters).

To specify, review the choices in mounting types, stem and mounting, float sizes, switching points and electrical specifications that appear on these pages.



**L500**

### **Product Configuration Choices:**

- Mounting & Materials:** Select mounting size, mount and stem material, float material, switch type, and optional enclosure from **Table A**.
- Float Size:** Select float from **Table B**.
- Switch Wiring:** Select switch wiring from **Table C**.
- Actuation Levels:** Select switch actuation level(s) from **Table D**.

### **A. Component Choices L500:**

Series	Mounting* Types	Mounting* & Stem Materials	Float Materials	Switch Types	Enclosures
	04 1/2" NPT	01 Brass	02 Polypropylene (hollow)	20 20VA SPST	00 No enclosure
	06 1" NPT	02 Polypropylene	05 PVC	03 50VA SPST (standard)	01 Polypropylene NEMA 4
	07 1 1/2" NPT	05 PVC	08 316 SS	04 100VA SPST	02 Cast aluminum
	08 1 3/4" NPT	08 316 SS	20 Buna-N	06 3VA SPDT	NEMA 4/7/9
<b>L500</b>	09 2" NPT				03 Cast Iron NEMA 4/7/9
	73 2" 150# ANSI Flange				
	75 3" 150# ANSI Flange				
	76 4" 150# ANSI Flange				

**Example:** L500-0901-0803-00 = 2" NPT mounting; brass mounting & stem material; 316 SS float; 50VA SPST switches; no enclosure

\*Other mountings and materials are available. Consult factory for details.



# Multiple-Stage Switches: **Vertical Mount**

**Innovative  
Solutions**



## **L500 Series Custom Switches with a Maximum Length of 11'**

### B. Float Sizes and Operating Specifications

Float Materials	Dimensions	Available Mount Types	Temperature	Pressure	Minimum Specific Gravity
Polypropylene (hollow)	1.810" x 1.875"	04, 06, 09, 73, 75, 76	-40° to +150° F	50 psig	.55
<b>316 stainless steel</b>	1.5" x 1.3"	04, 06, 09, 73, 75, 76	-40° to +300° F	120 psig	.85
316 stainless steel	2" ball	04, 06, 09, 73, 75, 76	-40° to +300° F	750 psig	.75
Teflon (hollow)	2.150" x 1.980"	04, 06, 09, 73, 75, 76	-40° to +500° F	100 psig	.95
Buna-N	1.250" x 1.875"	04, 06, 07, 09, 73, 75, 76	-40° to +180° F	150 psig	.65
Buna-N	1.875" x 1.750"	04, 06, 09, 73, 75, 76	-40° to +180° F	150 psig	.65

### C. Switch Wiring and Electrical Specifications

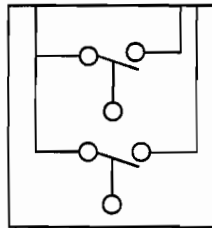
Each switching point requires one float. For special applications, a single float can be used to activate two switch points, though these points must have a minimum separation of 1/8" (3mm). The maximum number of actuation levels depends on the wiring type selected.

**Ratings:** 20, 50, or 100 VA @ 120 VAC SPST  
50 VA @ 240 VAC SPST  
100 W @ 240 VAC SPDT

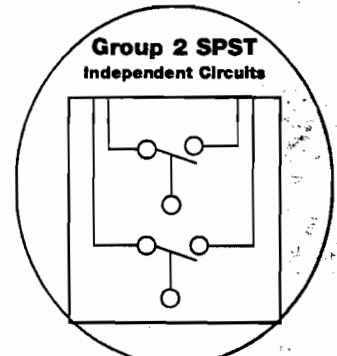
**Connection:** 24" Free Leads  
#22 AWG

**Mounting Attitude:** Vertical ±30°

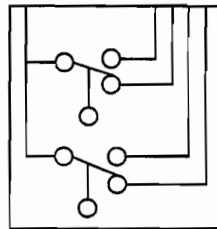
**Group 1 SPST**  
One Common Wire



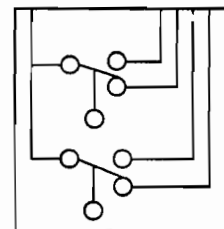
**Group 2 SPST**  
Independent Circuits



**Group 3 SPDT**  
One Common Wire



**Group 4 SPDT**  
Independent Circuits



### Switch Wiring Codes

Wiring Options	Group 1		Group 2 SPST		Group 3 SPDT		Group 4 SPDT	
	SPST				Black		None	
Common Wire	Black	None			Black		None	
	NO/NC	NO or NC	NO	NC	Common	NO	NC	
L1	Red	Red	Red	White-Red	Red	White-Red	White-Black-Red	
L2	Yellow	Yellow	Yellow	White-Yellow	Yellow	White-Yellow	White-Black-Yellow	
L3	Blue	Blue	Blue	White-Blue				
L4	Brown	Brown	Brown					
L5	Orange							
L6	Gray							



## Multiple-Stage Switches: **Vertical Mount**

**Innovative  
Solutions**



### **L500 Series Custom Switches with a Maximum Length of 11'**

#### **D. Actuation Level Dimensions**

**A** = 1 1/2" (38mm) minimum distance from actuation point to inside surface of tank or mounting pad.

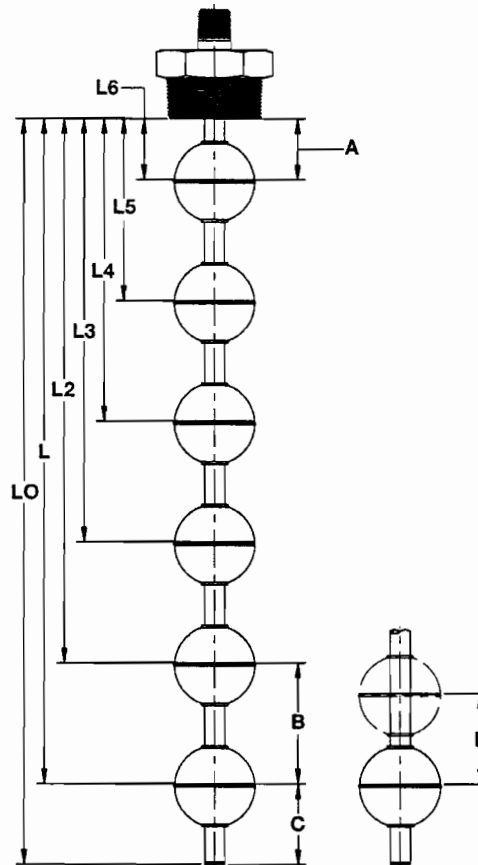
**B** = 3" (76mm) minimum distance between actuation levels.

**C** = 2" (51mm) minimum distance from end of unit to lowest actuation level.

**D** = 1/4" (6mm) minimum distance between points when a single float is used to activate two switches. (One float can activate two switches when the lower switch is NC and the upper switch is NO).

#### **Notes:**

1. A, B, and C dimensions are based on a specific gravity of 1.0.
2. When using one float for two actuation positions, contact the factory for available switch ratings.
3. Actuation levels are calibrated on descending fluid level, with water as the fluid, unless otherwise specified.
4. Standard tolerance on actuation levels is  $\pm 1/8"$  (3mm).



#### **Integrated Temperature Sensors**

All Innovative Solutions L500, multi-level switches can be specially equipped with integrated temperature sensors. Please contact Innovative for more information.

<b>Thermistor:</b>	Variable resistance, continuous output
<b>Thermocouple:</b>	"Type K Junction" continuous readout
<b>Thermostat:</b>	Fixed set point for high/low alarm switching

# Innovative Solutions

## Multi-Point Liquid Level Switch (L500 Large Size Vertical Mount)

### Installation & Maintenance

#### General Information:

Switches should be installed securely and clear of obstructions so the float(s) are free to move with liquid level changes.

Switches should be mounted in an area of the tank free of turbulence or direct streams.

Operate only within listed electrical ratings.

#### Maintenance

Periodically inspect the float to be sure it is not coated or contaminated by any material or substance that would significantly change its weight or volume.

#### Important Points

- Always operate within specified temperature and pressure ratings. Possible surges in temperature and pressure should also be observed, (see table below).
- Only use with liquids compatible with the material of construction. (Consult factory for information).
- Changes in fluid temperature can affect switch set-points since density/specific gravity may vary with temperature.

Float Material	Temperature	Pressure
Polypropylene	150°F	50 PSIG
Buna-N	180°F	150 PSIG
Stainless Steel (1 1/2")	300°F	120 PSIG
Stainless Steel (2" Ball)	300°F	750 PSIG

# Electrical Ratings and Wiring Diagrams

Reed switches used in *Innovative Solutions* level switches are hermetically sealed and a magnetically actuated SPST or SPDT rated as maximum power limits in Volt-Amps, (VA).

### CAUTION: DO NOT EXCEED MAXIMUM LOAD RATINGS

Contact protection such as a diode, (DC), or resistor, (AC), should be used to suppress high transient voltages or in rush currents that may cause burning or welding of the switch contacts.

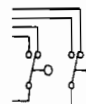
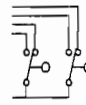
Switch Ratings—Maximum Loads (Resistive)			
VA	Volts	Amps (AC)	Amps (DC)
50 (SPST)	0-50	0.5	0.5
100 (SPST)	120	0.4	0.4
3.0 (SPDT)	120	0.8	0.8
	240	0.2	0.2
	30 VDC		0.2

Group 1 SPST  
One Common Wire



Group 2 SPST  
Independent Circuits

Group 3 SPDT  
One Common Wire



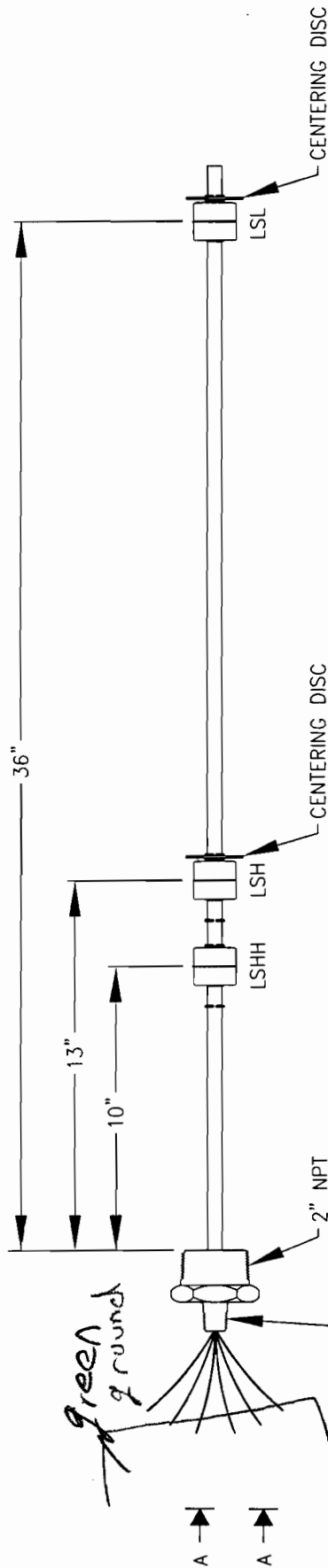
Group 4 SPDT  
Independent Circuits



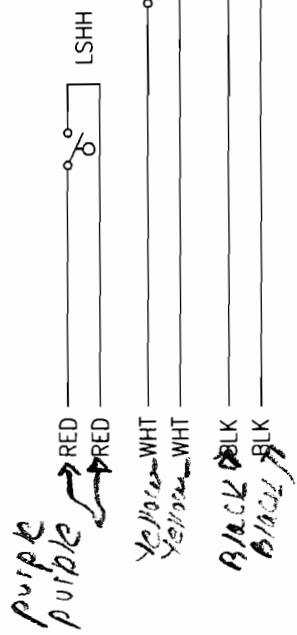
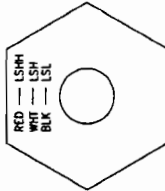
Note: Only two actuation points are shown in the diagrams above

Wire Color Code Table				
Common Wire	GROUP 1 Black	GROUP 2 None	GROUP 3 Black	GROUP 4 See Below
Level 1	NO/NC Red	NO or NC Red	NO White/Red	NO White/Black/Red
Level 2	Yellow	Yellow	Yellow	White/Yellow
Level 3	Blue	Blue	Blue	White/Blue
Level 4	Brown	Brown	Brown	White/Brown
Level 5	Orange	Orange	Orange	White/Orange
Level 6	Grey	Grey	Grey	White/Black/Orange

NOTE: More than one color designation denotes striped or multi-color wire jackets



ETCH NOMENCLATURE AS SHOWN



WIRING SCHEMATIC

VIEW A-A

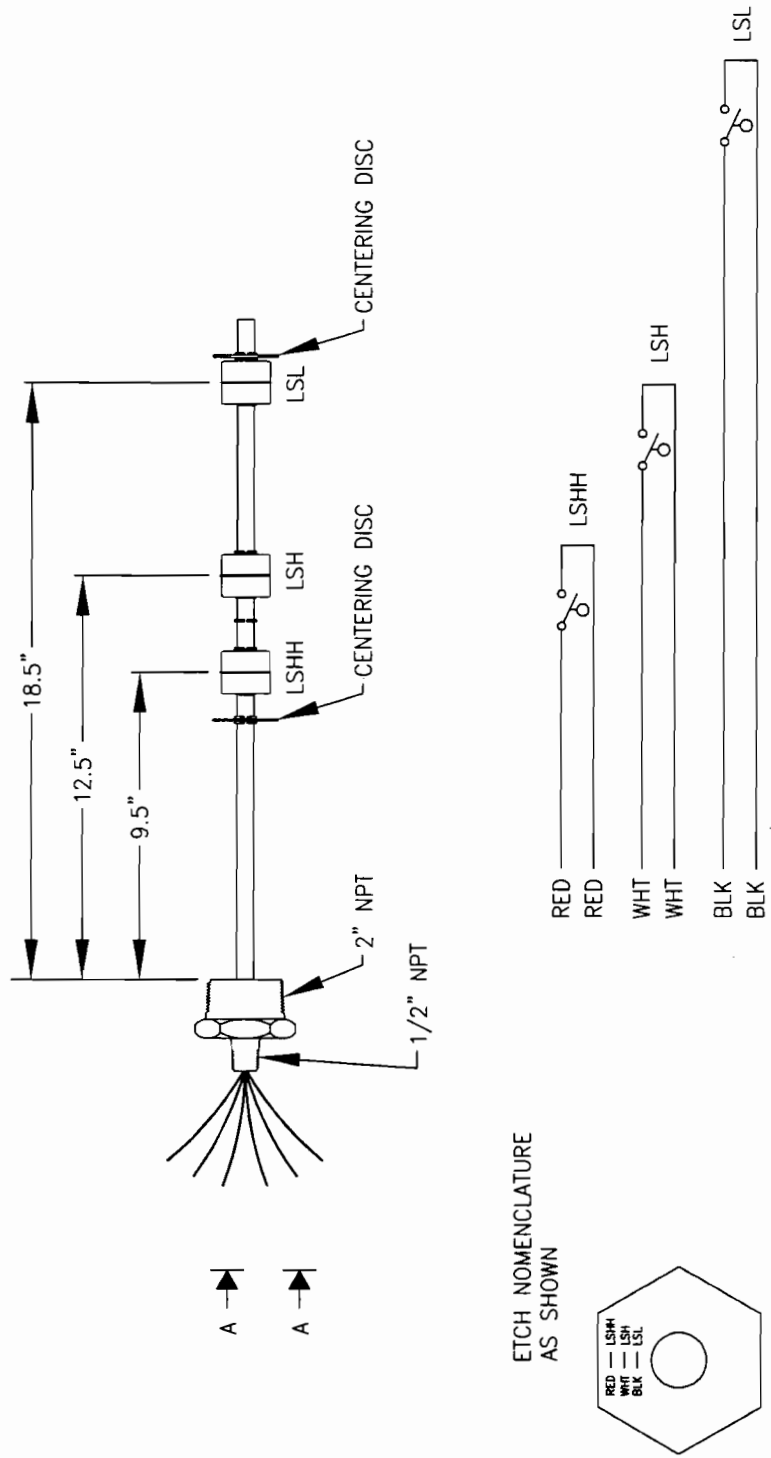
NOTE:

1. ALL MATERIAL TO BE 316 ST. ST'L.
2. SPECIFIC GRAVITY 0.6.
3. REED SWITCHES RATED AT 50VA, 125V.
4. SWITCH SHOULD BE IN THE DOWN POSITION FOR MEASUREMENT.
5. ALL WIRE TO BE 18 AWG., PVC JACKETED, 24" MIN. FREE LENGTH.

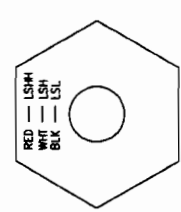
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DRWN BY	TJM	DATE	9/16/04
CHK BY		DATE	
APPR BY		DATE	
TITLE <b>LEVEL SWITCH, EQUALIZATION TANK</b>			
NYS DORMITORY AUTHORITY GOWANDA DAY HAB CENTER		JOB NO. 11757	
SCALE	NONE	DWG NO.	11757TJML-04
SIZE	B	SHEET	1 OF 1
REV.		DATE	
DESCRIPTION	REVISIONS		

**BISCO Environmental**  
Soil & Groundwater Remediation Equipment  
Randolph, Massachusetts 02368



ETCH NOMENCLATURE AS SHOWN



WIRING SCHEMATIC

NOTE:

1. ALL MATERIAL TO BE 316 ST. ST'L.
2. SPECIFIC GRAVITY 0.6.
3. REED SWITCHES RATED AT 50VA, 125V.
4. SWITCH SHOULD BE IN THE DOWN POSITION FOR MEASUREMENT.
5. ALL WIRE TO BE 18 AWG., PVC JACKETED, 24" MIN. FREE LENGTH.

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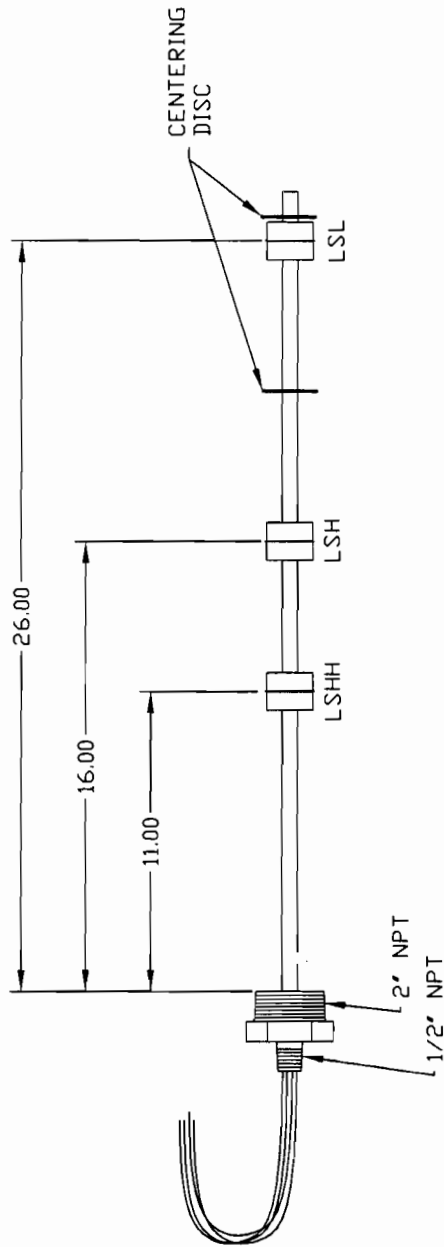
DRWN BY	TJM	DATE	9/16/04
CHK BY		DATE	
APPR BY		DATE	

**BISCO Environmental**  
Soil & Groundwater Remediation Equipment  
Randolph, Massachusetts 02368

TITLE		LEVEL SWITCH, AIR STRIPPER	
SCALE	NONE	DWG NO.	11757TML-05
SIZE	B	JOB NO.	11757
REV		SHEET	1 OF 1

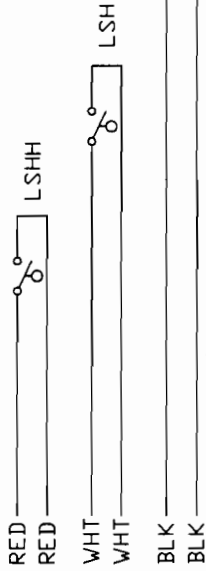
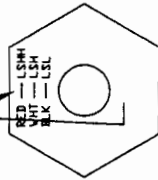
REV.	DESCRIPTION	DATE	APPR.
	REVISIONS		





A →  
A →

ETCH NOMENCLATURE  
AS SHOWN



WIRING SCHEMATIC

VIEW A-A

NOTE:

1. ALL MATERIAL TO BE 316 ST. ST'L.
2. SPECIFIC GRAVITY 0.6.
3. REED SWITCHES RATED AT 50VA, 125V.
4. SWITCH SHOULD BE IN THE DOWN POSITION FOR MEASUREMENT.
5. ALL WIRE TO BE 18 AWG., PVC JACKETED, 24' MIN. FREE LENGTH.

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DRWN BY	PRS	DATE	05/29/01
CHK BY		DATE	
APPR BY		DATE	
Soil & Groundwater Remediation Equipment Randolph, Massachusetts 02368			
TITLE	PHASE SEPARATOR 3 LEVEL FLOAT SWITCH		
SCALE	NONE	SIZE	B
DWG NO.	3FLTSEPLEV	JOB NO.	
SHEET	1	OF	1
REV			1

REV.	1	ADD SECOND CENTERING DISC	3/21/02	PRS
		DESCRIPTION	DATE	APPR.
		REVISIONS		



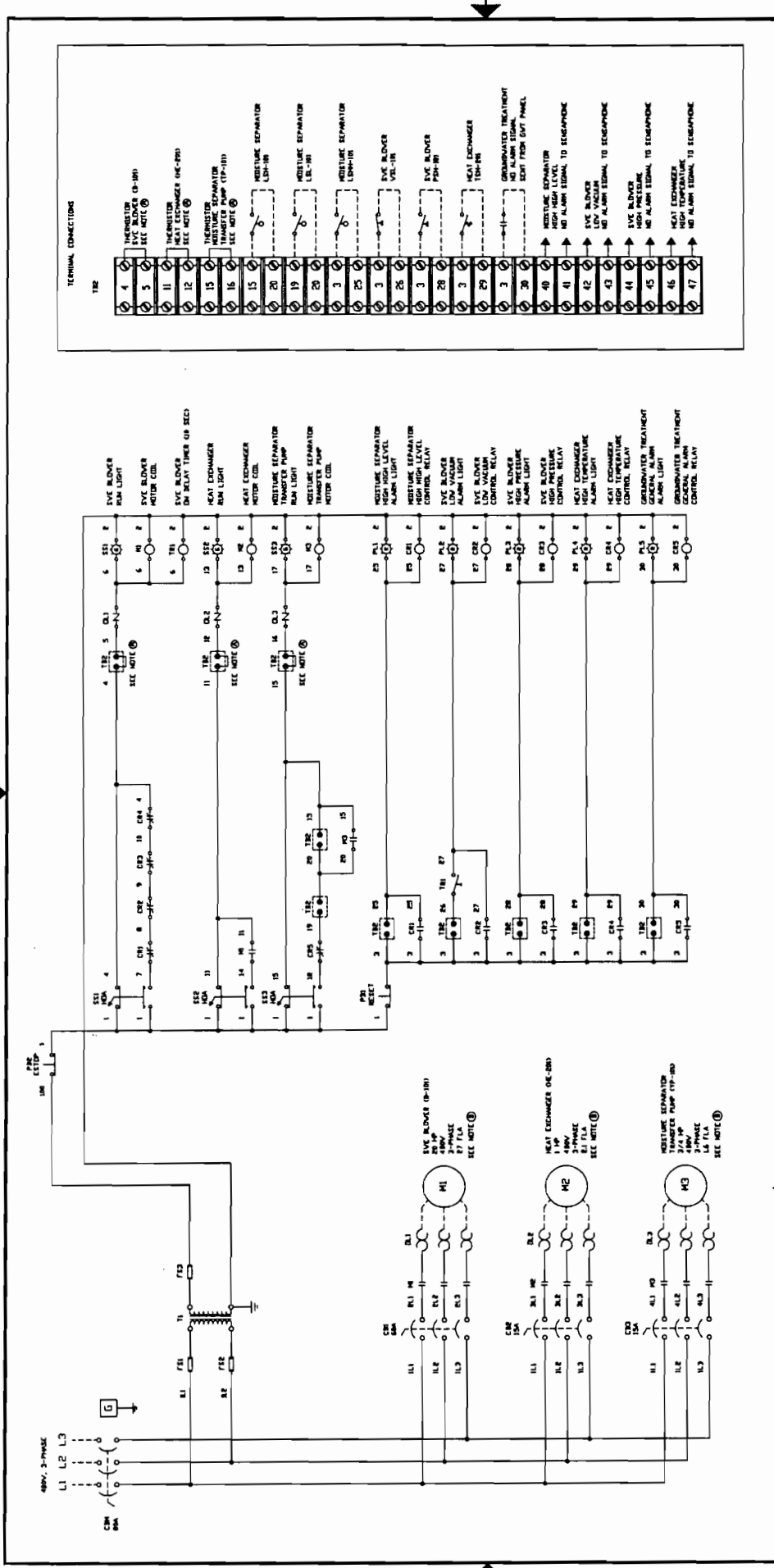
## SECTION 8

# CONTROL PANELS



## SECTION 8A

# SOIL VAPOR EXTRACTION SYSTEM CONTROLS



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DRWN BY SDH DATE 9/17/04  
 CHK BY DATE  
 APPR BY DATE

REV.	DESCRIPTION	DATE	APPR.

NOTE: MOVIE JUMPER IF OPTIONAL THERMISTOR IS TO BE CONNECTED.  
 NOTE: BASED ON THE 1998 IEC ACTING WIRING AND VARY IEC PROTECTED RELAY ASSEMBLY US-30A LISTED

REV.	DESCRIPTION	DATE	APPR.

CONFORMANCE NOTE:  
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DRWN BY SDH DATE 9/17/04  
 CHK BY DATE  
 APPR BY DATE

REV.	DESCRIPTION	DATE	APPR.

NOTE: MOVIE JUMPER IF OPTIONAL THERMISTOR IS TO BE CONNECTED.  
 NOTE: BASED ON THE 1998 IEC ACTING WIRING AND VARY IEC PROTECTED RELAY ASSEMBLY US-30A LISTED

REV.	DESCRIPTION	DATE	APPR.

**BISCO Environmental**  
 Soil & Groundwater Remediation Equipment  
 Randolph, Massachusetts 02368

TITLE: CONTROL PANEL

JOB NO. 11757

SCALE: N/A SIZE: B DWG NO. 11757SVE SHEET: 1 OF 2 PRELIM

CONFORMANCE NOTE:  
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DRWN BY SDH DATE 9/17/04  
 CHK BY DATE  
 APPR BY DATE

REV.	DESCRIPTION	DATE	APPR.

NOTE: MOVIE JUMPER IF OPTIONAL THERMISTOR IS TO BE CONNECTED.  
 NOTE: BASED ON THE 1998 IEC ACTING WIRING AND VARY IEC PROTECTED RELAY ASSEMBLY US-30A LISTED

REV.	DESCRIPTION	DATE	APPR.

CONFORMANCE NOTE:  
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DRWN BY SDH DATE 9/17/04  
 CHK BY DATE  
 APPR BY DATE

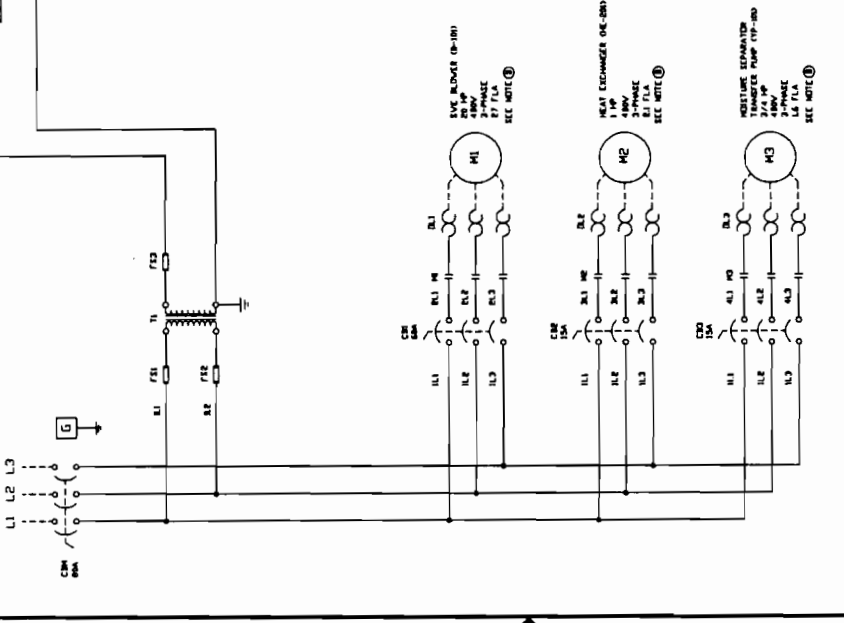
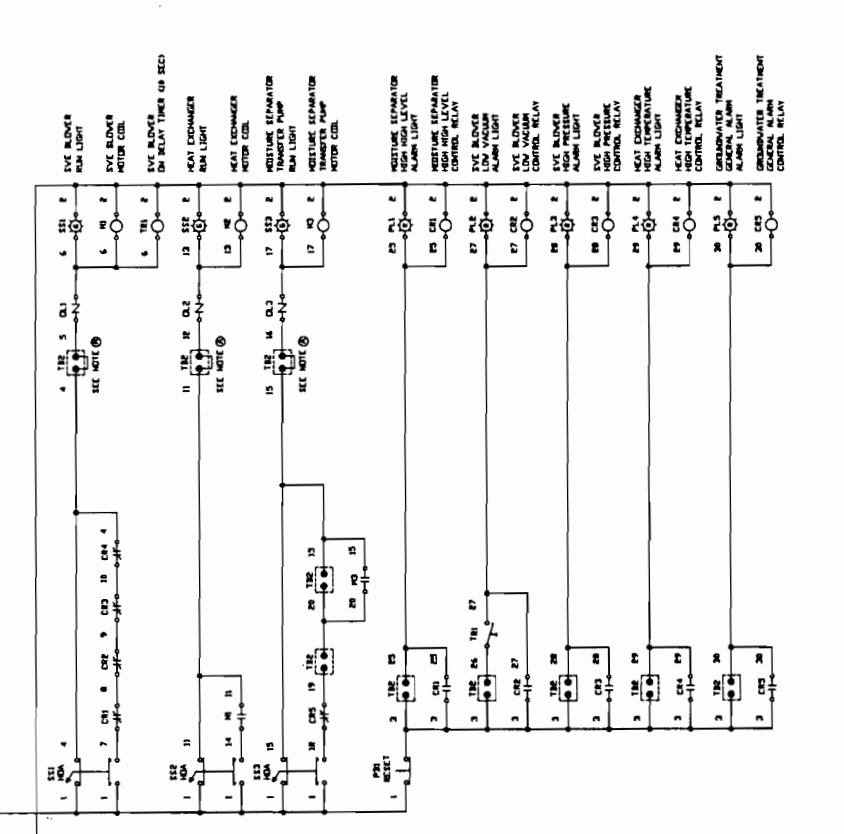
REV.	DESCRIPTION	DATE	APPR.

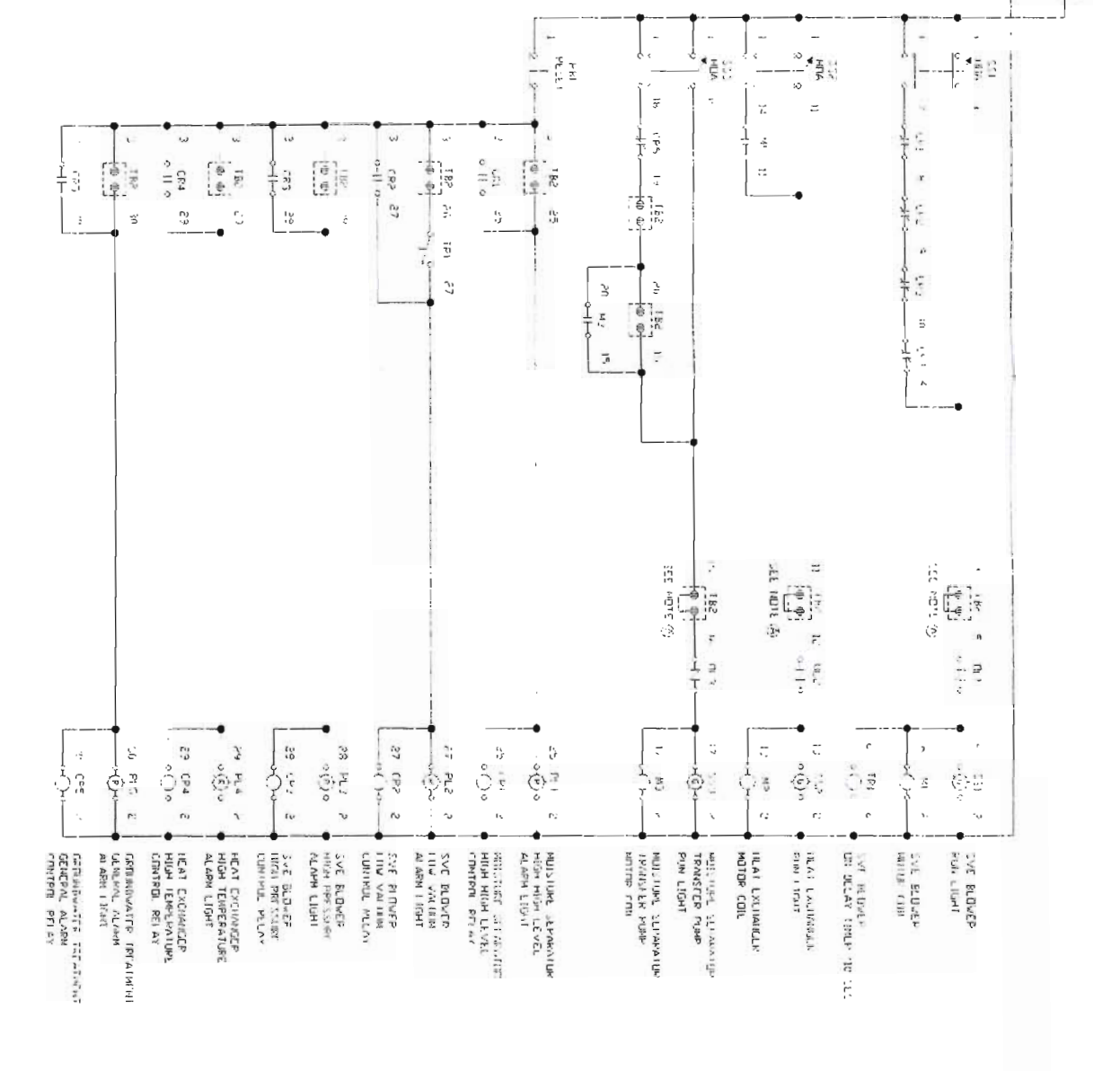
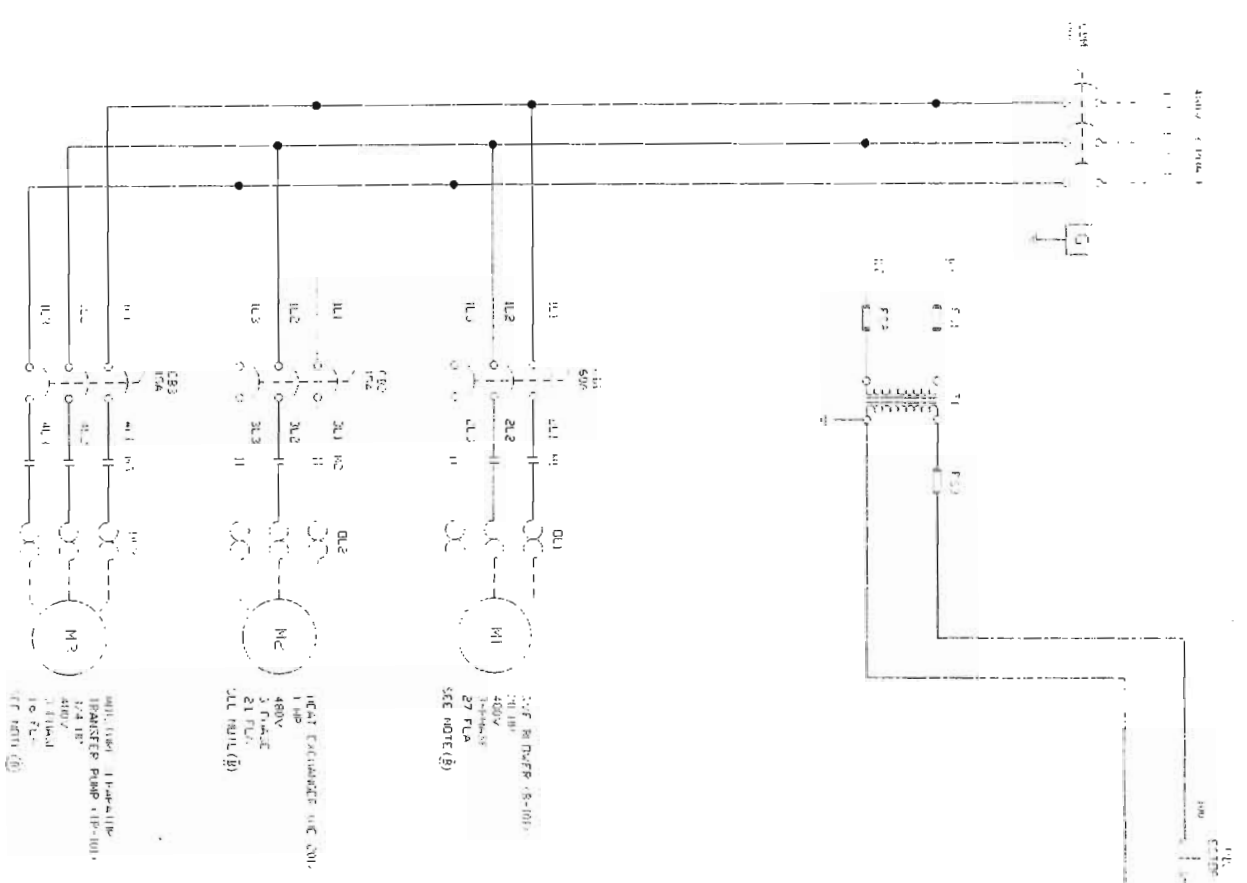
NOTE: MOVIE JUMPER IF OPTIONAL THERMISTOR IS TO BE CONNECTED.  
 NOTE: BASED ON THE 1998 IEC ACTING WIRING AND VARY IEC PROTECTED RELAY ASSEMBLY US-30A LISTED

REV.	DESCRIPTION	DATE	APPR.

TERMINAL CONNECTIONS

1	WATER
2	WATER
3	WATER
4	WATER
5	WATER
6	WATER
7	WATER
8	WATER
9	WATER
10	WATER
11	WATER
12	WATER
13	WATER
14	WATER
15	WATER
16	WATER
17	WATER
18	WATER
19	WATER
20	WATER
21	WATER
22	WATER
23	WATER
24	WATER
25	WATER
26	WATER
27	WATER
28	WATER
29	WATER
30	WATER
31	WATER
32	WATER
33	WATER
34	WATER
35	WATER
36	WATER
37	WATER
38	WATER
39	WATER
40	WATER
41	WATER
42	WATER
43	WATER
44	WATER
45	WATER
46	WATER
47	WATER





10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	51
52	53	54
55	56	57
58	59	60

NOTE: REWORK SHEET IF ORIGINAL INDICATED TO BE CLEAR CLERICAL MISTAKE.

NOTE: BASED ON THE 1995 NEC ACTUAL PRACTICE MAY VARY.

NOTES: INFORMATION SUBJECT TO CHANGE WITHOUT NOTICE.

REV	DESCRIPTION	DATE	APP'D
1	REVISION		

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**BISCO Environmental**

Soil & Groundwater Remediation Equipment  
Randolph, Massachusetts 02363

**CONTROL PANEL**

DATE: 9/17/04

SCALE: N/A

SHEET: 8

DWG NO: 117575VE

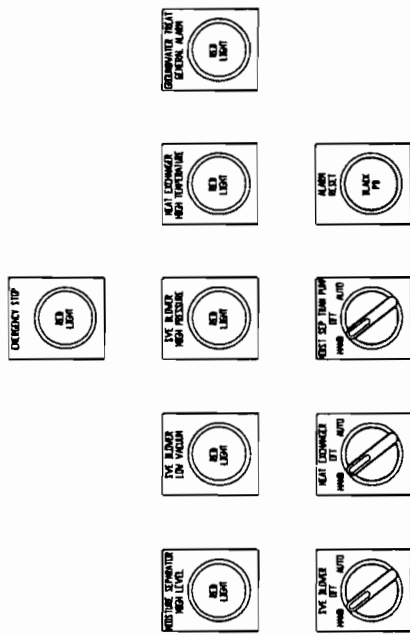
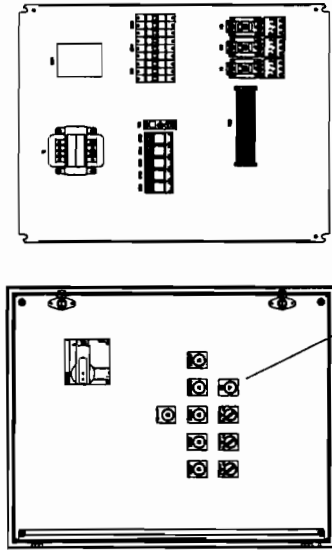
JOB NO: 11757

SHEET: 1 OF 2

REV: PRELIM

TERMINAL IDENTIFIER	DESCRIPTION
1	HEAT EXCHANGER HIGH TEMP
2	HEAT EXCHANGER HIGH TEMP
3	HEAT EXCHANGER HIGH TEMP
4	HEAT EXCHANGER HIGH TEMP
5	HEAT EXCHANGER HIGH TEMP
6	HEAT EXCHANGER HIGH TEMP
7	HEAT EXCHANGER HIGH TEMP
8	HEAT EXCHANGER HIGH TEMP
9	HEAT EXCHANGER HIGH TEMP
10	HEAT EXCHANGER HIGH TEMP
11	HEAT EXCHANGER HIGH TEMP
12	HEAT EXCHANGER HIGH TEMP
13	HEAT EXCHANGER HIGH TEMP
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47	HEAT EXCHANGER HIGH TEMP

COMPONENT	QTY	TYPE	MODEL #	DESCRIPTION
Control Enclosure	1	Hoffman	C-S030248	NEMA 4, Single door, 30"H x 24"W x 8"D
Control Enclosure	1	Hoffman	C-P3024	Sub Panel
Circuit Breaker (CBM)	1	Allen Bradley	140UG2C0080	Circuit breaker, 480V, 80A, 3-pole
Circuit Breaker (CBM)	1	Cutler-Hammer	GHMVD12B	Handle
Circuit Breaker (CBM)	1	Allen Bradley	37A100G3K	Terminal Kit
Circuit Breaker (CB1)	1	Allen Bradley	140UG2C0080	Circuit breaker, 480V, 3-pole, 80A
Circuit Breaker (CB2-3)	2	Allen Bradley	140UG2C015	Circuit breaker, 480V, 3-pole, 15A
Transformer (T1)	1	Hammond	PT250MOMJ-3	Transformer, 230V-480V/20V, 250VA
Fuse (F1-2)	2	Bussman	LFCC-1.5	Transformer Primary Fuse, 1.5 Amp
Fuse (F3)	1	Bussman	FNM-3	Transformer Secondary Fuse, 3 Amp
Contactor (M1)	1	Allen Bradley	100-C0D10	Contactor for 5HP at 480V, 3-phase
Contactor (M2-3)	2	Allen Bradley	100-C0D10	Contactor for 5HP at 480V, 3-phase
OL Block (M1)	1	Allen Bradley	193-EA1HC	12-37A OL block
HOA Switch (SS1-3)	2	Allen Bradley	193-EA1DB	Selector switch operator, illuminated
HOA Switch (SS1-3)	3	Allen Bradley	800EM1SM63	Light module
HOA Switch (SS1-3)	3	Allen Bradley	800E-20L5G	Normally open contact
Reset Button (PB1-3)	6	Allen Bradley	800E-2010	Pushbutton, momentary, black
Reset Button (PB1-3)	1	Allen Bradley	800EM-F7	Pushbutton, push-pull-maintain
Push Button (PB1-2)	1	Allen Bradley	800E-WHP24	Latch
Push Button (PB1-2)	2	Allen Bradley	800E-AZL	Normally closed contact
Pilot Light (PL1-5)	5	Allen Bradley	800E-2001	Pilot light, red, 120V
Control Relay (CR1-5)	5	Iscc	800EP-PUMD5R	Control relay, 120V, 4-pole
Control Relay (CR1-5)	5	Iscc	RUS-A110	Control relay socket
Timing Relay (TR1)	1	Allen Bradley	5Y4S-05	120V, On delay timer



**BISCO Environmental**  
Soil & Groundwater Remediation Equipment  
Randolph, Massachusetts 02368

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DATE: 9/17/04

CHK BY: SOH

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APPR BY: [Signature]

DATE: [Blank]

DESCRIPTION: CONTROL PANEL

REVISIONS: [Blank]

SCALE: N/A

SHEET: 2 OF 2

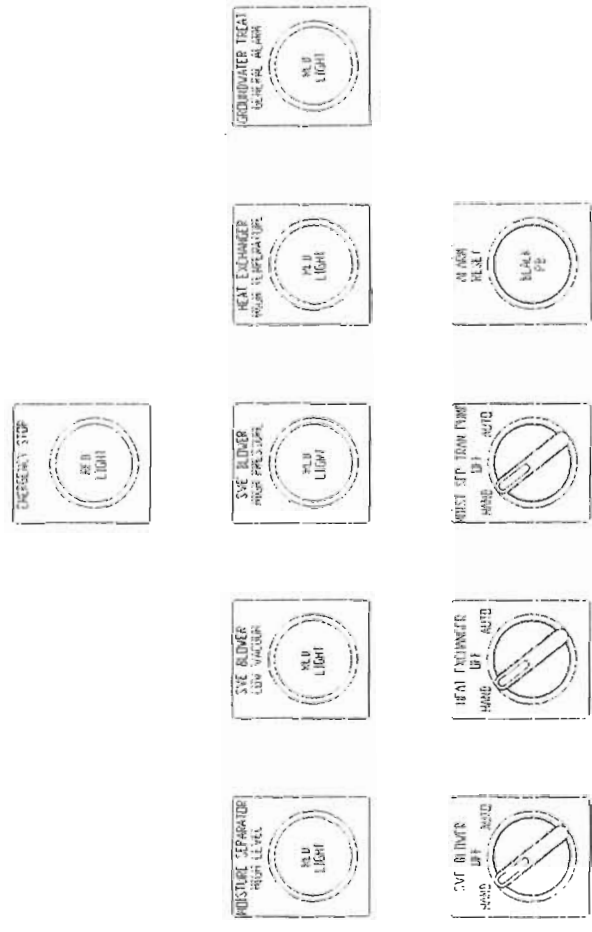
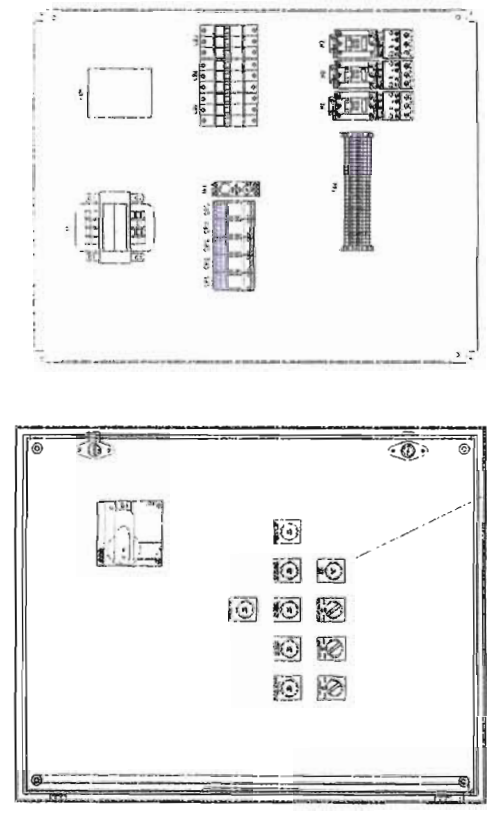
REV: PRELIM

JOB NO: 11757

CLIENT: M/S DOMITORY AUTHORITY  
EDMUND DAY REHAB CENTER

DWG NO: 11757/SVE

COMPONENT	QTY	TYPE	MODEL #	DESCRIPTION
Control Enclosure	1	Hoffman	C-SD30248	NEMA 4, Single door, 30"H x 24"W x 8"D
Control Enclosure	1	Hoffman	C-P3024	Sub Panel
Circuit Breaker (CBM)	1	Allen Bradley	140UG2C3C80	Circuit breaker, 480V, 80A, 3-pole
Circuit Breaker (CBM)	1	Cutler-Hammer	GHMVD12B	Handle
Circuit Breaker (CBM)	1	Cutler-Hammer	3TA100G3K	Terminal Kit
Circuit Breaker (CB1)	1	Allen Bradley	140UG2C3C60	Circuit breaker, 480V, 3-pole, 60A
Circuit Breaker (CB2-3)	2	Allen Bradley	140UG2C3C15	Circuit breaker, 480V, 3-pole, 15A
Transformer (T1)	1	Hammond	PT250MQMJ-3	Transformer, 230x460/120V, 250VA
Fuse (FS1-2)	2	Bussman	LPC-1.5	Transformer Primary Fuse, 1.5 Amp
Fuse (FS3)	1	Bussman	FNM-3	Transformer Secondary Fuse, 3 Amp
Contactor (M1)	1	Allen Bradley	100-C30D10	Contactor for 20HP at 480V, 3-phase
Contactor (M2-3)	2	Allen Bradley	100-C09D10	Contactor for 5HP at 480V, 3-phase
OL Block (M1)	1	Allen Bradley	193-EA1HC	12-37A OL block
OL Block (M2-3)	2	Allen Bradley	193-EA1DB	1-2.9A OL block
HOA Switch (SS1-3)	3	Allen Bradley	800EM-LSM33	Selector switch operator, illuminated
HOA Switch (SS1-3)	3	Allen Bradley	800E-2DL5G	Light module
Switch Contact (SS1-3)	6	Allen Bradley	800E-2X10	Normally open contact
Reset Button (PB1)	1	Allen Bradley	800EM-F2	Pushbutton, momentary, black
Estop (PB2)	1	Allen Bradley	800EM-MP24	Pushbutton, push-pull-maintain
Push Button (PB1-2)	2	Allen Bradley	800E-A2L	Latch
Push Button (PB1-2)	2	Allen Bradley	800E-2X01	Normally closed contact
Pilot Light (PL1-5)	5	Allen Bradley	800EP-PLM4D5R	Pilot light, red, 120V
Control Relay (CR1-5)	5	Idec	RLJAS-A110	Control relay, 120V, 4-pole
Control Relay (CR1-5)	5	Idec	SY4S-05	Control relay socket
Timing Relay (TR1)	1	Allen Bradley	700-FSA3JU23	120V, On delay timer



TITLE <b>CONTROL PANEL</b>		JOB NO. 11757
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DRAWN BY TDB	DATE 9/17/04	CHECKED BY DATE
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REV	DESCRIPTION REVISION	SCALE N/A
Dwg No. 11757SVC	Size B	SHEET 2 of 2
Job No. 11757	Title CONTROL PANEL	REV PRF/JM



# CONCEPT® Wall-Mount Enclosures



## Standard Sizes CONCEPT® Single-Door Wall-Mount Enclosures

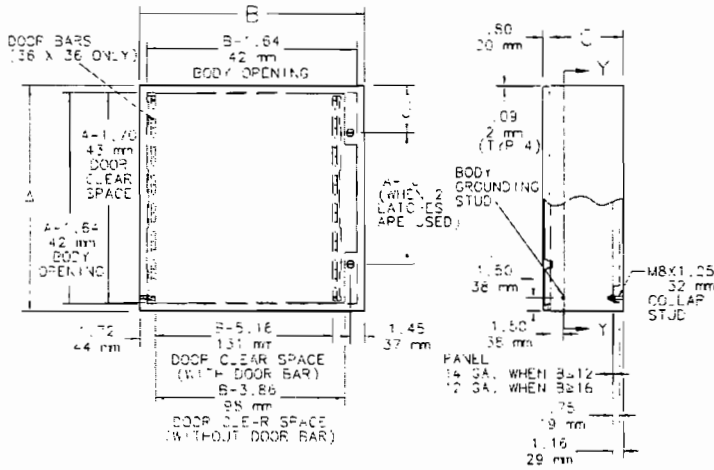
Enclosure Catalog Number ANSI 61 Gray	Enclosure Catalog Number RAL 7035 Lt. Gray	Door Ga.	Body Ga.	Enclosure Size A x B x C		* CONCEPT® Panel Catalog Number	Panel Size D x E		Mounting G x H		Latches qty style	J inch (mm)
				inch	(millimeter)		inch	(mm)	inch	(mm)		
CSD12126	CSD12126LG	16	16	12.00 x 12.00 x 6.00	(305 x 305 x 152)	CP1212	10.20 x 10.20	(259 x 259)	10.50 x 10.50	(267 x 267)	1 Qturn.	6.00 (152)
CSD16126	CSD16126LG	16	16	16.00 x 12.00 x 6.00	(406 x 305 x 152)	CP1612	14.20 x 10.20	(361 x 259)	14.50 x 10.50	(368 x 267)	1 Qturn.	8.00 (203)
CSD16166	CSD16166LG	16	16	16.00 x 16.00 x 6.00	(406 x 406 x 152)	CP1616	14.20 x 14.20	(361 x 361)	14.50 x 14.50	(368 x 368)	1 Qturn.	8.00 (203)
CSD16206	CSD16206LG	16	16	16.00 x 20.00 x 6.00	(406 x 508 x 152)	CP2016	18.20 x 14.20	(462 x 361)	14.50 x 18.50	(368 x 470)	1 Qturn.	8.00 (203)
CSD20166	CSD20166LG	16	16	20.00 x 16.00 x 6.00	(508 x 406 x 152)	CP2016	18.20 x 14.20	(462 x 361)	18.50 x 14.50	(470 x 368)	1 Qturn.	10.00 (254)
CSD20206	CSD20206LG	16	16	20.00 x 20.00 x 6.00	(508 x 508 x 152)	CP2020	18.20 x 18.20	(462 x 462)	18.50 x 18.50	(470 x 470)	1 Qturn.	10.00 (254)
CSD24166	CSD24166LG	16	16	24.00 x 16.00 x 6.00	(610 x 406 x 152)	CP2416	22.20 x 14.20	(564 x 361)	22.50 x 14.50	(572 x 368)	1 Qturn.	12.00 (305)
CSD24206	CSD24206LG	16	16	24.00 x 20.00 x 6.00	(610 x 508 x 152)	CP2420	22.20 x 18.20	(564 x 462)	22.50 x 18.50	(572 x 470)	1 Qturn.	12.00 (305)
CSD24246	CSD24246LG	14	16	24.00 x 24.00 x 6.00	(610 x 610 x 152)	CP2424	22.20 x 22.20	(564 x 564)	22.50 x 22.50	(572 x 572)	2 Qturn.	5.00 (127)
CSD16128	CSD16128LG	16	16	16.00 x 12.00 x 8.00	(406 x 305 x 203)	CP1612	14.20 x 10.20	(361 x 259)	14.50 x 10.50	(368 x 267)	1 Qturn.	8.00 (203)
CSD16168	CSD16168LG	16	16	16.00 x 16.00 x 8.00	(406 x 406 x 203)	CP1616	14.20 x 14.20	(361 x 361)	14.50 x 14.50	(368 x 368)	1 Qturn.	8.00 (203)
CSD16208	CSD16208LG	16	16	16.00 x 20.00 x 8.00	(406 x 508 x 203)	CP2016	18.20 x 14.20	(462 x 361)	14.50 x 18.50	(368 x 470)	1 Qturn.	8.00 (203)
CSD20168	CSD20168LG	16	16	20.00 x 16.00 x 8.00	(508 x 406 x 203)	CP2016	18.20 x 14.20	(462 x 361)	18.50 x 14.50	(470 x 368)	1 Qturn.	10.00 (254)
CSD20208	CSD20208LG	16	16	20.00 x 20.00 x 8.00	(508 x 508 x 203)	CP2020	18.20 x 18.20	(462 x 462)	18.50 x 18.50	(470 x 470)	1 Qturn.	10.00 (254)
CSD20248	CSD20248LG	16	16	20.00 x 24.00 x 8.00	(508 x 610 x 203)	CP2420	22.20 x 18.20	(564 x 462)	18.50 x 22.50	(470 x 572)	1 Qturn.	10.00 (254)
CSD24168	CSD24168LG	16	16	24.00 x 16.00 x 8.00	(610 x 406 x 203)	CP2416	22.20 x 14.20	(564 x 361)	22.50 x 14.50	(572 x 368)	1 Qturn.	12.00 (305)
CSD24208	CSD24208LG	16	16	24.00 x 20.00 x 8.00	(610 x 508 x 203)	CP2420	22.20 x 18.20	(564 x 462)	22.50 x 18.50	(572 x 470)	1 Qturn.	12.00 (305)
CSD24248	CSD24248LG	14	16	24.00 x 24.00 x 8.00	(610 x 610 x 203)	CP2424	22.20 x 22.20	(564 x 564)	22.50 x 22.50	(572 x 572)	2 Qturn.	5.00 (127)
CSD24308	CSD24308LG	14	16	24.00 x 30.00 x 8.00	(610 x 762 x 203)	CP3024	28.20 x 22.20	(716 x 564)	22.50 x 28.50	(572 x 724)	2 Qturn.	5.00 (127)
CSD30208	CSD30208LG	14	16	30.00 x 20.00 x 8.00	(762 x 508 x 203)	CP3020	28.20 x 18.20	(716 x 462)	28.50 x 18.50	(724 x 470)	2 Qturn.	5.00 (127)
CSD30248	CSD30248LG	14	16	30.00 x 24.00 x 8.00	(762 x 610 x 203)	CP3024	28.20 x 22.20	(716 x 564)	28.50 x 22.50	(724 x 572)	2 Qturn.	5.00 (127)
CSD36248	CSD36248LG	14	16	36.00 x 24.00 x 8.00	(914 x 610 x 203)	CP3624	34.20 x 22.20	(869 x 564)	34.50 x 22.50	(876 x 572)	2 Qturn.	5.00 (127)
CSD36308	CSD36308LG	14	14	36.00 x 30.00 x 8.00	(914 x 762 x 203)	CP3630	34.20 x 28.20	(869 x 716)	34.50 x 28.50	(876 x 724)	2 Qturn.	5.00 (127)
CSD36368	CSD36368LG	14	14	36.00 x 36.00 x 8.00	(914 x 914 x 254)	CP3636	34.20 x 34.20	(869 x 869)	34.50 x 34.50	(876 x 876)	2 Qturn.	5.00 (127)
CSD161210	CSD161210LG	16	16	16.00 x 12.00 x 10.00	(406 x 305 x 254)	CP1612	14.20 x 10.20	(361 x 259)	14.50 x 10.50	(368 x 267)	1 Qturn.	8.00 (203)
CSD161610	CSD161610LG	16	16	16.00 x 16.00 x 10.00	(406 x 406 x 254)	CP1616	14.20 x 14.20	(361 x 361)	14.50 x 14.50	(368 x 368)	1 Qturn.	8.00 (203)
CSD162010	CSD162010LG	16	16	16.00 x 20.00 x 10.00	(406 x 508 x 254)	CP2016	18.20 x 14.20	(462 x 361)	14.50 x 18.50	(368 x 470)	1 Qturn.	8.00 (203)
CSD201610	CSD201610LG	16	16	20.00 x 16.00 x 10.00	(508 x 406 x 254)	CP2016	18.20 x 14.20	(462 x 361)	18.50 x 14.50	(470 x 368)	1 Qturn.	10.00 (254)
CSD202010	CSD202010LG	16	16	20.00 x 20.00 x 10.00	(508 x 508 x 254)	CP2020	18.20 x 18.20	(462 x 462)	18.50 x 18.50	(470 x 470)	1 Qturn.	10.00 (254)
CSD202410	CSD202410LG	16	16	20.00 x 24.00 x 10.00	(508 x 610 x 254)	CP2420	22.20 x 18.20	(564 x 462)	18.50 x 22.50	(470 x 572)	1 Qturn.	10.00 (254)
CSD241610	CSD241610LG	16	16	24.00 x 16.00 x 10.00	(610 x 406 x 254)	CP2416	22.20 x 14.20	(564 x 361)	22.50 x 14.50	(572 x 368)	1 Qturn.	12.00 (305)
CSD242010	CSD242010LG	16	16	24.00 x 20.00 x 10.00	(610 x 508 x 254)	CP2420	22.20 x 18.20	(564 x 462)	22.50 x 18.50	(572 x 470)	1 Qturn.	12.00 (305)
CSD242410	CSD242410LG	14	16	24.00 x 24.00 x 10.00	(610 x 610 x 254)	CP2424	22.20 x 22.20	(564 x 564)	22.50 x 22.50	(572 x 572)	2 Qturn.	5.00 (127)
CSD243010	CSD243010LG	14	16	24.00 x 30.00 x 10.00	(610 x 762 x 254)	CP3024	28.20 x 22.20	(716 x 564)	22.50 x 28.50	(572 x 724)	2 Qturn.	5.00 (127)
CSD302010	CSD302010LG	14	16	30.00 x 20.00 x 10.00	(762 x 508 x 254)	CP3020	28.20 x 18.20	(716 x 462)	28.50 x 18.50	(724 x 470)	2 Qturn.	5.00 (127)
CSD302410	CSD302410LG	14	16	30.00 x 24.00 x 10.00	(762 x 610 x 254)	CP3024	28.20 x 22.20	(716 x 564)	28.50 x 22.50	(724 x 572)	2 Qturn.	5.00 (127)
CSD303010	CSD303010LG	14	14	30.00 x 30.00 x 10.00	(762 x 762 x 254)	CP3030	28.20 x 28.20	(716 x 716)	28.50 x 28.50	(724 x 724)	2 Qturn.	5.00 (127)
CSD362410	CSD362410LG	14	16	36.00 x 24.00 x 10.00	(914 x 610 x 254)	CP3624	34.20 x 22.20	(869 x 564)	34.50 x 22.50	(876 x 572)	2 Qturn.	5.00 (127)
CSD363010	CSD363010LG	14	14	36.00 x 30.00 x 10.00	(914 x 762 x 254)	CP3630	34.20 x 28.20	(869 x 716)	34.50 x 28.50	(876 x 724)	2 Qturn.	5.00 (127)
CSD363610	CSD363610LG	14	14	36.00 x 36.00 x 10.00	(914 x 914 x 254)	CP3636	34.20 x 34.20	(869 x 869)	34.50 x 34.50	(876 x 876)	2 Qturn.	5.00 (127)
CSD423610	CSD423610LG	14	14	42.00 x 36.00 x 10.00	(1067 x 762 x 254)	CP4236	40.20 x 34.20	(1021 x 869)	40.50 x 34.50	(1029 x 876)	1 3 pt.	21.00 (533)
CSD482410	CSD482410LG	14	14	48.00 x 24.00 x 10.00	(1219 x 610 x 254)	CP4824	46.20 x 22.20	(1173 x 564)	46.50 x 22.50	(1181 x 572)	1 3 pt.	24.00 (610)
CSD483610	CSD483610LG	14	14	48.00 x 36.00 x 10.00	(1219 x 762 x 254)	CP4836	46.20 x 34.20	(1173 x 869)	46.50 x 34.50	(1181 x 876)	1 3 pt.	24.00 (610)

Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch.  
 \* Panels must be ordered separately. Optional zinc-plated CONCEPT® panels available for most sizes. Optional NEMA-size panels require conversion kit cat. number CCPM4 (see General Accessories).  
 NOTE: Panels have a formed flange along any side that is longer than 22.20 in. (564mm). Panels CP2420 and CP2424 have a flange on all four sides.



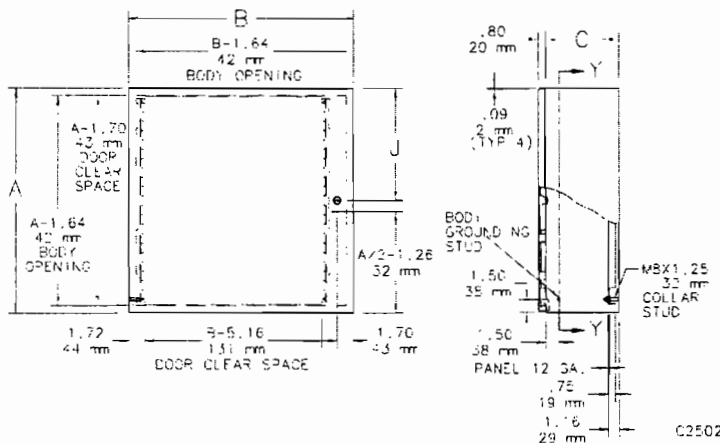


CONCEPT® Single-Door Wall-Mount Enclosures



Single-Door Enclosure with Quarter-turn Latching

Data Pockets for Solid Door Enclosures		
Enclosure Size		
A	B	Pocket
Any	12.00 (305)	None
<30.00 (762)	<20.00 (508)	Small
>30.00 (762)	>20.00 (508)	Large



Single-Door Enclosure with 3-point Latching

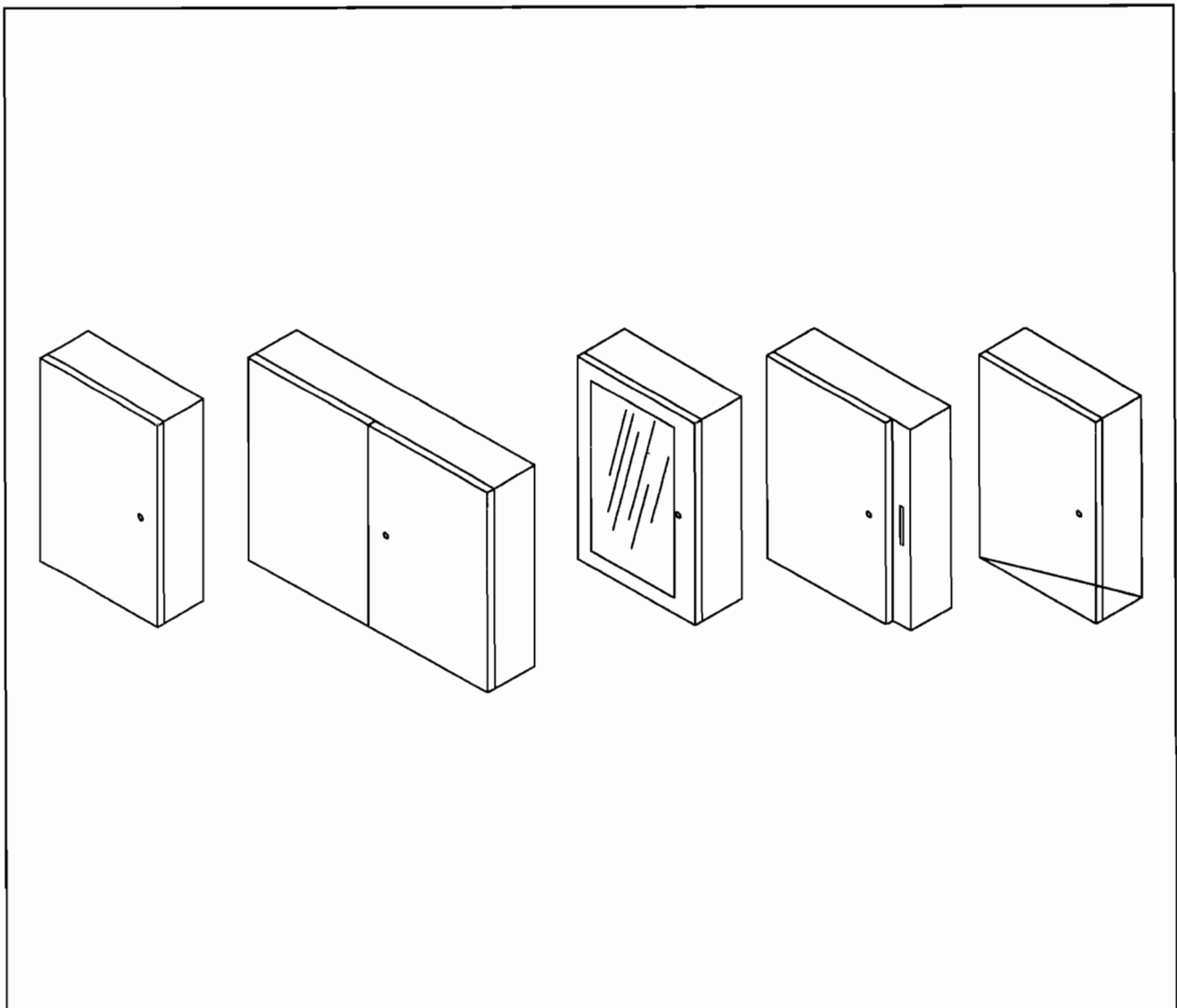
For Section Y-Y see following page



<del>CSD603610</del>	<del>CSD603610LG</del>	<del>14</del>	<del>14</del>	<del>60.00 x 36.00 x 10.00 (1524 x 914 x 254)</del>	<del>CP6036</del>	<del>58.20 x 34.20 (1478 x 869)</del>	<del>58.50 x 34.50 (1486 x 876)</del>	<del>1</del>	<del>3 pt.</del>	<del>30.00 (762)</del>
<del>CSD202012</del>	<del>CSD202012LG</del>	<del>16</del>	<del>16</del>	<del>20.00 x 20.00 x 12.00 (508 x 508 x 305)</del>	<del>CP2020</del>	<del>18.20 x 18.20 (462 x 462)</del>	<del>18.50 x 18.50 (470 x 470)</del>	<del>1</del>	<del>Qturn.</del>	<del>10.00 (254)</del>
<del>CSD242012</del>	<del>CSD242012LG</del>	<del>16</del>	<del>16</del>	<del>24.00 x 20.00 x 12.00 (610 x 508 x 305)</del>	<del>CP2420</del>	<del>22.20 x 18.20 (564 x 462)</del>	<del>22.50 x 18.50 (572 x 470)</del>	<del>1</del>	<del>Qturn.</del>	<del>12.00 (305)</del>
<del>CSD242412</del>	<del>CSD242412LG</del>	<del>14</del>	<del>16</del>	<del>24.00 x 24.00 x 12.00 (610 x 610 x 305)</del>	<del>CP2424</del>	<del>22.20 x 22.20 (564 x 564)</del>	<del>22.50 x 22.50 (572 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD302412</del>	<del>CSD302412LG</del>	<del>14</del>	<del>16</del>	<del>30.00 x 24.00 x 12.00 (762 x 610 x 305)</del>	<del>CP3024</del>	<del>28.20 x 22.20 (716 x 564)</del>	<del>28.50 x 22.50 (724 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD303012</del>	<del>CSD303012LG</del>	<del>14</del>	<del>14</del>	<del>30.00 x 30.00 x 12.00 (762 x 762 x 305)</del>	<del>CP3030</del>	<del>28.20 x 28.20 (716 x 716)</del>	<del>28.50 x 28.50 (724 x 724)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD362412</del>	<del>CSD362412LG</del>	<del>14</del>	<del>16</del>	<del>36.00 x 24.00 x 12.00 (914 x 610 x 305)</del>	<del>CP3624</del>	<del>34.20 x 22.20 (869 x 564)</del>	<del>34.50 x 22.50 (876 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD363012</del>	<del>CSD363012LG</del>	<del>14</del>	<del>14</del>	<del>36.00 x 30.00 x 12.00 (914 x 762 x 305)</del>	<del>CP3630</del>	<del>34.20 x 28.20 (869 x 716)</del>	<del>34.50 x 28.50 (876 x 724)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD363612</del>	<del>CSD363612LG</del>	<del>14</del>	<del>14</del>	<del>36.00 x 36.00 x 12.00 (914 x 914 x 305)</del>	<del>CP3636</del>	<del>34.20 x 34.20 (869 x 869)</del>	<del>34.50 x 34.50 (876 x 876)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD423612</del>	<del>CSD423612LG</del>	<del>14</del>	<del>14</del>	<del>42.00 x 36.00 x 12.00 (1067 x 914 x 305)</del>	<del>CP4236</del>	<del>40.20 x 34.20 (1021 x 869)</del>	<del>40.50 x 34.50 (1029 x 876)</del>	<del>1</del>	<del>3-point</del>	<del>21.00 (533)</del>
<del>CSD482412</del>	<del>CSD482412LG</del>	<del>14</del>	<del>14</del>	<del>48.00 x 24.00 x 12.00 (1219 x 610 x 305)</del>	<del>CP4824</del>	<del>46.20 x 22.20 (1173 x 564)</del>	<del>46.50 x 22.50 (1181 x 572)</del>	<del>1</del>	<del>3-point</del>	<del>24.00 (610)</del>
<del>CSD483612</del>	<del>CSD483612LG</del>	<del>14</del>	<del>14</del>	<del>48.00 x 36.00 x 12.00 (1219 x 914 x 305)</del>	<del>CP4836</del>	<del>46.20 x 34.20 (1173 x 869)</del>	<del>46.50 x 34.50 (1181 x 876)</del>	<del>1</del>	<del>3-point</del>	<del>24.00 (610)</del>
<del>CSD603612</del>	<del>CSD603612LG</del>	<del>14</del>	<del>14</del>	<del>60.00 x 36.00 x 12.00 (1524 x 914 x 305)</del>	<del>CP6036</del>	<del>58.20 x 34.20 (1478 x 869)</del>	<del>58.50 x 34.50 (1486 x 876)</del>	<del>1</del>	<del>3-point</del>	<del>30.00 (762)</del>
<del>CSD242416</del>	<del>CSD242416LG</del>	<del>14</del>	<del>14</del>	<del>24.00 x 24.00 x 16.00 (610 x 610 x 406)</del>	<del>CP2424</del>	<del>22.20 x 22.20 (564 x 564)</del>	<del>22.50 x 22.50 (572 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD363016</del>	<del>CSD363016LG</del>	<del>14</del>	<del>14</del>	<del>36.00 x 30.00 x 16.00 (914 x 762 x 406)</del>	<del>CP3630</del>	<del>34.20 x 28.20 (869 x 716)</del>	<del>34.50 x 28.50 (876 x 724)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD483616</del>	<del>CSD483616LG</del>	<del>14</del>	<del>14</del>	<del>48.00 x 36.00 x 16.00 (1219 x 914 x 406)</del>	<del>CP4836</del>	<del>46.20 x 34.20 (1173 x 869)</del>	<del>46.50 x 34.50 (1181 x 876)</del>	<del>1</del>	<del>3-point</del>	<del>24.00 (610)</del>
<del>CSD242420</del>	<del>CSD242420LG</del>	<del>14</del>	<del>14</del>	<del>24.00 x 24.00 x 20.00 (610 x 610 x 508)</del>	<del>CP2424</del>	<del>22.20 x 22.20 (564 x 564)</del>	<del>22.50 x 22.50 (572 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD302420</del>	<del>CSD302420LG</del>	<del>14</del>	<del>14</del>	<del>30.00 x 24.00 x 20.00 (762 x 610 x 508)</del>	<del>CP3024</del>	<del>28.20 x 22.20 (716 x 564)</del>	<del>28.50 x 22.50 (724 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD363020</del>	<del>CSD363020LG</del>	<del>14</del>	<del>14</del>	<del>36.00 x 30.00 x 20.00 (914 x 762 x 508)</del>	<del>CP3630</del>	<del>34.20 x 28.20 (869 x 716)</del>	<del>34.50 x 28.50 (876 x 724)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>

NOTE: Panels have a formed flange along any side that is longer than 22.20 in. (564mm). Panels CP2420 and CP2424 have a flange on all four sides.

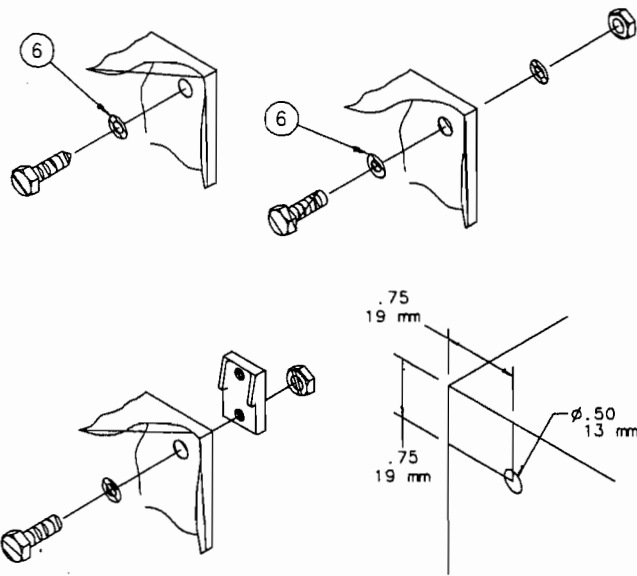
# CONCEPT<sup>®</sup>

## Wall-Mount Enclosure



<p><b>! WARNING</b></p> <p>To avoid electric shock, do not energize any circuits before all internal and external electrical and mechanical clearances are checked to assure that all assembled equipment functions safely and properly.</p>		<p><b>! WARNING</b></p> <p>Um elektrische Schocks zu vermeiden, setzen Sie die Stromkreise erst dann Spannung aus, wenn alle internen und externen mechanischen Sicherheitsabstände überprüft worden sind, um sicherzustellen, daß alle zusammengebauten Geräte sicher und ordnungsgemäß funktionieren.</p>
<p><b>! PRECAUCION</b></p> <p>Para evitar una descarga eléctrica no energice ningun circuito antes de que todos los espacios mecánicos y eléctricos (internos y externos) se revisen para asegurar que todo el equipo ensamblado funcione bien y de manera segura.</p>		<p><b>! AVERTISSEMENT</b></p> <p>Pour éviter les décharges électriques, n'activer aucun circuit avant de vérifier tous les circuits internes et externes et tous les dégagements mécaniques afin de s'assurer que les fonctions de tous les équipements assemblés fonctionnent correctement et en toute sécurité.</p>

### MOUNTING INSTRUCTIONS (optional mounting feet page 9)



#### ENGLISH

Mounting holes have been provided in the back of the enclosure for convenient mounting through the enclosure. Attach enclosure to wall or other structure using customer supplied 3/8 inch or M8 fastener, flat washers, and nuts. To insure proper sealing and enclosure protection rating, use the provided sealing washers. Install sealing washers inside the enclosure with rubber face against the enclosure.

#### ENGLISH

##### Mounting Feet

##### UL/CSA Requirement:

- Use of mounting feet mandatory on all type 3,4,4X applications.
- If wall mounting provisions have been omitted, holes must be added per detail above.

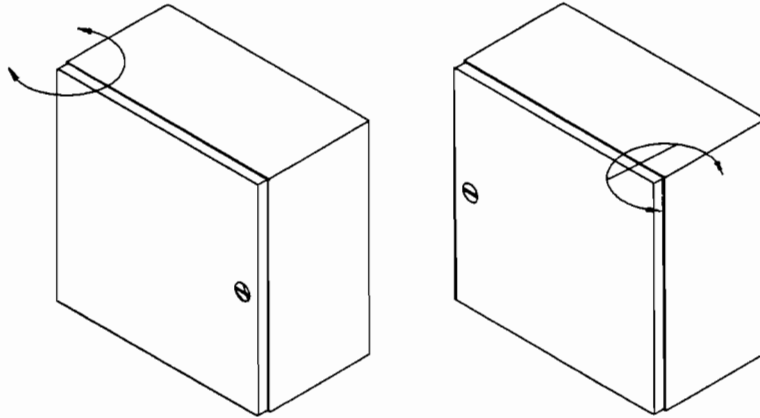
The use of the optional mounting feet allows simple mounting with fasteners outside the enclosure.

- Steel Zinc Plated Mounting Foot Kit P/N C-MFK
- Stainless Steel Mounting Foot Kit P/N C-MFKSS
- Composite Mounting Foot Kit P/N C-MTGFT

Kits provide all necessary hardware to install the mounting feet as shown.

(order separately)

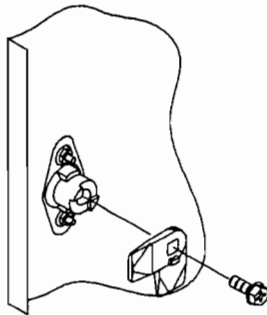
## REVERSING DOOR HINGES (lower door only)



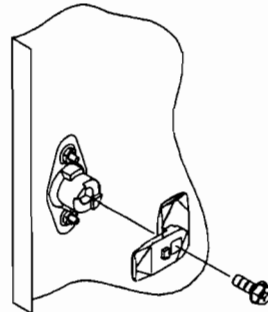
### ENGLISH

- 1) Remove door from body by removing hinge pins.
- 2) Unscrew hinges from body.
- 3) Drill  $\varnothing.203$  (5.16 mm) on opposite enclosure flange at drill point locations.
- 4) Reinstall hinges and door.
- 5) Seal the unused hinge holes with customer supplied #10 or M5 screw and silicone sealer.

## REVERSING LATCH DIRECTION



Clockwise to open.

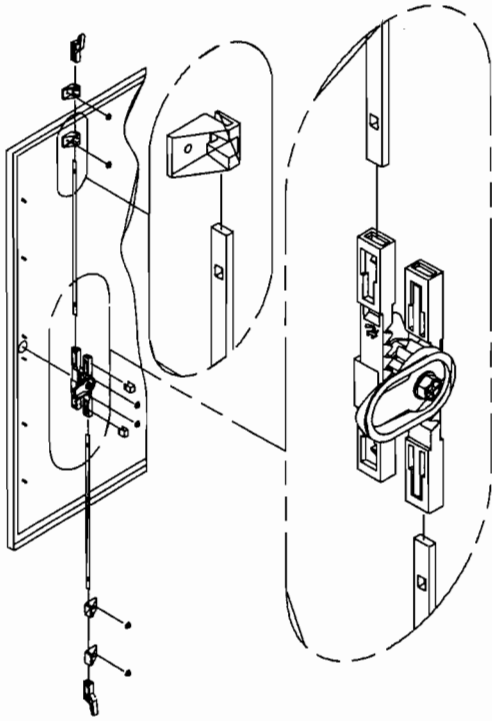


Counterclockwise to open.

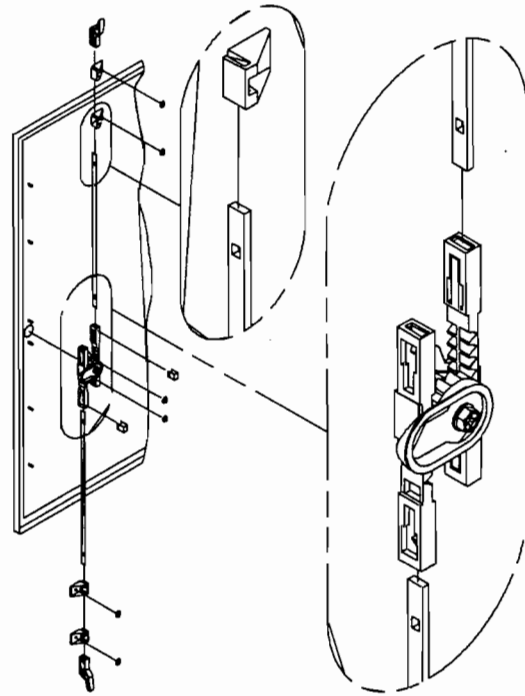
### ENGLISH

- 1) Remove Latch Cam.
- 2) Invert as shown and reinstall cam.
- 3) Torque fastener to 4.3Nm (38 in-lbs)

## REVERSING MULTIPOINT LATCH DIRECTION (lower door only)



Clockwise to open.

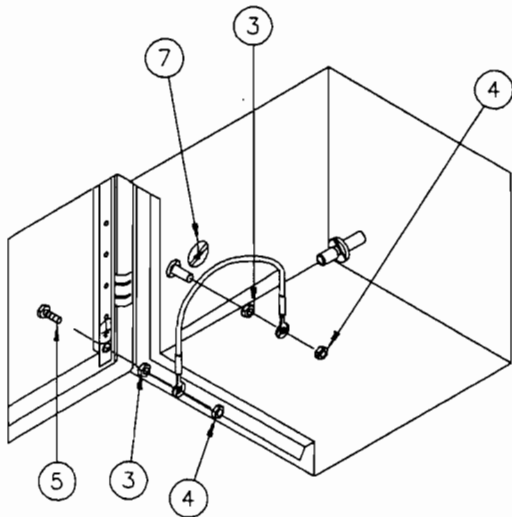


Counterclockwise to open.

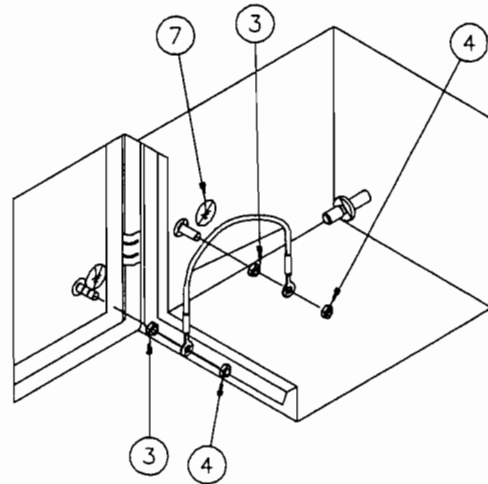
### ENGLISH





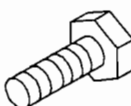



- 1) Remove latch system from door.
- 2) Disengage rods from racks.
- 3) Remove cam and orient racks as shown.
- 4) Reinstall cam, torque cam fastener to 38 in-lbs (4.3 Nm).
- 5) Reposition rod guides.
- 6) Insert rods in racks.
- 7) Assemble latch system onto door; torque nuts to 22 in-lbs (2.5 Nm)

**GROUNDING (MILD STEEL)**

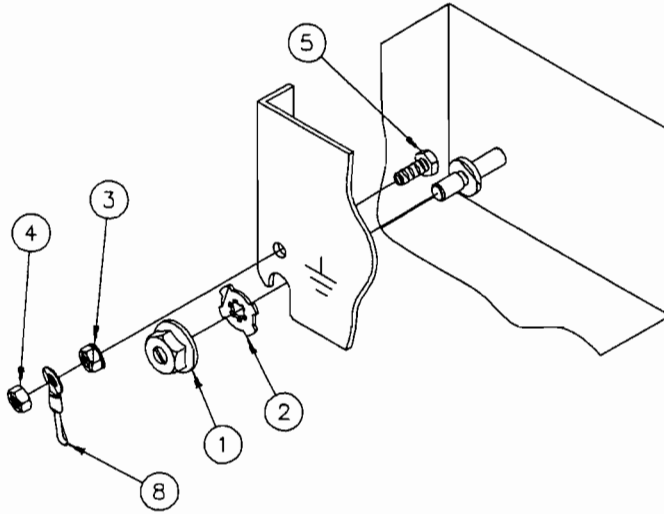


**GROUNDING (STAINLESS STEEL)**



1	M8-1.25	2	M6-1	3	M6-1	4	M6-1
	(4x) (8x)		(1x)		(3x)		(3x)
5	M6-1x16	6	7	8	supplied by customer		
	(2x)		(4x)		(2x)		

## PANEL INSTALLATION / GROUNDING



### NOTE:

- For proper panel installation, it may be necessary to bend mounting studs slightly to permit the panel to fit in place.

**HARDWARE KITS**

Included with your Hoffman enclosure is a complete package of hardware for back panel installation. Also provided is all the necessary hardware for grounding the back panel and doors to the enclosure body.

Shown are the proper installation procedures for grounding the doors, covers, and optional panels and mounting the optional side and back panels.

Ground wires (item 8) are available from Hoffman Enclosures. Consult the latest Hoffman Specifiers Guide.



## REPAINTING INSTRUCTIONS

**SUGGESTED PAINTS:** The following paints typically provide superior adhesion qualities:

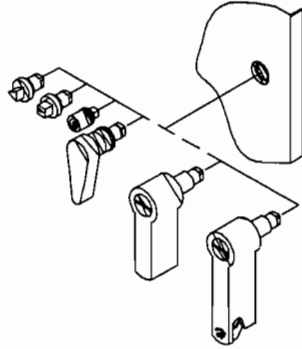
- Two Component Epoxies
- Two Component Polyurethanes
- Lacquers
- Acrylics
- Alkyd Baking Enamels
- Industrial Enamel

**SURFACE PREPARATION:** Wet wipe all surfaces to be painted with xylene solvent. Allow surfaces to flash dry three to five minutes. If a delay of greater than two hours occurs before painting, wet wipe again.

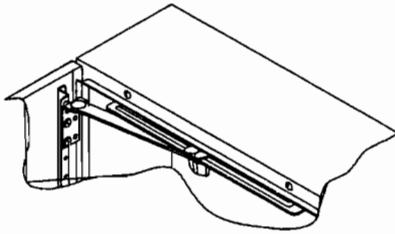
**PAINTING:** Apply top coat per paint manufacturer's instructions. Allow adequate cure time between coats.

Allow top coat to cure completely prior to testing paint adhesion. Consult with the paint manufacturer for proper cure time.

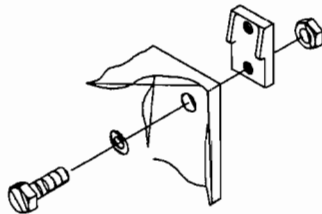
# EXTERNAL ACCESSORIES



Latch Accessories

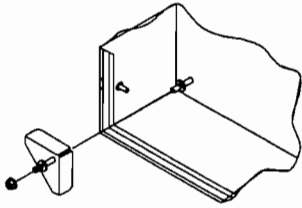


Door Stop Kit

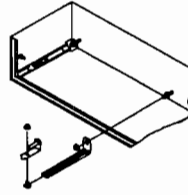


Mounting Feet

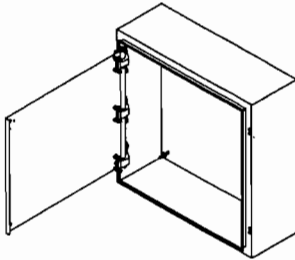
# INTERNAL ACCESSORIES



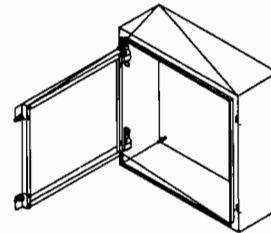
Panel Conversion Kit



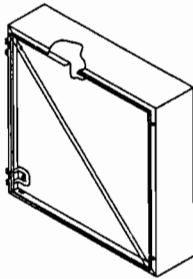
Adjustable Mounting Kit



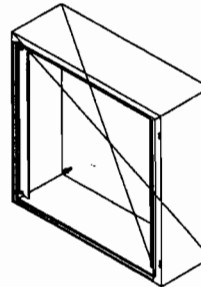
Swing-Out Panel



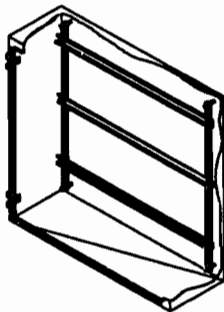
Swing-Out Frame



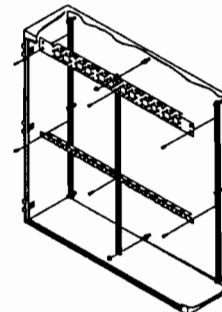
Dead Front Panel



Rack Angles



DIN Rail Kit



Grid Straps

## GENERAL ACCESSORIES

### **Temperature Control**

Options are available to provide an optimal environment for your controls. Options include louvers, filter fans, heat exchangers, air conditioners, and electric heaters.

### **Floor Stand Kits**

Field or factory installation available on single door enclosures.

### **Drip Shield Kits**

Field or factory installation available on single or double door enclosures.

### **Electrical Interlocks**

Internal safety lockout while the enclosure contents are energized.

### **Corrosion Inhibitors**

Protect interior components from corrosion.

### **Hole Seals**

Used to seal extra conduit openings, pushbutton holes, or cutouts against dust, dirt, oil, and water.

### **Folding Shelves**

Can be used to support instruments and test equipment.

### **Terminal Kit Assemblies**

Provides an easy method to mount terminal blocks.

### **Pedestals**

Provides floor mounting for small to medium size enclosures.

### **Safety Lockouts**

Protect personnel and equipment by enabling multiple padlocks to be installed on a de-energized switch.

### **Touch-Up Paint**

Used to repair the finish of enclosures and panels.

### **Enclosure Stabilizers**

Provides stability to floor mounted enclosures which are not bolted to the floor.

### **Window Kits**

Available for many types of Hoffman enclosures.

### **Data Pocket Kits**

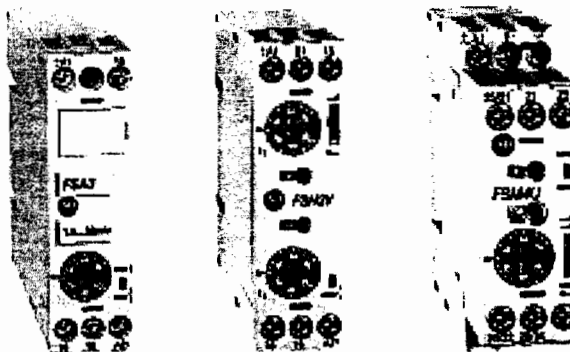
Convenient place for documentation.



# Electronic High Performance Timing Relays


(Catalog Number 700-FS)

## Product Data



The Bulletin 700-FS Electronic High Performance Timing Relays consist of Multi-Function, Single Function and Special Function designs. These products offer the customer optimum space utilization and maximum functionality. In addition, the timing ranges are easily adjusted, and the LEDs provide visual indication of the coil and timing status.

- 22.5mm (5/8 inch) Wide
- Dual Voltage
  - 24-48V DC
  - 24-240V AC
- DIN Rail Mounting
- Finger Safe Terminals
- Single Pull Double Throw (SPDT) Contact Configuration
  - Multi-Function/Multi-Range (On-Delay, Off-Delay, On-and-Off-Delay, One Shot, Fleeting Off-Delay, Flasher, On-Delay Pulse Generator, Pulse Converter, On-Function, Off-Function, with 10 Timing Ranges)
  - Single Function (On-Delay, Off-Delay, On-and-Off-Delay, One Shot, Fleeting Off-Delay, Flasher (Pulse), Flasher (Pause), On-Delay Pulse Generator, On-Delay (Pulse Controlled), One Shot/Watch Dog, Pulse Converter, with 12 Timing Ranges)
  - Special Function/Multi-Range (Flasher, True Off-Delay, Star-Delta, with 12 Timing Ranges)
- Double Pull Double Throw (DPDT) Contact Configuration
  - Multi-Function/Multi-Range (On-Delay, Off-Delay, On-and-Off-Delay, One Shot, Fleeting Off-Delay, Flasher, On-Delay Pulse Generator, Pulse Converter, On-Function, Off-Function, with 10 Timing Ranges)
  - Single Function/Multi-Range (On-Delay, Off-Delay, with 10 Timing Ranges)

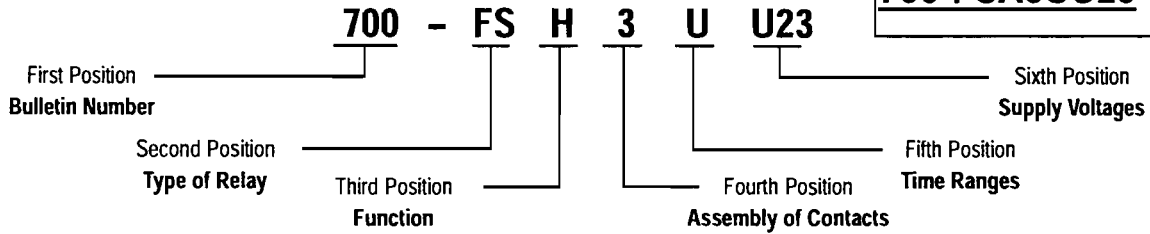
 Rockwell Automation

Allen-Bradley

**Model Number:**

**700-FSA3UU23**

**Catalog Number Explanation**



**Multi-Function Timing Relays**

700-FS	M	3	U	U23
	Function	Assembly of contacts	Time ranges	Supply voltages
M	Multi-function timing relays 8 Single-functions: A, B, C, D, E, F, I, L, Q, ON and OFF function additional (for installation and maintenance)	3 1 Change-over contact 1 C/O (SPDT) 4 2 Change-over contacts 2 C/O (DPDT)	U 0.05 s...60 h	Z12 12 VDC U23 24...48 VDC 24...240 V 50/60 Hz

**Single Function Timing Relays**

700-FS	A	3	A	U23
	Function	Assembly of contacts	Time ranges	Supply voltages
A	On-delay	all functions: 3 1 Change-over contact 1 C/O (SPDT)  Functions A and B: 4 2 Change-over contacts 2 C/O (DPDT)	A 0.05...1 s	Z12 12 VDC U23 24...48 VDC 24...240 V 50/60 Hz
B	Off-delay		B 0.15...3 s	
C	On- and off-delay		C 0.5...10 s	
D	One shot		D 1.5...30 s	
E	Fleeting off-delay		E 0.05...1 min	
F	Flasher (repeat cycle starts w/pulse)		F 0.15...3 min	
G	Flasher (repeat cycle starts w/pause)		G 0.5...10 min	
H	Flasher (repeat cycle starts w/pulse or pause)		H 1.5...30 min	
I	On-delay pulse generator		I 0.05...1 h	
J	On-delay (pulse controlled)		J 0.15...3 h	
K	One shot / watch dog (pulse controlled)		K 0.5...10 h	
L	Pulse converter		L 3.0...60 h	
U			U 0.05 s...60 h	

NOTE: Only the 700-FSA and 700-FSB are available with the "U" multi-time setting ranges (0.05s to 60h).

**Special Function Timing Relays**



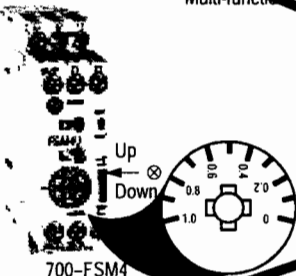

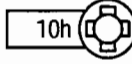

700-FS	H	3	U	U23
	Function	Assembly of contacts	Time ranges	Supply voltages
H	Flasher (repeat cycle starting with pulse or pause)	3 1 Change-over contact 1 C/O (SPDT)	U 0.05 s...60 h V 0.05 s ... 60 h (2 ranges)	Z12 12 VDC U23 24...48 VDC 24...240 V 50/60 Hz

700-FS	Q	3	Q	U18
	Function	Assembly of contacts	Time ranges	Supply voltages
Q	Off-delay without supply voltages (true off-delay)	3 1 Change-over contact 1 C/O (SPDT) 4 2 Change-over contact 2 C/O (DPDT)	Q 0.15 s ... 10 min	U18 24...240 VDC 24...240 V 50/60 Hz

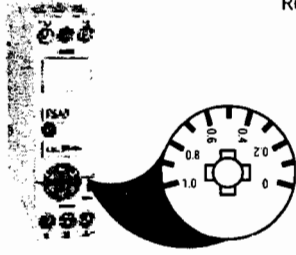

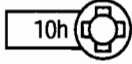
700-FS	Y	2	C	U23
	Function	Assembly of contacts	Time ranges	Supply voltages
Y	Star-delta timing relays	2 2 normally open contacts 2 N.O.	C 0.5...10 s D 1.5...30 s E 0.05...1 min F 0.15...3 min G 0.5...10 min	U23 24...48 VDC 24...240 V 50/60 Hz

Technical Data

700-FSM Multi-Function High Performance Timing Relays

Description	SPDT		DPDT	
	Multi-time setting range 0.05 s...60 h			
<p>Multi-function timing relays 700-FSM3U includes 10 setting functions:</p> <p>(A) - On-delay                      (B) - Off-delay                      (C) - On- and off-delay                      (D) - One shot                      (E) - Fleeting off-delay                      (F) - Flasher (repeat cycle starts with pulse)                      (I) - On-delay pulse generator                      (L) - Pulse converter                      (On) - ON-Function*                      (Off) - OFF-Function*                      * (for installation and maintenance)</p>				
				
<p>NOTE: Switch  is on SPDT relays only. When switch is down, one contact is instantaneous and one is timed. When switch is up, both contacts are timed.</p>	<p>Supply voltages (A1/A2)</p> <p>U23 24...48 VDC; 24...240 VAC, 50/60 Hz</p> <p>Z12 12 VDC</p>	<p>Cat. No.</p> <p>700-FSM3UU23</p> <p>700-FSM3UZ12</p>	<p>Cat. No.</p> <p>700-FSM4UU23</p> <p>700-FSM4UZ12</p>	

700-FS Single Function High Performance Timing Relays

Description	SPDT		DPDT	
	available mono-time ranges		Multi-time setting ranges	
<p>22.5 mm Timing Relays</p> 	<p>Complete the Cat. No. with the corresponding identification  from the table on the next page.</p> <p>NOTE: Only the 700-FSA and 700-FSB are available with the "U" multi-time setting ranges (0.05s to 60h).</p>		<p>0.05 s...60 h</p> 	
<p>Supply voltages (A1/A2)</p> <p>Z12 12 VDC</p> <p>U23 24...48 VDC</p> <p>24...240 VAC, 50/60 Hz</p>	<p>Cat. No.</p>		<p>Cat. No.</p>	
<p>See 700-FS Timing Charts</p>	<p>Cat. No.</p>		<p>Cat. No.</p>	
<p><b>(A) On-delay</b> The output contact changes state after the time delay is completed.</p>	<p>700-FSA3CU23 700-FSA3FU23 <b>700-FSA3UU23</b> 700-FSA3U23 700-FSA3U23</p>		<p>700-FSA4UU23 700-FSA4UZ12</p>	
<p><b>(B) Off-delay</b> Input power must be supplied to terminal (A1/A2) continuously. The output contact changes state when switch "S" is closed. When switch "S" is opened, the time delay begins. After the time delay is completed, the contact returns to shelf state.</p>	<p>700-FSB3CU23 700-FSB3FU23 700-FSB3UU23 700-FSB3U23 700-FSB3U23</p>		<p>700-FSB4UU23 700-FSB4UZ12</p>	
<p><b>(C) On- and off-delay</b> Input power must be supplied to terminal (A1/A2) continuously. The output contact changes state when switch "S" is closed and the time delay complete. When switch "S" is opened, the time delay begins again. After the time delay is completed, the contact returns to shelf state.</p>	<p>700-FSC3KU23 700-FSC3LU23 700-FSC3U23 700-FSC3U23</p>		<p>—</p>	
<p><b>(D) One shot</b> The output contact changes state when the relay is energized. The output contact returns to shelf state when the time delay is completed.</p>	<p>700-FSD3KU23 700-FSD3LU23 700-FSD3U23 700-FSD3U23</p>		<p>—</p>	
<p><b>(E) Fleeting off-delay (Min. Pulse AC 50ms – DC 30ms)</b> Input power must be supplied to terminal (A1/A2) continuously. The output contact changes state after closing and opening switch "S". After the time delay is completed, the contact returns to shelf state.</p>	<p>700-FSE3KU23 700-FSE3LU23 700-FSE3U23 700-FSE3U23</p>		<p>—</p>	
<p><b>(F) Flasher (Repeat Cycle Starting with Pulse)</b> The output contact changes state when power is applied. At the end of the time delay, the output contact returns to shelf state. This cycle continues until the power is removed.</p>	<p>700-FSF3KU23 700-FSF3LU23 700-FSF3U23 700-FSF3U23</p>		<p>—</p>	

### Technical Data, Continued

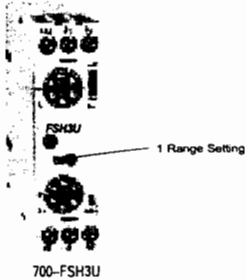
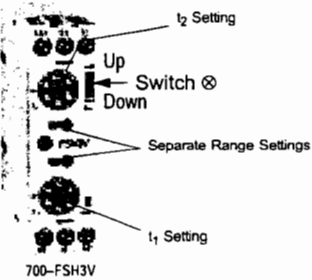
See 700-FS Timing Charts	SPDT	DPDT
	Cat. No.	Cat. No.
<b>(G) Flasher (Repeat Cycle Starting with Pause)</b> The output contact remains in the shelf state until the time delay is completed. When the time delay is completed, the contact changes state. This cycle continues until the power is removed.	700-FSG3KU23 700-FSG3LU23 700-FSG3⊙Z12 700-FSG3⊙U23	—
<b>(I) On-delay pulse generator</b> The output contact changes state when the time delay is completed. After 0.5s the contact opens.	700-FSI3KU23 700-FSI3LU23 700-FSI3⊙Z12 700-FSI3⊙U23	—
<b>(J) On-delay (pulse controlled) (Min. Pulse AC 50ms - DC 30ms)</b> Input power must be supplied to terminal (A1/A2) continuously. When switch "S" is closed, the time delay begins. The output contact changes state at the end of the time delay. The output contact returns to shelf state when the power to (A1/A2) is removed.	700-FSJ3KU23 700-FSJ3LU23 700-FSJ3⊙Z12 700-FSJ3⊙U23	—
<b>(K) One shot / watch dog (pulse controlled) (Min. Pulse AC 50ms - DC 30ms)</b> Input power must be supplied to terminal (A1/A2) continuously. When switch "S" is closed, the output contact changes state. The output contact will open when switch "S" is open for longer than the time setting.	700-FSK3KU23 700-FSK3LU23 700-FSK3⊙Z12 700-FSK3⊙U23	—
<b>(L) Pulse converter (Min. Pulse AC 50ms - DC 30ms)</b> Input power must be supplied to terminal (A1/A2) continuously. When switch "S" is closed, the output contact changes state. When the time delay is completed, the output contact returns to shelf state. The time "T" is not influenced by the duration of the control pulse.	700-FSL3KU23 700-FSL3LU23 700-FSL3⊙Z12 700-FSL3⊙U23	—

#### ⊙ Mono-Time Ranges

Complete the Cat. No. with mono-time range identification

Time ranges	0.05...1 s	0.15...3 s	0.5...10 s	1.5...30 s	0.05...1 min	0.15...3 min	
⊙	A	B	C	D	E	F	
Time ranges	0.5...10 min	1.5...30 min	0.05...1 h	0.15...3 h	0.5...10 h	3.0...60 h	0.05 s...60 h
⊙	G	H	I	J	K	L	U

### 700-FSH Special Function Flasher (repeat cycle starting with pulse or pause) Timing Relays



Description	SPDT
	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>700-FSH3U</p> </div> <div style="text-align: center;">  <p>700-FSH3V</p> </div> </div> <p style="text-align: center;"><b>Supply voltages (A1/A2)</b></p> <p>Z12 12 VDC U23 24...48 VDC 24...240 VAC, 50/60 Hz</p>
See 700-FS Timing Charts	Cat. No.
<p><b>(H) Flasher (repeat cycle starting with pulse or pause)</b> The repeat cycle timer permits different settings for on and off times. The following operating modes are possible:</p> <ul style="list-style-type: none"> <li>- Oscillating mode; repeat cycle starts with voltage applied at A1 and B1, and continues to repeat until voltage is off.</li> <li>- One cycle mode; started by energizing B1 with voltage on A1 and A2.</li> <li>- Output starts with pulse or pause (switch ⊗ Up or Down).</li> <li>- 700-FSH3U provides (1) range setting for t<sub>1</sub> and t<sub>2</sub>.</li> <li>- 700-FSH3V provides (2) range settings for t<sub>1</sub> and t<sub>2</sub>.</li> </ul> <p>Supply voltage controlled, Oscillating Mode starting with pause - Switch ⊗ is Up Supply voltage controlled, Oscillating Mode starting with pulse - Switch ⊗ is Down Pulse controlled, output starts with pulse (Min. Pulse AC 50ms - DC 30ms) - Switch ⊗ is Up Pulse controlled, output starts with pulse (Min. Pulse AC 50ms - DC 30ms) - Switch ⊗ is Down</p>	<p>700-FSH3U23 700-FSH3VU23 700-FSH3UZ12 700-FSH3VZ12</p>

NOTE: If B1 is pulsed, a one full time cycle consisting of t<sub>1</sub> and t<sub>2</sub> is completed.





## Technical Data, Continued

### 700-FSQ Special Function Off-Delay without Supply Voltage Timing Relays

Description	 SPDT	 DPDT
Supply voltages (A1/A2) U18 24...240 V AC 50/60 Hz 24...240 V DC	Multi-time setting range, Q 0.15 s...10 min (2.5s) 0.15...2.5 s (10s) 0.5...10 s (80s) 4...80 s (10mn) 0.5...10 min	
See 700-FS Timing Charts	Cat. No.	Cat. No.
<b>(Q) Off-delay without supply voltage (true off-delay)</b> When the input power is turned on, the output contact changes state. When the power is removed, the time delay begins. The output contact returns to shelf state at the end of the time delay.	700-FSQ3QU18	700-FSQ4QU18

### 700-FSY Special Function Star Delta Timing Relays

Description	 2 NO
	Available mono-time ranges Complete the Cat. No. with the corresponding identification $\odot$ from the table below.
Supply voltages (A1/A2) U23 24...48 VDC 24...240 VAC, 50/60 Hz	Cat. No.
<b>(Y) Star-delta timing relay</b> When power is applied, the output contact 17/18(Y) changes state. After the time setting, the output contact 17/18(Y) returns to shelf state. After the fixed time (50 to 60 ms), the output contact 17/28 $\Delta$ changes state. Both output contacts return to shelf state whenever the power is removed.	700-FSY2DU23 700-FSY2 $\odot$ U23

#### $\odot$ Mono-Time Ranges

Complete the Cat. No. with mono-time range identification. For 700-FSY relays only.

Time ranges	0.5...10 s	1.5...30 s	0.05...1 min	0.15...3 min	0.5...10 min
$\odot$	C	D	E	F	G

## Specifications

### Time characteristics (according to VDE 0435, Part 2021)

Setting accuracy	$\pm 5\%$ of full scale
Repeatability	$\pm 0.2\%$ of the setting values
Tolerance	voltage: $\pm 0.001\%/\Delta U$ temperature: $\pm 0.025\%/^{\circ}\text{C}$

### Supply

Supply voltages	24...48 VDC and 24...240VAC, 50/60 Hz (dual voltage)
Voltage tolerance	-20% to +20% (DC), -15% to +10% (AC)
Power consumption	0.5 W at 24 VDC, 5 VA at 240 VAC
Time energized	100%
Reset time	50 ms
Voltage isolation	$\leq 20$ ms without reset (supply voltage)
Cable length - (supply voltage control)	max. 250 m (800 ft)

### Pulse control (B1)

Pulse duration	$\geq 50$ ms (AC), $\geq 30$ ms (DC)
Input voltage	Supply voltage range
Input current	1 mA
Cable length	max. 250 m (800 ft) without parallel load between B1 and A2 max. 50 m (160 ft) with load ( $< 3$ k $\Omega$ ) between B1 and A2

## Specifications, Continued

### Outputs

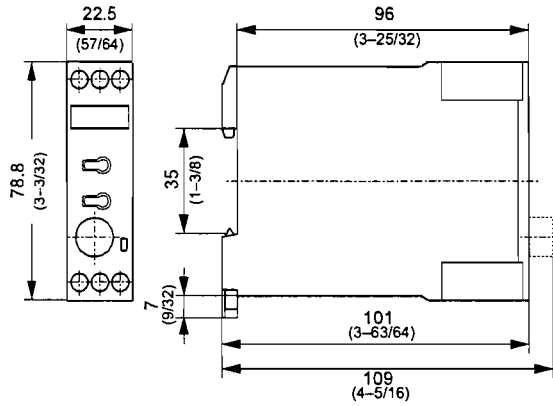
Contact type	Relay as changeover switch		
Switching capacity	Voltage: 440 VAC according to IEC 947-5-1: 3 A/440 VAC (inductive load, AC 14) 1 A/24 VDC (inductive load, DC 13) according to UL 508: 1.5 A/250 VAC (B300)	Current $I_{th}$ : 8 A  3 A/250 VAC (inductive load, AC 15)  3 A/120 VAC (B300)	Power: 2000 VA
Short-circuit protection	10 A gL (Fast Blow Fuse)		
Life	mechanical: 30 Mil. of operations electrical operations: 4 Mil. at 1 A/250 VAC, $\cos \varphi = 1$ 0.2 Mil. at 6 A/250 VAC, $\cos \varphi = 1$ 1.5 Mil. at 1 A/250 VAC, $\cos \varphi = 0.3$ 0.3 Mil. at 3 A/250 VAC, $\cos \varphi = 0.3$ 0.5 Mil. at 6 A/24 VDC, resistive      2 Mil. at 4 A/24 VDC, resistive 2 Mil. at 0.2 A/230 VDC, resistive      1 Mil. at 0.4 A/24 VDC, L/R = 20 ms 1 Mil. at 0.2 A/110 VDC, L/R = 20 ms      1 Mil. at 0.1 A/230 VDC, L/R = 20 ms		
State indicator	1 LED, combination signal		
Setting accuracy	$\pm 5\%$ of full scale		

### General Data

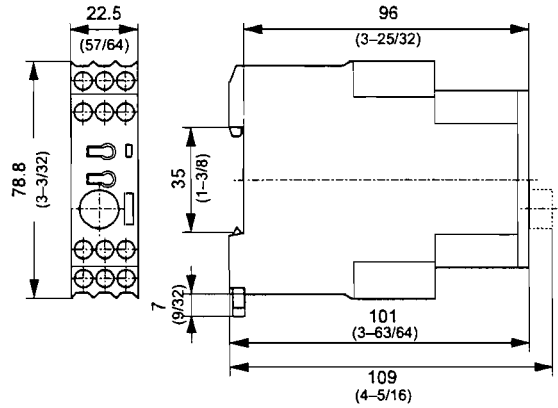
Insulation characteristics	2 kVAC/50 Hz test voltage according to VDE 0435 and 6 kV 1.2/50 $\mu$ s surge voltage according to IEC 947-1 between all inputs and outputs
EMC/Interference immunity	Performance of following requirements: Surge capacity of the supply voltage according to IEC 1000-4-5: 4 kV 1.2/50 $\mu$ s Burst according to IEC 1000-4-4: 6 kV 6/50 ns ESD discharge according to IEC 1000-4-2: Contact 8 kV, air 8 kV Electromagnetical HF field according to IEC 801-3 and conducted electromagnetical HF signal according to IEC 801-6: Level 3
EMC/Emission	Electromagnetical fields according to EN 55 022: class B
Safe isolation	according to VDE 106, part 101
Climatic withstand	56 Cycles (24 h) at 25...40°C and 95% rel. humidity according to IEC 68-2-30 and IEC 68-2-3
Vibration resistance	4 g in 3 axis at 10...500 Hz, test FC according to IEC 68-2-6
Shock resistance	50 g according to IEC 68-2-27
Protection class	Enclosure: IP 40 IP 30 (Single-function) Terminal: IP 20 according to IEC 947-1
Weight	100 g
Approval	UL, C-UL, Germanischer Lloyd, CE Certified
Ambient temperature	Open: -25°C ... +60°C Enclosed: -25°C ... +45°C Storage: -40°C ... +85°C
Terminals	Screw terminal M3.5 for Posidrive Number.2, Philips and slotted screws Number.2. suitable for power screwdriver. Rated tightening torque 8.8 LB-IN 0.8 Nm (max. 1.2 Nm) Dual-chamber system for terminal cross-sections of 1 x 0.5 mm <sup>2</sup> ... 2 x 2.5 mm <sup>2</sup> (solid) or stranded 2 x 2.5 mm <sup>2</sup> (flexible with sleeve), AWG 20 to 14. Finger protection according to VDE 0106
Mounting	Front mounting; For snap-on mounting on DIN rail 35 mm or screw fixing by adapter and 2 screws M4
Disposal	Synthetic material without dioxin according to EC/EFTA notification Number. 93/0141/D – electrical contacts with cadmium

### Approximate Dimensions

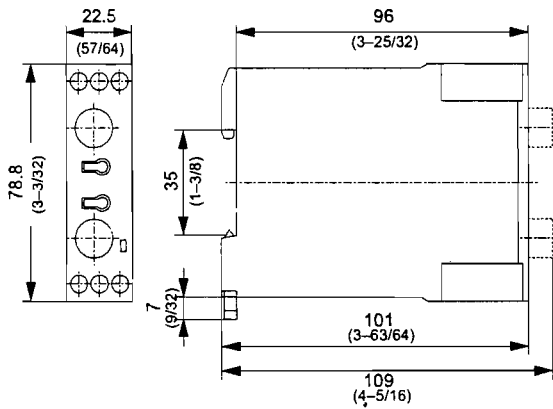
Dimensions are shown in millimeters (inches).  
 Dimensions are not intended to be used for  
 manufacturing purposes.



700-FS (1 C/O)

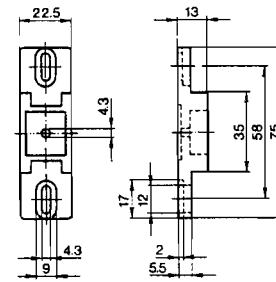


700-FS (2 C/O)



700-FSH3V...

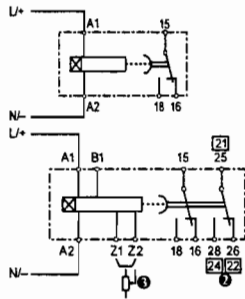
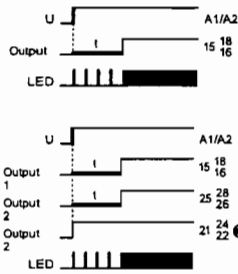
For panel mounting, Use the 199-FSA Panel Mounting Adapter.



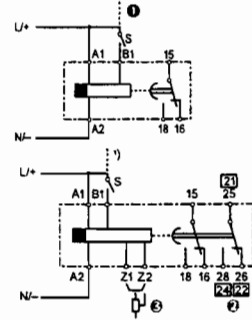
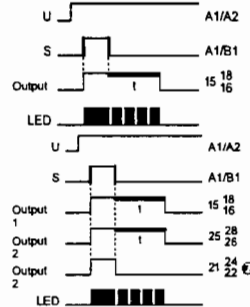
199-FSA

# Timing Charts, Single Function

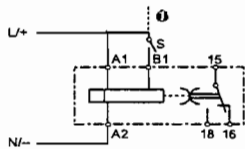
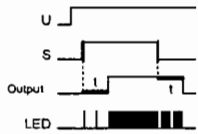
(A) On-delay



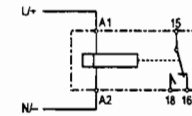
(B) Off-delay



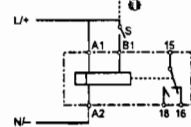
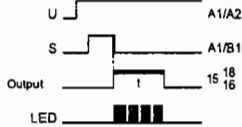
(C) On-and-Off-delay



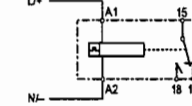
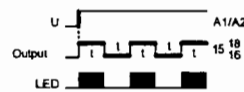
(D) One shot



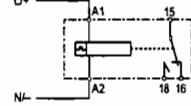
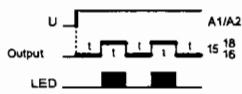
(E) Fleeting off-delay (Min. Pulse AC 50ms-DC 30ms)



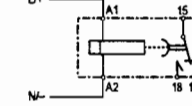
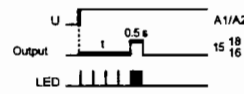
(F) Flasher (Repeat cycle starting with pulse)



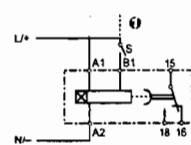
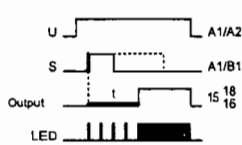
(G) Flasher (Repeat cycle starting with pause)



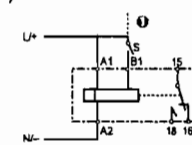
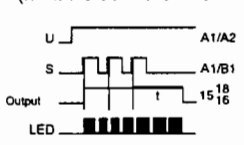
(I) On-delay pulse generator



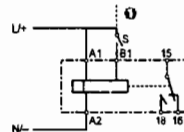
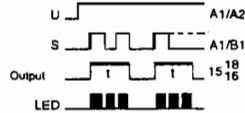
(J) On-delay (pulse controlled) (Min. Pulse AC 50ms-DC 30ms)



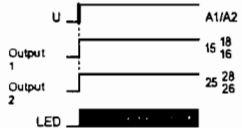
(K) One shot/watch dog (pulse controlled) (Min. Pulse AC 50ms - DC 30ms)



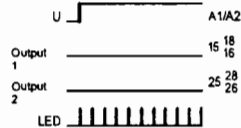
(L) Pulse converter



(On) ON-Function



(Off) OFF-Function



Cleverly designed function display LED (Green)

- Output in rest position, no timing
- Output in rest position, time running
- Output in operation position, no timing
- Output in operation position, time running

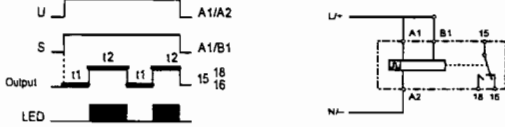
① A voltage other than the supply voltage can also be used at B1.

② Output 2, selectable as instantaneous contact with sliding switch (⊗) on front panel (instantaneous when switch is down, timed when switch is up).

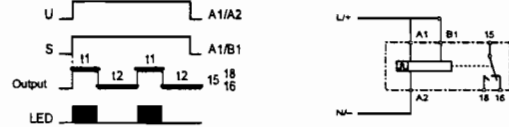
③ Bridge or potentiometer 10 kΩ, min. 0.25 W (low voltage) for external time setting. Set timer dial to 0.0.

## Timing Charts, Special Function

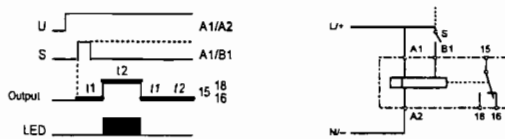
**(H) Flasher repeat cycle timer – Switch “X” is Up**  
 Supply voltage connected to A1 and B1.  
 Oscillating Mode starting with pause.



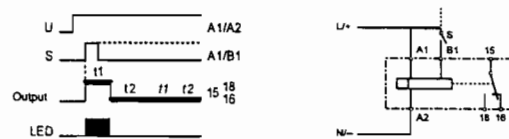
**(H) Flasher repeat cycle timer – Switch “X” is Down**  
 Supply voltage connected to A1 and B1.  
 Oscillating Mode starting with pulse.



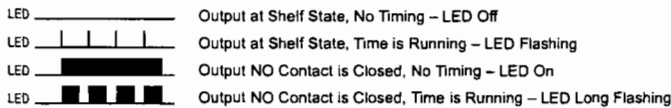
**(H) Flasher repeat cycle timer – Switch “X” is Up**  
 Pulse controlled, output starts with pause  
 (Min. Pulse AC 50ms – DC 30ms)  
 One Cycle Mode



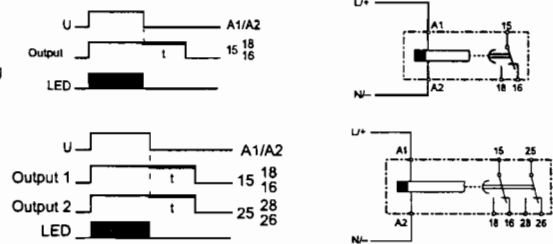
**(H) Flasher repeat cycle timer – Switch “X” is Down**  
 Pulse controlled, output starts with pulse  
 (Min. Pulse AC 50ms – DC 30ms)  
 One Cycle Mode



### LED Operation Chart – Green LED



### (Q) Off-delay without supply voltage (True Off-Delay)



### (Y) Star-Delta



### Wiring Connections

- 17 Common
- 18 Y
- 28 Δ

2 NO with Common

## Applications

Sequence	Description	Wiring Diagram
<b>On-Delay (A)</b> Switch (X) Down, (Contact 21–24/22) is Instantaneous 700-FSM DPDT Only Delayed Motor Starting	Pushing the Start Button energizes A1. After the time delay, Motor 1M will start	

## Applications, Continued

Sequence	Description	Wiring Diagram
<p><b>Off-Delay (B) Switch (X) Down, (21-24/22) is Instantaneous</b> 700-FSM DPDT Only Delayed Motor Stopping</p>	<p>A1 and A2 must be energized continuously. Pushing the Start Button will energize Motor 1M. Pushing the Stop Button will de-energize B1 and Motor 1M will be de-energized after the time delay is completed.</p>	
<p><b>On-and-Off Delay (C) Motor Starting and Stopping in a Sequence</b></p>	<p>Input Power must be applied to A1 and A2 continuously. Pushing the Start Button will energize B1 to start the On-Delay, and energize Motor 1M after the time delay is complete. When B1 is de-energized by pushing the Stop Button, the Off-Delay will begin, and Motor 2M will turn off after the time delay is completed.</p>	
<p><b>One Shot (D) Motor On for a Predetermined Time</b></p>	<p>Each time the Float Switch is closed, Motor 1M will run for the predetermined time that is set on the one shot timer.</p>	
<p><b>Fleeting Off-Delay (E) Motor On for a Predetermined Time After a Stop</b></p>	<p>Pushing the Start Button and then the Stop Button to energize and de-energize Motor 1M, will cause Motor 2M to be energized for a set time delay.</p>	
<p><b>Flasher (Repeat Cycle Starting with Pulse) (F)</b></p>	<p>When Limit Switch (1LS) closes, the Timer (TR) will close and open the contact, causing the forward FM and Reverse RM Motor Starters to go on and off.</p>	

## Applications, Continued

Sequence	Description	Wiring Diagram
<p><b>Flasher (Repeat Cycle Starting with Pause) (G)</b> Turning On an Alarm Horn After a Time Delay</p>	<p>When Limit Switch (1LS) closes, the Timer TR will be energized. The Horn will not sound until the time setting is completed.</p>	
<p><b>On-Delay Pulse Generator (I)</b> Turning On or Off a Latching Contactor for Lighting</p>	<p>The Selector Switch will energize the daylight sensor. The Contact (1DL) closes due to darkness and the Timer (1TR) will time out, and then close contact 1TR to send a pulse (0.5s) to the Latching Contactor to turn on the lights. When daylight comes, the switch 1DL will switch back and energize 2TR after a time delay. The 2TR contact will pulse closed (0.5s) to reset the lighting contactor. If the signals to 1DL are short, the 1TR and 2TR contacts will not pulse.</p>	<p style="text-align: center;">Timers 1TR and 2TR are set to eliminate short sensor signals.</p>
<p><b>On-Delay (Pulse Controlled) (J)</b> Pulse Starts The On-Delay that Turns On a Motor</p>	<p>A1 and A2 must be energized continuously. A pulse or input from the "ON" Pressure Switch starts the On-Delay. After the delay is complete, the Motor 1M will start. A signal from the "Reset" Pressure Switch turns the Motor 1M off. The delay prevents short off times.</p>	
<p><b>One Shot/Watch Dog (Pulse Controlled) (K)</b> Conveyor Keeps Running Only As Long As a Package is Sensed Every Time Setting (5 Min)</p>	<p>A1 and A2 must be energized continuously. A pulse must be received every time setting (or sooner) to maintain the Motor 1M running. This could be an energy saver, because the Motor 1M will turn off if the Photo SW is open for a period of time.</p>	

## Applications, Continued

Sequence	Description	Wiring Diagram
<p><b>Pulse Converter (L)</b> Pulses Are Turned Into a Set or Predetermined Output</p>	<p>When the Photo Switch closes the first time, the contact TR closes to energize Motor 1M for the predetermined time setting. The timer will not be reset by the opening or pulsing of the Photo SW until the time delay is completed. Time setting is 0.05s to 10h.</p>	
<p><b>Off-Delay Without Supply Voltage (Q)</b> (True Off-Delay)</p>	<p>A1 and A2 do not require continuous power for the off-delay time setting to be completed. Turning the switch to On will energize Motor 1M. When the switch is turned to Off, or the power is removed, Motor 1M will remain on for the time delay setting</p>	
<p><b>Star-Delta (Y)</b> Starting a Star-Delta Motor</p>	<p>Pushing the Start Button energizes the relay CR and the timer TR. Both will hold in through CR. Contact 17-18 will close energizing the Star Contact (Y), and starting the motor for the predetermined time. Then contact 17-18 will open and 50ms to 65ms later contact 17-28 will close to energize the Delta Contact (Δ).</p>	



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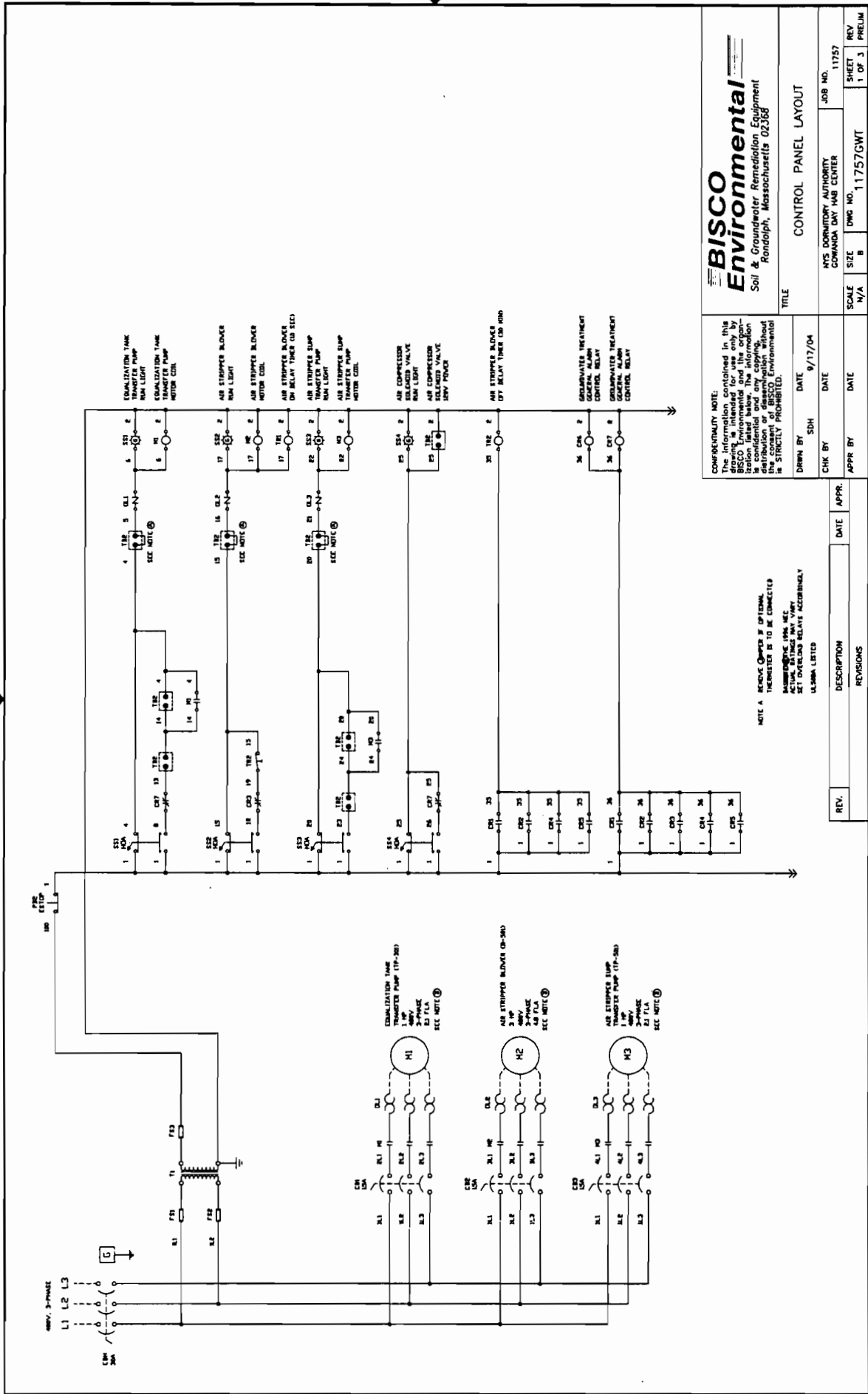
Allen-Bradley Headquarters, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414 382-2000 Fax: (1) 414 382-4444





## SECTION 8B

# GROUNDWATER TREATMENT SYSTEM CONTROLS



**Bisco Environmental**  
Soil & Groundwater Remediation Equipment  
Randolph, Massachusetts 02368

**CONTROL PANEL LAYOUT**

COMPLIANCE NOTE: This drawing is intended for use only by Bisco Environmental and its original distributor. The design and distribution of this drawing without the written consent of Bisco Environmental is strictly prohibited.

DATE: 9/17/04  
JOB NO.: 11757

SCALE: N/A  
SIZE: B  
DWG NO.: 11757CWT

REV SHEET: 1 OF 3  
PRELIM

NOTE A: THESE QUANTITIES ARE INDICATED IN THIS DRAWING TO BE COMPLETED BY THE INSTALLER. SET OVERLOAD RELAYS ACCORDINGLY. ULTIMATE LISTED.

DESCRIPTION: CONTROL PANEL LAYOUT

REVISIONS:

REV.	DESCRIPTION	DATE	APPR.

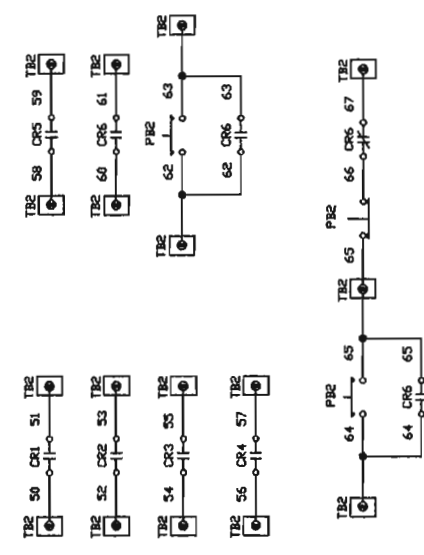
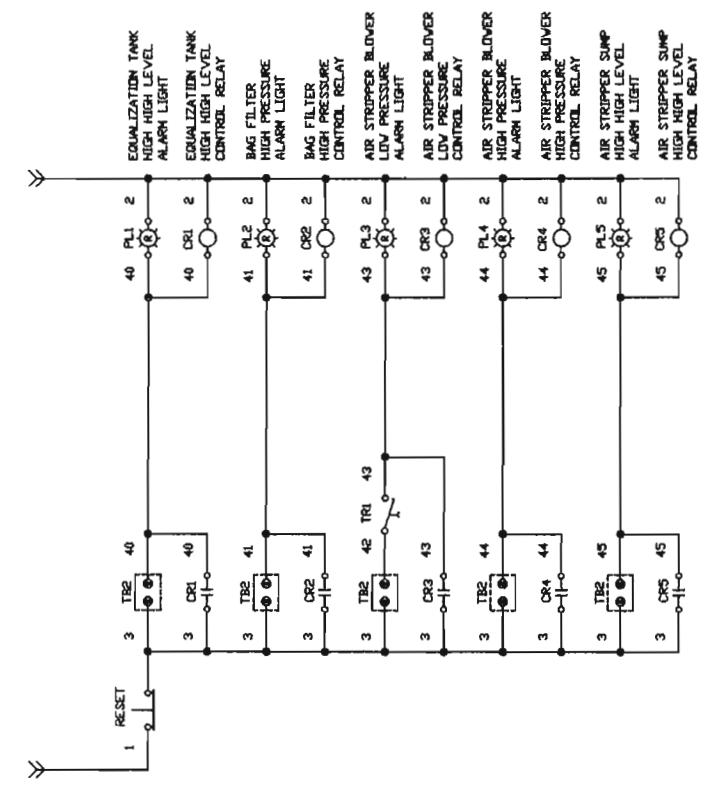
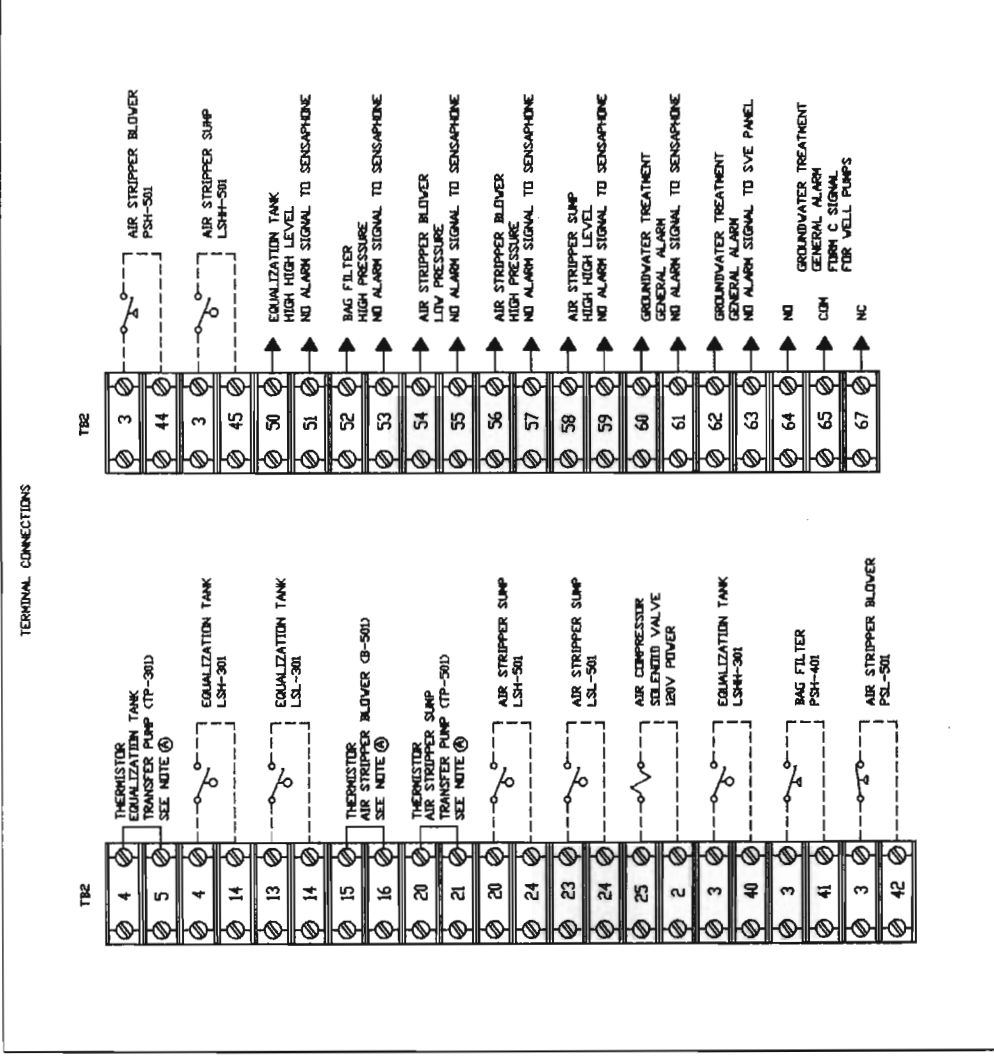
COMPANILITY NOTE: This drawing is intended for use only by Bisco Environmental and its original distributor. The design and distribution of this drawing without the written consent of Bisco Environmental is strictly prohibited.

DATE: 9/17/04  
JOB NO.: 11757

SCALE: N/A  
SIZE: B  
DWG NO.: 11757CWT

REV SHEET: 1 OF 3  
PRELIM





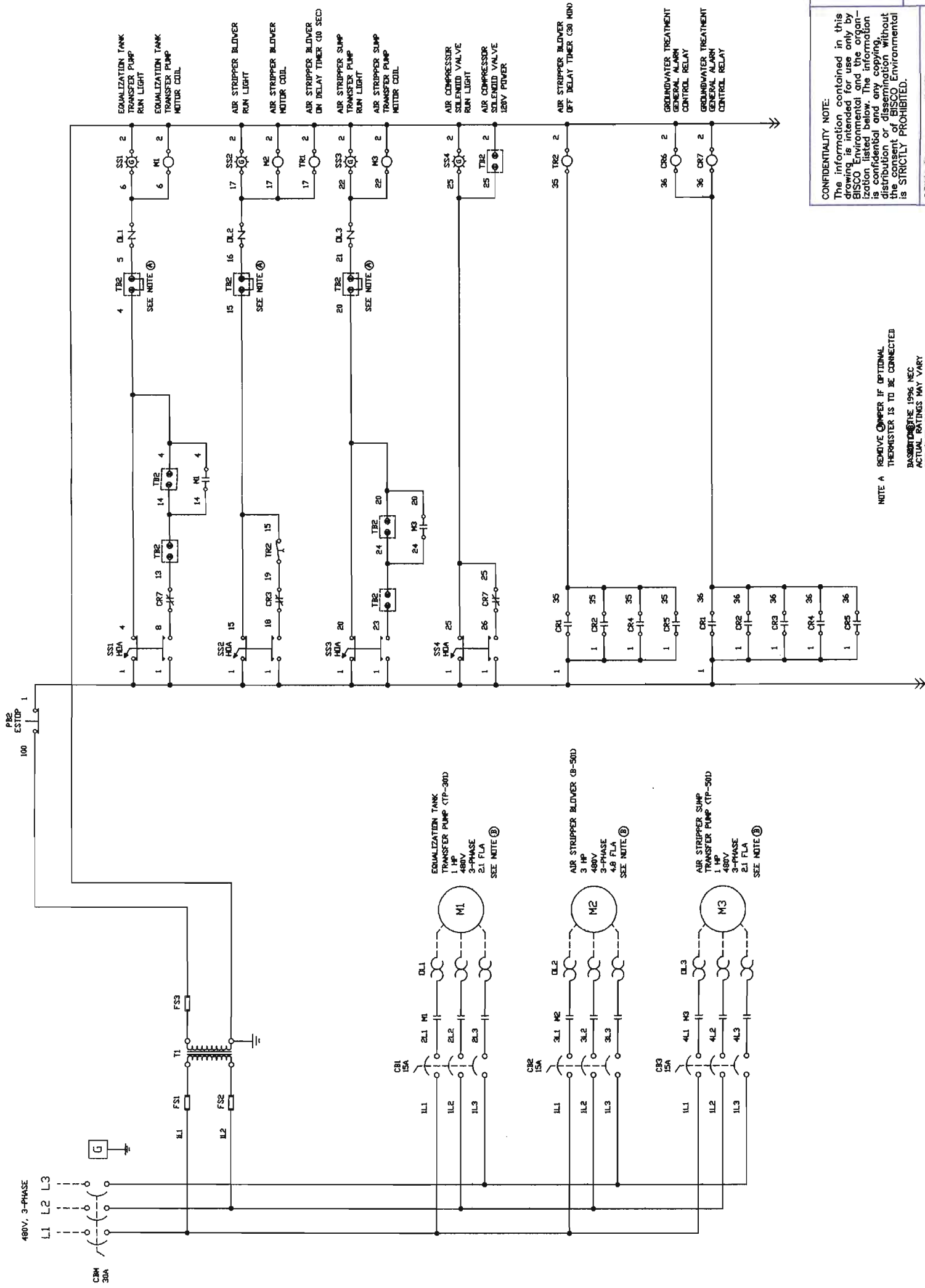
**CONFIDENTIALITY NOTE:**  
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NOTE ⑥ REMOVE JUMPER IF OPTIONAL THERMISTOR IS TO BE CONNECTED UL-508A LISTED

REV.	DESCRIPTION	DATE	APPR.
	REVISIONS		



TITLE		CONTROL PANEL LAYOUT	
DRAWN BY	DATE	CHK BY	DATE
SDH	9/17/04		
APPR BY	DATE	SCALE	SIZE
		N/A	B
JOB NO.		DWG NO.	
11757		11757GWT	
SHEET		REV	
2 OF 3		PRELIM	



**BISCO Environmental**  
Soil & Groundwater Remediation Equipment  
Randolph, Massachusetts 02368

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NOTE A REMOVE THERMISTOR IF OPTIONAL THERMISTOR IS TO BE CONNECTED  
BASEMOUNTING 1996 NEC  
ACTUAL RATINGS MAY VARY  
SET OVERLOAD RELAYS ACCORDINGLY  
UL508A LISTED

TITLE: CONTROL PANEL LAYOUT

DRWN BY: SDH DATE: 9/17/04

CHK BY: DATE:

APPR BY: DATE:

SCALE: N/A SIZE: B

DWG NO.: 11757GWT

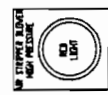
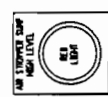
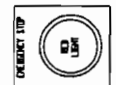
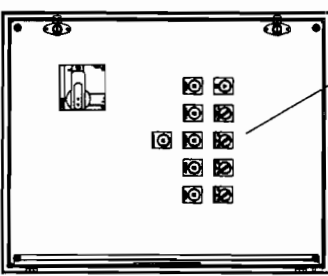
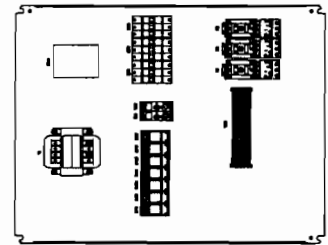
JOB NO.: 11757

SHEET: 1 OF 3

REV: PRELIM

REV.	DESCRIPTION	DATE	APPR.

COMPONENT	QTY	TYPE	MODEL #	DESCRIPTION
Control Enclosure	1	Hoffman	C-SD30248	NEMA 4, Single door, 30"H x 24"W x 8"D
Control Enclosure	1	Hoffman	C-P3024	Sub Panel
Circuit Breaker (CBM)	1	Allen Bradley	14DUG2C3C30	Circuit breaker, 480V, 30A, 3-pole
Circuit Breaker (CBM)	1	Cutler-Hammer	GHMV012B	Handle
Circuit Breaker (CBM)	1	Cutler-Hammer	3TA100G3K	Terminal Kit
Circuit Breaker (CB1-3)	3	Allen Bradley	14DUG2C3C15	Circuit breaker, 480V, 3-pole, 15A
Transformer (T1)	1	Hammond	P7250MCMJ-3	Transformer, 230-460/120V, 250VA
Fuse (FS1-2)	2	Bussman	LP DC-1.5	Transformer Primary Fuse, 1.5 Amp
Fuse (FS3)	1	Bussman	FNM-3	Transformer Secondary Fuse, 3 Amp
Contactors (M1-3)	3	Allen Bradley	100-C09D10	Contactors for SHP at 480V, 3-phase
OL Block (M1-3)	2	Allen Bradley	193-EA-2F8	1.2 9A OL Block
OL Block (M2)	1	Allen Bradley	193-EA-2F8	3.7-12A OL Block
HOA Switch (SS1-4)	4	Allen Bradley	800EM-L5M33	Selector switch operator, illuminated
HOA Switch (SS1-4)	4	Allen Bradley	800E-2DL5G	Light module
Switch Contact (SS1-4)	8	Allen Bradley	800E-2X10	Normally open contact
Reset Button (PB1)	1	Allen Bradley	800EM-MP24	Pushbutton, momentary, black
Estop (PB2)	1	Allen Bradley	800E-A2L	Pushbutton, push-to-maintain
Push Button (PB1-2)	2	Allen Bradley	800E-2X1	Latch
Push Button (PB2)	3	Allen Bradley	800E-2X01	Normally closed contact
Push Button (PB2)	1	Allen Bradley	800E-2X10	Normally open contact
Pilot Light (PL1-5)	5	Allen Bradley	800EP-PUM40GR	Pilot light, red, 120V
Control Relay (CR1-7)	7	Idtec	RU4S-A110	Control relay, 120V, 4-pole
Control Relay (CR1-7)	7	Idtec	SY4S-05	Control relay socket
Timing Relay (TR1-2)	2	Allen Bradley	700FSA3UJ23	120V, On delay timer



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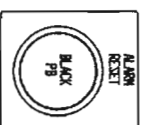
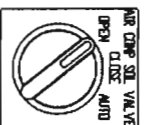
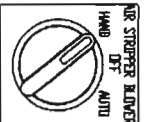
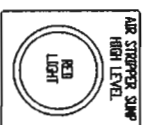
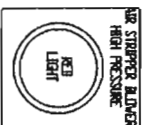
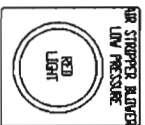
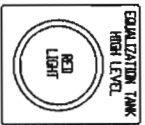
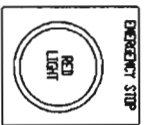
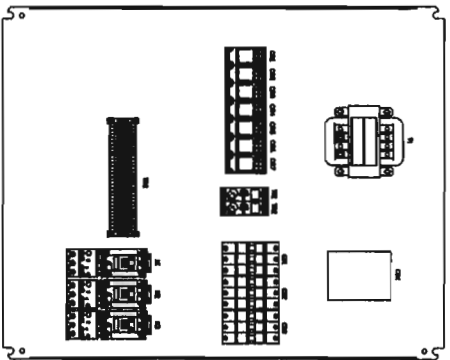
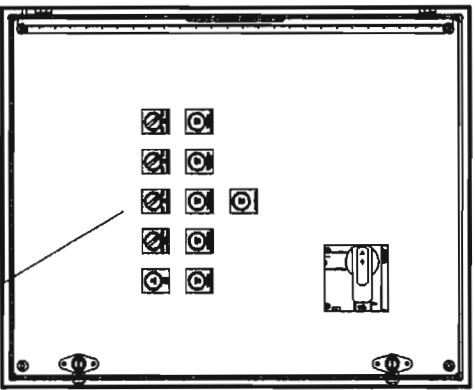
**BISCO Environmental**  
Soil & Groundwater Remediation Equipment  
Randolph, Massachusetts 02368

TITLE: CONTROL PANEL LAYOUT  
JOB NO. 11757  
SCALE: N/A  
SIZE: 8 1/2" x 11"

DRWN BY: SDH DATE: 9/17/04  
CHK BY: DATE:  
APPR BY: DATE:  
REVISIONS

REV. DESCRIPTION REVISIONS

REV. DESCRIPTION REVISIONS



COMPONENT	QTY	TYPE	MODEL #	DESCRIPTION
Control Enclosure	1	Hoffman	C-SD30248	NEMA 4, Single door, 30"H x 24"W x 8"D
Control Enclosure	1	Hoffman	C-P3024	Sub Panel
Circuit Breaker (CBM)	1	Allen Bradley	140UG2C3C30	Circuit breaker, 480V, 30A, 3-pole
Circuit Breaker (CBM)	1	Cutler-Hammer	GMMVD12B	Handle
Circuit Breaker (CBM)	1	Cutler-Hammer	3TA100G3K	Terminal Kit
Circuit Breaker (CBT-3)	3	Allen Bradley	140UG2C3C15	Circuit breaker, 480V, 3-pole, 15A
Transformer (T1)	1	Hammond	PT250MQMLJ-3	Transformer, 230X460/120V, 250VA
Fuse (FS1-2)	2	Bussman	LPCC-1.5	Transformer Primary Fuse, 1.5 Amp
Fuse (FS3)	1	Bussman	FNM-3	Transformer Secondary Fuse, 3 Amp
Contactor (M1-3)	3	Allen Bradley	100-C09D10	Contactor for SHP at 480V, 3-phase
OL Block (M1.3)	2	Allen Bradley	193-EA1DB	1-2.9A OL block
OL Block (M2)	1	Allen Bradley	193-EA2FB	3.7-12A OL block
HOA Switch (SS1-4)	4	Allen Bradley	800EM-LSM33	Selector switch operator, illuminated
HOA Switch (SS1-4)	4	Allen Bradley	800E-2DL5G	Light module
Switch Contact (SS1-4)	8	Allen Bradley	800E-2X10	Normally open contact
Reset Button (PB1)	1	Allen Bradley	800EM-F2	Pushbutton, momentary, black
Estop (PB2)	1	Allen Bradley	800EM-MP24	Pushbutton, push-pull-maintain
Push Button (PB1-2)	2	Allen Bradley	800E-A2L	Latch
Push Button (PB1-2)	2	Allen Bradley	800E-2X01	Normally closed contact
Push Button (PB2)	3	Allen Bradley	800E-2X10	Normally open contact
Pilot Light (PL1-5)	5	Allen Bradley	800EP-PLM4DSR	Pilot light, red, 120V
Control Relay (CR1-7)	7	Idec	RJ4S-A110	Control relay, 120V, 4-pole
Control Relay (CR1-7)	7	Idec	SY4S-05	Control relay socket
Timing Relay (TR1-2)	2	Allen Bradley	700F-SA3JU23	120V, On delay timer

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TITLE  
**CONTROL PANEL LAYOUT**

PANEL LISTED UL508A

REV.	DESCRIPTION	DATE	APPR.	CHK BY	DATE	SCALE	SIZE	DWG NO.	JOB NO.	SHEET	REV
	REVISIONS			SDH	9/17/04	N/A	B	11757GWT	11757	3 OF 3	PRELIM

## Standard Sizes CONCEPT® Single-Door Wall-Mount Enclosures

Enclosure Catalog Number ANSI 61 Gray	Enclosure Catalog Number RAL 7035 Lt. Gray	Door Ga.	Body Ga.	Enclosure Size A x B x C		* CONCEPT® Panel Catalog Number	Panel Size D x E		Mounting G x H		Latches qty style	J inch (mm)
				inch	(millimeter)		inch	(mm)	inch	(mm)		
CSD12126	CSD12126LG	16	16	12.00 x 12.00 x 6.00	(305 x 305 x 152)	CP1212	10.20 x 10.20	(259 x 259)	10.50 x 10.50	(267 x 267)	1	Qtum. 6.00 (152)
CSD16126	CSD16126LG	16	16	16.00 x 12.00 x 6.00	(406 x 305 x 152)	CP1612	14.20 x 10.20	(361 x 259)	14.50 x 10.50	(368 x 267)	1	Qtum. 8.00 (203)
CSD16166	CSD16166LG	16	16	16.00 x 16.00 x 6.00	(406 x 406 x 152)	CP1616	14.20 x 14.20	(361 x 361)	14.50 x 14.50	(368 x 368)	1	Qtum. 8.00 (203)
CSD16206	CSD16206LG	16	16	16.00 x 20.00 x 6.00	(406 x 508 x 152)	CP2016	18.20 x 14.20	(462 x 361)	14.50 x 18.50	(368 x 470)	1	Qtum. 8.00 (203)
CSD20166	CSD20166LG	16	16	20.00 x 16.00 x 6.00	(508 x 406 x 152)	CP2016	18.20 x 14.20	(462 x 361)	18.50 x 14.50	(470 x 368)	1	Qtum. 10.00 (254)
CSD20206	CSD20206LG	16	16	20.00 x 20.00 x 6.00	(508 x 508 x 152)	CP2020	18.20 x 18.20	(462 x 462)	18.50 x 18.50	(470 x 470)	1	Qtum. 10.00 (254)
CSD24166	CSD24166LG	16	16	24.00 x 16.00 x 6.00	(610 x 406 x 152)	CP2416	22.20 x 14.20	(564 x 361)	22.50 x 14.50	(572 x 368)	1	Qtum. 12.00 (305)
CSD24206	CSD24206LG	16	16	24.00 x 20.00 x 6.00	(610 x 508 x 152)	CP2420	22.20 x 18.20	(564 x 462)	22.50 x 18.50	(572 x 470)	1	Qtum. 12.00 (305)
CSD24246	CSD24246LG	14	16	24.00 x 24.00 x 6.00	(610 x 610 x 152)	CP2424	22.20 x 22.20	(564 x 564)	22.50 x 22.50	(572 x 572)	2	Qtum. 5.00 (127)
CSD16128	CSD16128LG	16	16	16.00 x 12.00 x 8.00	(406 x 305 x 203)	CP1612	14.20 x 10.20	(361 x 259)	14.50 x 10.50	(368 x 267)	1	Qtum. 8.00 (203)
CSD16168	CSD16168LG	16	16	16.00 x 16.00 x 8.00	(406 x 406 x 203)	CP1616	14.20 x 14.20	(361 x 361)	14.50 x 14.50	(368 x 368)	1	Qtum. 8.00 (203)
CSD16208	CSD16208LG	16	16	16.00 x 20.00 x 8.00	(406 x 508 x 203)	CP2016	18.20 x 14.20	(462 x 361)	14.50 x 18.50	(368 x 470)	1	Qtum. 8.00 (203)
CSD20168	CSD20168LG	16	16	20.00 x 16.00 x 8.00	(508 x 406 x 203)	CP2016	18.20 x 14.20	(462 x 361)	18.50 x 14.50	(470 x 368)	1	Qtum. 10.00 (254)
CSD20208	CSD20208LG	16	16	20.00 x 20.00 x 8.00	(508 x 508 x 203)	CP2020	18.20 x 18.20	(462 x 462)	18.50 x 18.50	(470 x 470)	1	Qtum. 10.00 (254)
CSD20248	CSD20248LG	16	16	20.00 x 24.00 x 8.00	(508 x 610 x 203)	CP2420	22.20 x 18.20	(564 x 462)	18.50 x 22.50	(470 x 572)	1	Qtum. 10.00 (254)
CSD24168	CSD24168LG	16	16	24.00 x 16.00 x 8.00	(610 x 406 x 203)	CP2416	22.20 x 14.20	(564 x 361)	22.50 x 14.50	(572 x 368)	1	Qtum. 12.00 (305)
CSD24208	CSD24208LG	16	16	24.00 x 20.00 x 8.00	(610 x 508 x 203)	CP2420	22.20 x 18.20	(564 x 462)	22.50 x 18.50	(572 x 470)	1	Qtum. 12.00 (305)
CSD24248	CSD24248LG	14	16	24.00 x 24.00 x 8.00	(610 x 610 x 203)	CP2424	22.20 x 22.20	(564 x 564)	22.50 x 22.50	(572 x 572)	2	Qtum. 5.00 (127)
CSD24308	CSD24308LG	14	16	24.00 x 30.00 x 8.00	(610 x 762 x 203)	CP3024	28.20 x 22.20	(716 x 564)	22.50 x 28.50	(572 x 724)	2	Qtum. 5.00 (127)
CSD30248	CSD30248LG	14	16	30.00 x 24.00 x 8.00	(762 x 610 x 203)	CP3024	28.20 x 22.20	(716 x 564)	28.50 x 22.50	(724 x 572)	2	Qtum. 5.00 (127)
CSD36368	CSD36368LG	14	14	36.00 x 36.00 x 8.00	(914 x 914 x 254)	CP3636	34.20 x 34.20	(869 x 869)	34.50 x 34.50	(876 x 876)	2	Qtum. 5.00 (127)
CSD36248	CSD36248LG	14	16	36.00 x 24.00 x 8.00	(914 x 610 x 203)	CP3624	34.20 x 22.20	(869 x 564)	34.50 x 22.50	(876 x 572)	2	Qtum. 5.00 (127)
CSD36308	CSD36308LG	14	14	36.00 x 30.00 x 8.00	(914 x 762 x 203)	CP3630	34.20 x 28.20	(869 x 716)	34.50 x 28.50	(876 x 724)	2	Qtum. 5.00 (127)
CSD161210	CSD161210LG	16	16	16.00 x 12.00 x 10.00	(406 x 305 x 254)	CP1612	14.20 x 10.20	(361 x 259)	14.50 x 10.50	(368 x 267)	1	Qtum. 8.00 (203)
CSD161610	CSD161610LG	16	16	16.00 x 16.00 x 10.00	(406 x 406 x 254)	CP1616	14.20 x 14.20	(361 x 361)	14.50 x 14.50	(368 x 368)	1	Qtum. 8.00 (203)
CSD162010	CSD162010LG	16	16	16.00 x 20.00 x 10.00	(406 x 508 x 254)	CP2016	18.20 x 14.20	(462 x 361)	14.50 x 18.50	(368 x 470)	1	Qtum. 8.00 (203)
CSD201610	CSD201610LG	16	16	20.00 x 16.00 x 10.00	(508 x 406 x 254)	CP2016	18.20 x 14.20	(462 x 361)	18.50 x 14.50	(470 x 368)	1	Qtum. 10.00 (254)
CSD202010	CSD202010LG	16	16	20.00 x 20.00 x 10.00	(508 x 508 x 254)	CP2020	18.20 x 18.20	(462 x 462)	18.50 x 18.50	(470 x 470)	1	Qtum. 10.00 (254)
CSD202410	CSD202410LG	16	16	20.00 x 24.00 x 10.00	(508 x 610 x 254)	CP2420	22.20 x 18.20	(564 x 462)	18.50 x 22.50	(470 x 572)	1	Qtum. 10.00 (254)
CSD241610	CSD241610LG	16	16	24.00 x 16.00 x 10.00	(610 x 406 x 254)	CP2416	22.20 x 14.20	(564 x 361)	22.50 x 14.50	(572 x 368)	1	Qtum. 12.00 (305)
CSD242010	CSD242010LG	16	16	24.00 x 20.00 x 10.00	(610 x 508 x 254)	CP2420	22.20 x 18.20	(564 x 462)	22.50 x 18.50	(572 x 470)	1	Qtum. 12.00 (305)
CSD242410	CSD242410LG	14	16	24.00 x 24.00 x 10.00	(610 x 610 x 254)	CP2424	22.20 x 22.20	(564 x 564)	22.50 x 22.50	(572 x 572)	2	Qtum. 5.00 (127)
CSD243010	CSD243010LG	14	16	24.00 x 30.00 x 10.00	(610 x 762 x 254)	CP3024	28.20 x 22.20	(716 x 564)	22.50 x 28.50	(572 x 724)	2	Qtum. 5.00 (127)
CSD302010	CSD302010LG	14	16	30.00 x 20.00 x 10.00	(762 x 508 x 254)	CP3020	28.20 x 18.20	(716 x 462)	28.50 x 18.50	(724 x 470)	2	Qtum. 5.00 (127)
CSD302410	CSD302410LG	14	16	30.00 x 24.00 x 10.00	(762 x 610 x 254)	CP3024	28.20 x 22.20	(716 x 564)	28.50 x 22.50	(724 x 572)	2	Qtum. 5.00 (127)
CSD303010	CSD303010LG	14	14	30.00 x 30.00 x 10.00	(762 x 762 x 254)	CP3030	28.20 x 28.20	(716 x 716)	28.50 x 28.50	(724 x 724)	2	Qtum. 5.00 (127)
CSD362410	CSD362410LG	14	16	36.00 x 24.00 x 10.00	(914 x 610 x 254)	CP3624	34.20 x 22.20	(869 x 564)	34.50 x 22.50	(876 x 572)	2	Qtum. 5.00 (127)
CSD363010	CSD363010LG	14	14	36.00 x 30.00 x 10.00	(914 x 762 x 254)	CP3630	34.20 x 28.20	(869 x 716)	34.50 x 28.50	(876 x 724)	2	Qtum. 5.00 (127)
CSD363610	CSD363610LG	14	14	36.00 x 36.00 x 10.00	(914 x 914 x 254)	CP3636	34.20 x 34.20	(869 x 869)	34.50 x 34.50	(876 x 876)	2	Qtum. 5.00 (127)
CSD423610	CSD423610LG	14	14	42.00 x 36.00 x 10.00	(1067 x 762 x 254)	CP4236	40.20 x 34.20	(1021 x 869)	40.50 x 34.50	(1029 x 876)	1	3 pt. 21.00 (533)
CSD482410	CSD482410LG	14	14	48.00 x 24.00 x 10.00	(1219 x 610 x 254)	CP4824	46.20 x 22.20	(1173 x 564)	46.50 x 22.50	(1181 x 572)	1	3 pt. 24.00 (610)
CSD483610	CSD483610LG	14	14	48.00 x 36.00 x 10.00	(1219 x 762 x 254)	CP4836	46.20 x 34.20	(1173 x 869)	46.50 x 34.50	(1181 x 876)	1	3 pt. 24.00 (610)

Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch.

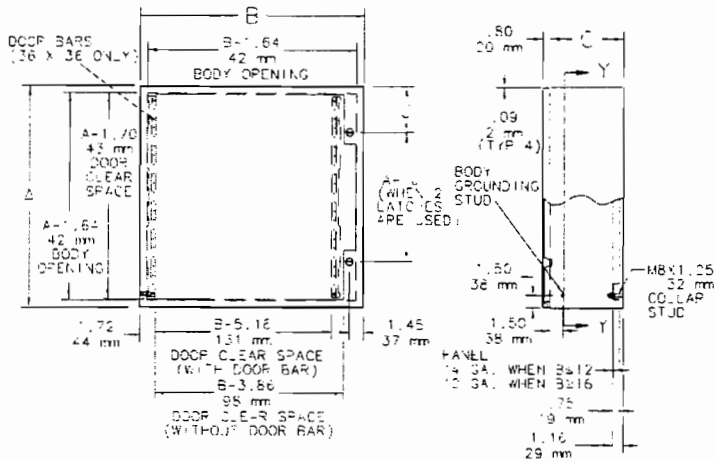
\* Panels must be ordered separately. Optional zinc-plated CONCEPT® panels available for most sizes. Optional NEMA-size panels require conversion kit cat. number CCPM4 (see General Accessories).

NOTE: Panels have a formed flange along any side that is longer than 22.20 in. (564mm). Panels CP2420 and CP2424 have a flange on all four sides.

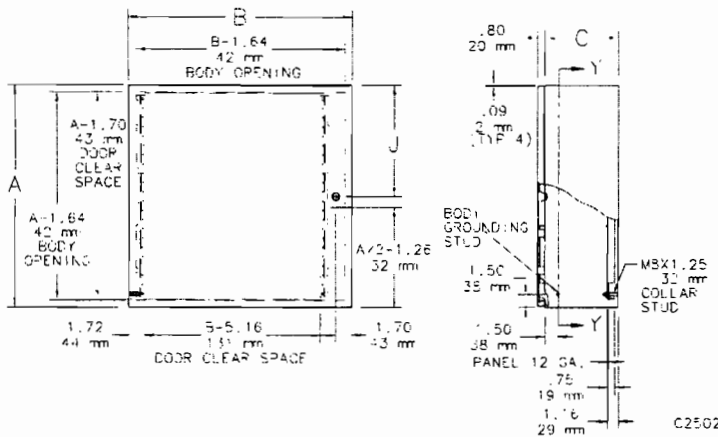




■ CONCEPT® Single-Door Wall-Mount Enclosures



Single-Door Enclosure with Quarter-turn Latching



Single-Door Enclosure with 3-point Latching

Data Pockets for Solid Door Enclosures		
Enclosure Size		
A	B	Pocket
Any	12.00 (305)	None
<30.00 (762)	<20.00 (508)	Small
>30.00 (762)	>20.00 (508)	Large

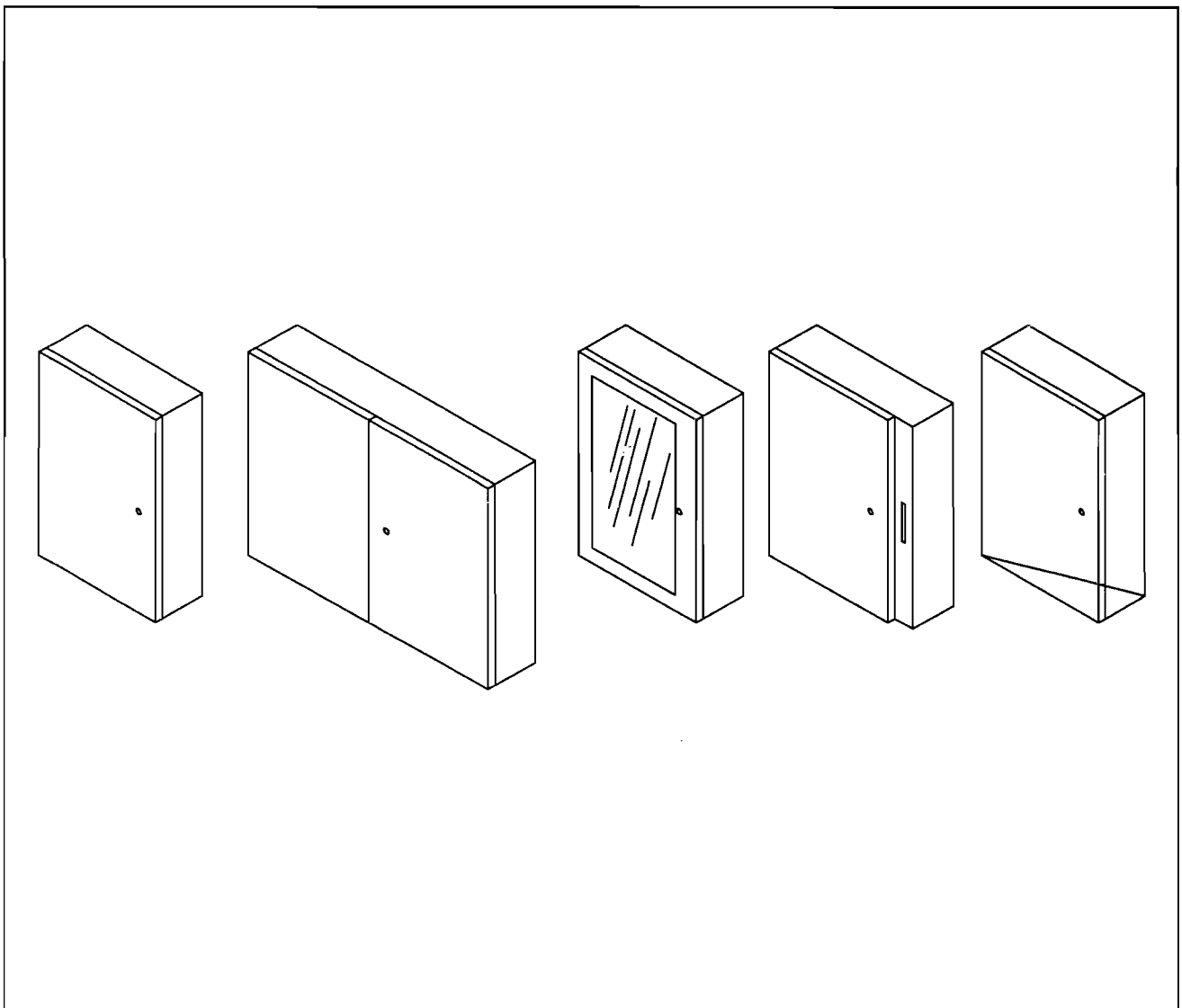
For Section Y-Y see following page



<del>CSD603610</del>	<del>CSD603610LG</del>	<del>14</del>	<del>14</del>	<del>60.00 x 36.00 x 10.00 (1524 x 914 x 254)</del>	<del>CP6036</del>	<del>58.20 x 34.20 (1478 x 869)</del>	<del>58.50 x 34.50 (1486 x 876)</del>	<del>1</del>	<del>3 pt.</del>	<del>30.00 (762)</del>
<del>CSD202012</del>	<del>CSD202012LG</del>	<del>16</del>	<del>16</del>	<del>20.00 x 20.00 x 12.00 (508 x 508 x 305)</del>	<del>CP2020</del>	<del>18.20 x 18.20 (462 x 462)</del>	<del>18.50 x 18.50 (470 x 470)</del>	<del>1</del>	<del>Qturn.</del>	<del>10.00 (254)</del>
<del>CSD242012</del>	<del>CSD242012LG</del>	<del>16</del>	<del>16</del>	<del>24.00 x 20.00 x 12.00 (610 x 508 x 305)</del>	<del>CP2420</del>	<del>22.20 x 18.20 (564 x 462)</del>	<del>22.50 x 18.50 (572 x 470)</del>	<del>1</del>	<del>Qturn.</del>	<del>12.00 (305)</del>
<del>CSD242412</del>	<del>CSD242412LG</del>	<del>14</del>	<del>16</del>	<del>24.00 x 24.00 x 12.00 (610 x 610 x 305)</del>	<del>CP2424</del>	<del>22.20 x 22.20 (564 x 564)</del>	<del>22.50 x 22.50 (572 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD302412</del>	<del>CSD302412LG</del>	<del>14</del>	<del>16</del>	<del>30.00 x 24.00 x 12.00 (762 x 610 x 305)</del>	<del>CP3024</del>	<del>28.20 x 22.20 (716 x 564)</del>	<del>28.50 x 22.50 (724 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD303012</del>	<del>CSD303012LG</del>	<del>14</del>	<del>14</del>	<del>30.00 x 30.00 x 12.00 (762 x 762 x 305)</del>	<del>CP3030</del>	<del>28.20 x 28.20 (716 x 716)</del>	<del>28.50 x 28.50 (724 x 724)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD362412</del>	<del>CSD362412LG</del>	<del>14</del>	<del>16</del>	<del>36.00 x 24.00 x 12.00 (914 x 610 x 305)</del>	<del>CP3624</del>	<del>34.20 x 22.20 (869 x 564)</del>	<del>34.50 x 22.50 (876 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD363012</del>	<del>CSD363012LG</del>	<del>14</del>	<del>14</del>	<del>36.00 x 30.00 x 12.00 (914 x 762 x 305)</del>	<del>CP3630</del>	<del>34.20 x 28.20 (869 x 716)</del>	<del>34.50 x 28.50 (876 x 724)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD363612</del>	<del>CSD363612LG</del>	<del>14</del>	<del>14</del>	<del>36.00 x 36.00 x 12.00 (914 x 914 x 305)</del>	<del>CP3636</del>	<del>34.20 x 34.20 (869 x 869)</del>	<del>34.50 x 34.50 (876 x 876)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD423612</del>	<del>CSD423612LG</del>	<del>14</del>	<del>14</del>	<del>42.00 x 36.00 x 12.00 (1067 x 914 x 305)</del>	<del>CP4236</del>	<del>40.20 x 34.20 (1021 x 869)</del>	<del>40.50 x 34.50 (1029 x 876)</del>	<del>1</del>	<del>3-point</del>	<del>21.00 (533)</del>
<del>CSD482412</del>	<del>CSD482412LG</del>	<del>14</del>	<del>14</del>	<del>48.00 x 24.00 x 12.00 (1219 x 610 x 305)</del>	<del>CP4824</del>	<del>46.20 x 22.20 (1173 x 564)</del>	<del>46.50 x 22.50 (1181 x 572)</del>	<del>1</del>	<del>3-point</del>	<del>24.00 (610)</del>
<del>CSD483612</del>	<del>CSD483612LG</del>	<del>14</del>	<del>14</del>	<del>48.00 x 36.00 x 12.00 (1219 x 914 x 305)</del>	<del>CP4836</del>	<del>46.20 x 34.20 (1173 x 869)</del>	<del>46.50 x 34.50 (1181 x 876)</del>	<del>1</del>	<del>3-point</del>	<del>24.00 (610)</del>
<del>CSD603612</del>	<del>CSD603612LG</del>	<del>14</del>	<del>14</del>	<del>60.00 x 36.00 x 12.00 (1524 x 914 x 305)</del>	<del>CP6036</del>	<del>58.20 x 34.20 (1478 x 869)</del>	<del>58.50 x 34.50 (1486 x 876)</del>	<del>1</del>	<del>3-point</del>	<del>30.00 (762)</del>
<del>CSD242416</del>	<del>CSD242416LG</del>	<del>14</del>	<del>14</del>	<del>24.00 x 24.00 x 16.00 (610 x 610 x 406)</del>	<del>CP2424</del>	<del>22.20 x 22.20 (564 x 564)</del>	<del>22.50 x 22.50 (572 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD363016</del>	<del>CSD363016LG</del>	<del>14</del>	<del>14</del>	<del>36.00 x 30.00 x 16.00 (914 x 762 x 406)</del>	<del>CP3630</del>	<del>34.20 x 28.20 (869 x 716)</del>	<del>34.50 x 28.50 (876 x 724)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD483616</del>	<del>CSD483616LG</del>	<del>14</del>	<del>14</del>	<del>48.00 x 36.00 x 16.00 (1219 x 914 x 406)</del>	<del>CP4836</del>	<del>46.20 x 34.20 (1173 x 869)</del>	<del>46.50 x 34.50 (1181 x 876)</del>	<del>1</del>	<del>3-point</del>	<del>24.00 (610)</del>
<del>CSD242420</del>	<del>CSD242420LG</del>	<del>14</del>	<del>14</del>	<del>24.00 x 24.00 x 20.00 (610 x 610 x 508)</del>	<del>CP2424</del>	<del>22.20 x 22.20 (564 x 564)</del>	<del>22.50 x 22.50 (572 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD302420</del>	<del>CSD302420LG</del>	<del>14</del>	<del>14</del>	<del>30.00 x 24.00 x 20.00 (762 x 610 x 508)</del>	<del>CP3024</del>	<del>28.20 x 22.20 (716 x 564)</del>	<del>28.50 x 22.50 (724 x 572)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>
<del>CSD363020</del>	<del>CSD363020LG</del>	<del>14</del>	<del>14</del>	<del>36.00 x 30.00 x 20.00 (914 x 762 x 508)</del>	<del>CP3630</del>	<del>34.20 x 28.20 (869 x 716)</del>	<del>34.50 x 28.50 (876 x 724)</del>	<del>2</del>	<del>Qturn.</del>	<del>5.00 (127)</del>

NOTE: Panels have a formed flange along any side that is longer than 22.20 in. (564mm). Panels CP2420 and CP2424 have a flange on all four sides.

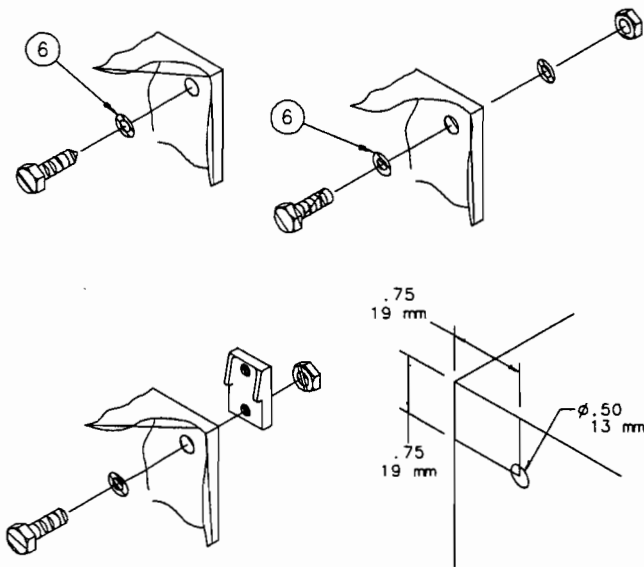
# CONCEPT<sup>®</sup>

## Wall-Mount Enclosure



<p><b>⚠ WARNING</b></p> <p>To avoid electric shock, do not energize any circuits before all internal and external electrical and mechanical clearances are checked to assure that all assembled equipment functions safely and properly.</p>		<p><b>⚠ WARNING</b></p> <p>Um elektrische Schocks zu vermeiden, setzen Sie die Stromkreise erst dann Spannung aus, wenn alle internen und externen mechanischen Sicherheitsabstände überprüft worden sind, um sicherzustellen, daß alle zusammengebauten Geräte sicher und ordnungsgemäß funktionieren.</p>
<p><b>⚠ PRECAUTION</b></p> <p>Para evitar una descarga eléctrica no energice ningún circuito antes de que todos los espacios mecánicos y eléctricos (internos y externos) se revisen para asegurar que todo el equipo ensamblado funcione bien y de manera segura.</p>		<p><b>⚠ AVERTISSEMENT</b></p> <p>Pour éviter les décharges électriques, n'activez aucun circuit avant de vérifier tous les circuits internes et externes et tous les dégagements mécaniques afin de s'assurer que les fonctions de tous les équipements assemblés fonctionnent correctement et en toute sécurité.</p>

### MOUNTING INSTRUCTIONS (optional mounting feet page 9)



#### ENGLISH

Mounting holes have been provided in the back of the enclosure for convenient mounting through the enclosure. Attach enclosure to wall or other structure using customer supplied 3/8 inch or M8 fastener, flat washers, and nuts. To insure proper sealing and enclosure protection rating, use the provided sealing washers. Install sealing washers inside the enclosure with rubber face against the enclosure.

#### ENGLISH

##### Mounting Feet

##### UL/CSA Requirement:

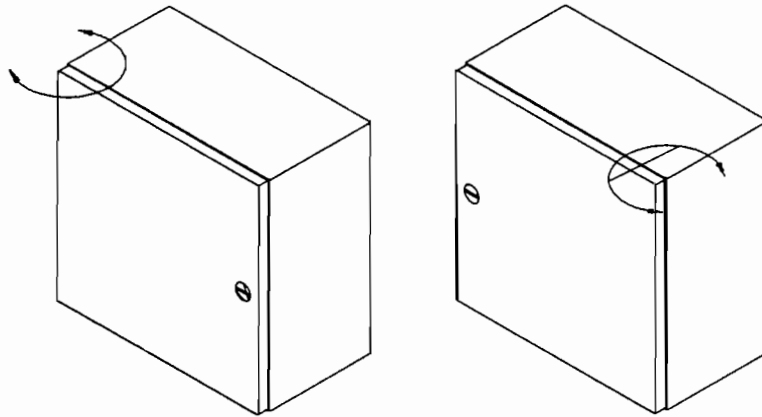
- Use of mounting feet mandatory on all type 3,4,4X applications.
- If wall mounting provisions have been omitted, holes must be added per detail above.

The use of the optional mounting feet allows simple mounting with fasteners outside the enclosure.

- Steel Zinc Plated Mounting Foot Kit P/N C-MFK
- Stainless Steel Mounting Foot Kit P/N C-MFKSS
- Composite Mounting Foot Kit P/N C-MTGFT

Kits provide all necessary hardware to install the mounting feet as shown.  
(order separately)

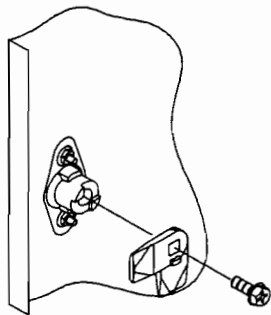
## REVERSING DOOR HINGES (lower door only)



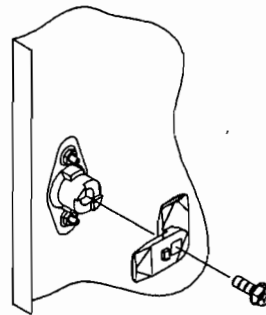
### ENGLISH

- 1) Remove door from body by removing hinge pins.
- 2) Unscrew hinges from body.
- 3) Drill  $\varnothing.203$  (5.16 mm) on opposite enclosure flange at drill point locations.
- 4) Reinstall hinges and door.
- 5) Seal the unused hinge holes with customer supplied #10 or M5 screw and silicone sealer.

## REVERSING LATCH DIRECTION



Clockwise to open.

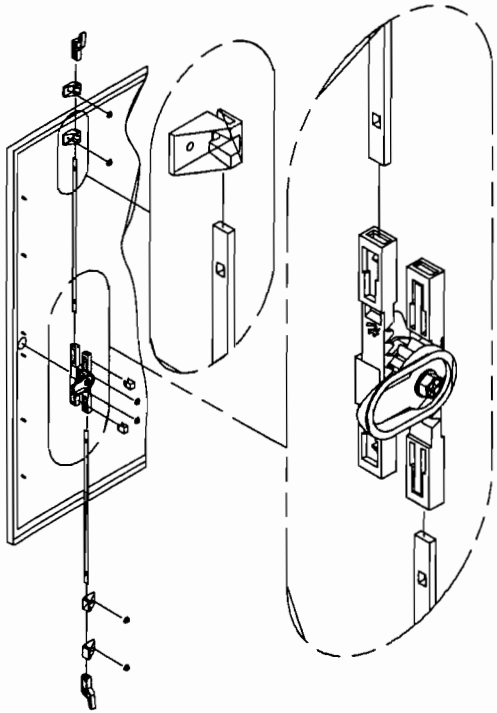


Counterclockwise to open.

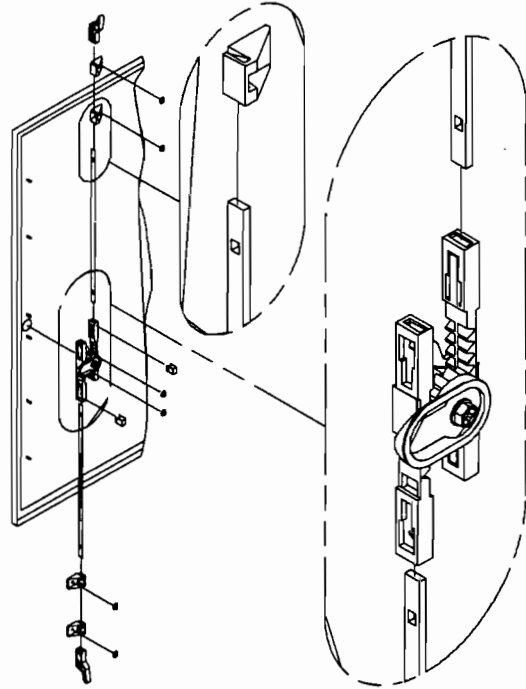
### ENGLISH

- 1) Remove Latch Cam.
- 2) Invert as shown and reinstall cam.
- 3) Torque fastener to 4.3Nm (38 in-lbs)

## REVERSING MULTIPOINT LATCH DIRECTION (lower door only)



Clockwise to open.

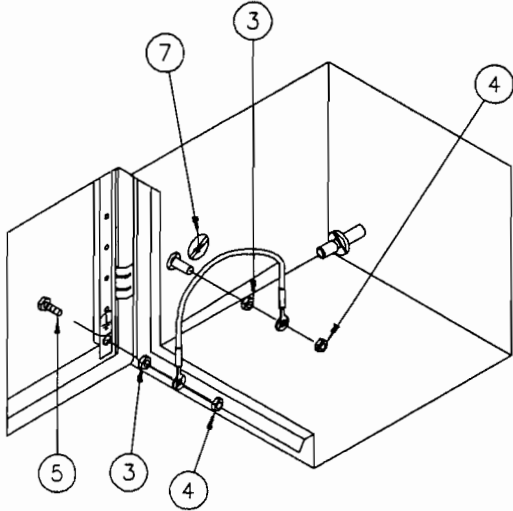


Counterclockwise to open.

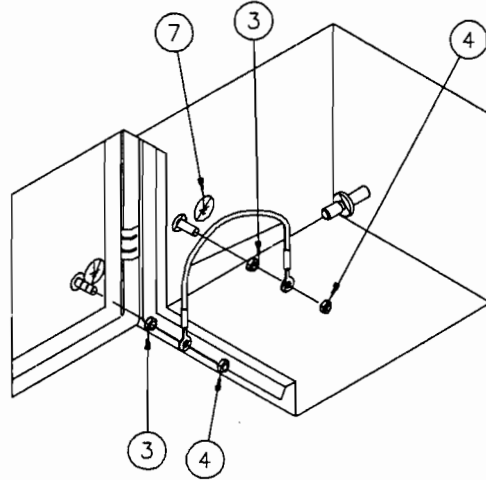
### ENGLISH




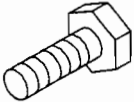


- 1) Remove latch system from door.
- 2) Disengage rods from racks.
- 3) Remove cam and orient racks as shown.
- 4) Reinstall cam, torque cam fastener to 38 in-lbs (4.3 Nm).
- 5) Reposition rod guides.
- 6) Insert rods in racks.
- 7) Assemble latch system onto door; torque nuts to 22 in-lbs (2.5 Nm)

**GROUNDING (MILD STEEL)**

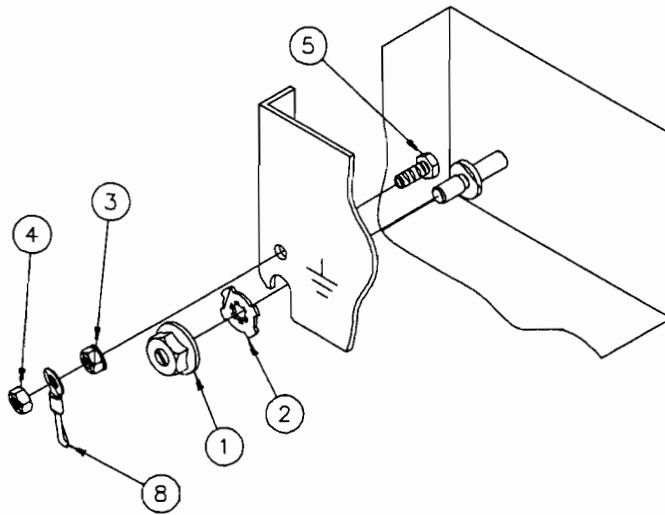


**GROUNDING (STAINLESS STEEL)**



1	M8-1.25	2	M6-1	4	M6-1
	(4x) (8x)		(1x)		(3x)
5	M6-1x16	6	7	8	supplied by customer
	(2x)		(4x)		(2x)

## PANEL INSTALLATION / GROUNDING



### NOTE:

- For proper panel installation, it may be necessary to bend mounting studs slightly to permit the panel to fit in place.

**HARDWARE KITS**

Included with your Hoffman enclosure is a complete package of hardware for back panel installation. Also provided is all the necessary hardware for grounding the back panel and doors to the enclosure body.

Shown are the proper installation procedures for grounding the doors, covers, and optional panels and mounting the optional side and back panels.

Ground wires (item 8) are available from Hoffman Enclosures. Consult the latest Hoffman Specifiers Guide.



## REPAINTING INSTRUCTIONS

**SUGGESTED PAINTS:** The following paints typically provide superior adhesion qualities:

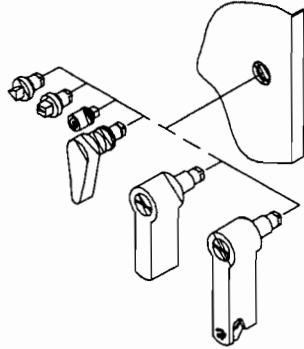
- Two Component Epoxies
- Two Component Polyurethanes
- Lacquers
- Acrylics
- Alkyd Baking Enamels
- Industrial Enamel

**SURFACE PREPARATION:** Wet wipe all surfaces to be painted with xylene solvent. Allow surfaces to flash dry three to five minutes. If a delay of greater than two hours occurs before painting, wet wipe again.

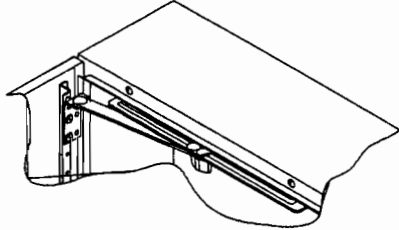
**PAINTING:** Apply top coat per paint manufacturer's instructions. Allow adequate cure time between coats.

Allow top coat to cure completely prior to testing paint adhesion. Consult with the paint manufacturer for proper cure time.

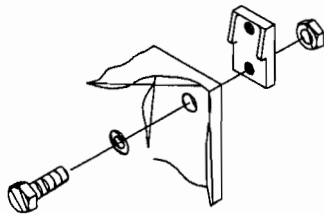
# EXTERNAL ACCESSORIES



Latch Accessories

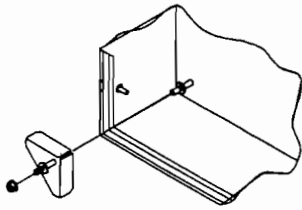


Door Stop Kit

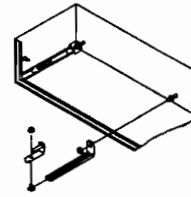


Mounting Feet

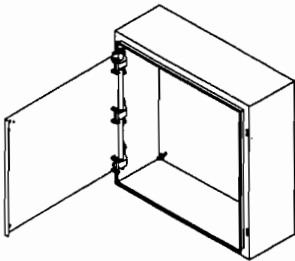
# INTERNAL ACCESSORIES



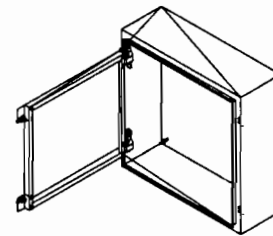
Panel Conversion Kit



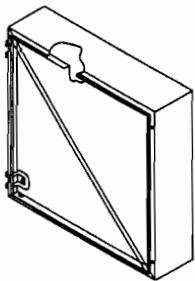
Adjustable Mounting Kit



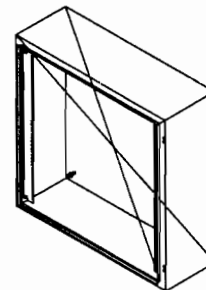
Swing-Out Panel



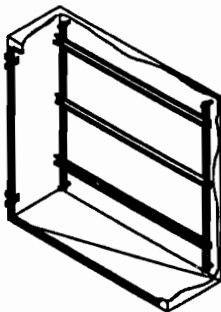
Swing-Out Frame



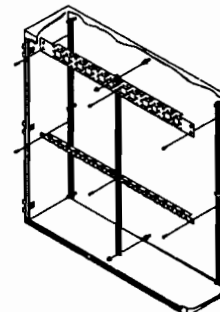
Dead Front Panel



Rack Angles



DIN Rail Kit



Grid Straps

## GENERAL ACCESSORIES

### **Temperature Control**

Options are available to provide an optimal environment for your controls. Options include louvers, filter fans, heat exchangers, air conditioners, and electric heaters.

### **Floor Stand Kits**

Field or factory installation available on single door enclosures.

### **Drip Shield Kits**

Field or factory installation available on single or double door enclosures.

### **Electrical Interlocks**

Internal safety lockout while the enclosure contents are energized.

### **Corrosion Inhibitors**

Protect interior components from corrosion.

### **Hole Seals**

Used to seal extra conduit openings, pushbutton holes, or cutouts against dust, dirt, oil, and water.

### **Folding Shelves**

Can be used to support instruments and test equipment.

### **Terminal Kit Assemblies**

Provides an easy method to mount terminal blocks.

### **Pedestals**

Provides floor mounting for small to medium size enclosures.

### **Safety Lockouts**

Protect personnel and equipment by enabling multiple padlocks to be installed on a de-energized switch.

### **Touch-Up Paint**

Used to repair the finish of enclosures and panels.

### **Enclosure Stabilizers**

Provides stability to floor mounted enclosures which are not bolted to the floor.

### **Window Kits**

Available for many types of Hoffman enclosures.

### **Data Pocket Kits**

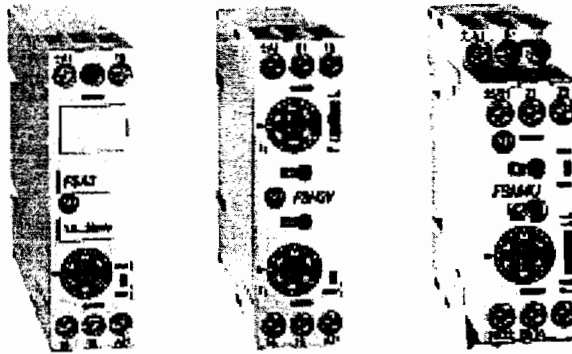
Convenient place for documentation.



# Electronic High Performance Timing Relays


(Catalog Number 700-FS)

## Product Data



The Bulletin 700-FS Electronic High Performance Timing Relays consist of Multi-Function, Single Function and Special Function designs. These products offer the customer optimum space utilization and maximum functionality. In addition, the timing ranges are easily adjusted, and the LEDs provide visual indication of the coil and timing status.

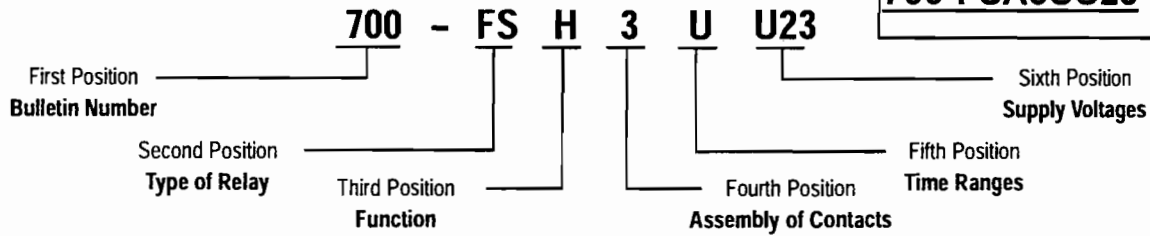
- 22.5mm (5/8 inch) Wide
- Dual Voltage
  - 24-48V DC
  - 24-240V AC
- DIN Rail Mounting
- Finger Safe Terminals
- Single Pull Double Throw (SPDT) Contact Configuration
  - Multi-Function/Multi-Range (On-Delay, Off-Delay, On-and-Off-Delay, One Shot, Fleeting Off-Delay, Flasher, On-Delay Pulse Generator, Pulse Converter, On-Function, Off-Function, with 10 Timing Ranges)
  - Single Function (On-Delay, Off-Delay, On-and-Off-Delay, One Shot, Fleeting Off-Delay, Flasher (Pulse), Flasher (Pause), On-Delay Pulse Generator, On-Delay (Pulse Controlled), One Shot/Watch Dog, Pulse Converter, with 12 Timing Ranges)
  - Special Function/Multi-Range (Flasher, True Off-Delay, Star-Delta, with 12 Timing Ranges)
- Double Pull Double Throw (DPDT) Contact Configuration
  - Multi-Function/Multi-Range (On-Delay, Off-Delay, On-and-Off-Delay, One Shot, Fleeting Off-Delay, Flasher, On-Delay Pulse Generator, Pulse Converter, On-Function, Off-Function, with 10 Timing Ranges)
  - Single Function/Multi-Range (On-Delay, Off-Delay, with 10 Timing Ranges)

 **Rockwell** Automation

**Allen-Bradley**

**Catalog Number Explanation**

**Model Number:**  
**700-FSA3UU23**



**Multi-Function Timing Relays**

700-FS	M	3	U	U23
Function	Assembly of contacts	Time ranges	Supply voltages	
M Multi-function timing relays 8 Single-functions: A, B, C, D, E, F, I, L, Q, and OFF function additional (for installation and maintenance)	3 1 Change-over contact 1 C/O (SPDT) 4 2 Change-over contacts 2 C/O (DPDT)	U 0.05 s...60 h	Z12 12 VDC U23 24...48 VDC 24...240 V 50/60 Hz	

**Single Function Timing Relays**

700-FS	A	3	A	U23
Function	Assembly of contacts	Time ranges	Supply voltages	
A On-delay B Off-delay C On- and off-delay D One shot E Fleeting off-delay F Flasher (repeat cycle starts w/pulse) G Flasher (repeat cycle starts w/pause) I On-delay pulse generator J On-delay (pulse controlled) K One shot / watch dog (pulse controlled) L Pulse converter	all functions: 3 1 Change-over contact 1 C/O (SPDT) Functions A and B: 4 2 Change-over contacts 2 C/O (DPDT)	A 0.05...1 s B 0.15...3 s C 0.5...10 s D 1.5...30 s E 0.05...1 min F 0.15...3 min G 0.5...10 min H 1.5...30 min I 0.05...1 h J 0.15...3 h K 0.5...10 h L 3.0...60 h U 0.05 s...60 h	Z12 12 VDC U23 24...48 VDC 24...240 V 50/60 Hz	NOTE: Only the 700-FSA and 700-FSB are available with the "U" multi-time setting ranges (0.05s to 60h).

**Special Function Timing Relays**

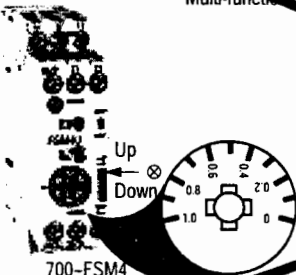
700-FS	H	3	U	U23
Function	Assembly of contacts	Time ranges	Supply voltages	
H Flasher (repeat cycle starting with pulse or pause)	3 1 Change-over contact 1 C/O (SPDT)	U 0.05 s...60 h V 0.05 s ... 60 h (2 ranges)	Z12 12 VDC U23 24...48 VDC 24...240 V 50/60 Hz	

700-FS	Q	3	Q	U18
Function	Assembly of contacts	Time ranges	Supply voltages	
Q Off-delay without supply voltages (true off-delay)	3 1 Change-over contact 1 C/O (SPDT) 4 2 Change-over contact 2 C/O (DPDT)	Q 0.15 s ... 10 min	U18 24...240 VDC 24...240 V 50/60 Hz	

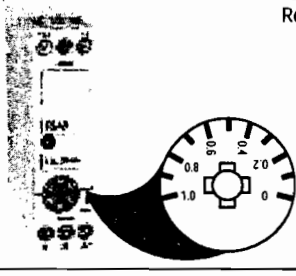
700-FS	Y	2	C	U23
Function	Assembly of contacts	Time ranges	Supply voltages	
Y Star-delta timing relays	2 2 normally open contacts 2 N.O.	C 0.5...10 s D 1.5...30 s E 0.05...1 min F 0.15...3 min G 0.5...10 min	U23 24...48 VDC 24...240 V 50/60 Hz	

Technical Data

700-FSM Multi-Function High Performance Timing Relays

Description	SPDT	
	Multi-time setting range 0.05 s...60 h	SPDT
<p>Multi-function timing relays 700-FSM3U includes 10 setting functions:</p> <p>(A) - On-delay                      (B) - Off-delay                      (C) - On- and off-delay                      (D) - One shot                      (E) - Fleeting off-delay                      (F) - Flasher (repeat cycle starts with pulse)                      (I) - On-delay pulse generator                      (L) - Pulse converter                      (On) - ON-Function *                      (Off) - OFF-Function *</p> <p>* (for installation and maintenance)</p>		<p>(1s) 0.05...1 s                      (3s) 0.15...3 s                      (10s) 0.5...10 s                      (1mn) 0.05...1 min                      (3mn) 0.15...3 min                      (10mn) 0.5...10 min                      (1h) 0.05...1 h                      (3h) 0.15...3 h                      (10h) 0.5...10 h                      (60h) 3...60 h</p>
<p>NOTE: Switch ⊗ is on SPDT relays only. When switch ⊗ is down, one contact is instantaneous and one is timed. When switch is up, both contacts are timed.</p>	<p>Supply voltages (A1/A2)</p> <p>U23 24...48 VDC; 24...240 VAC, 50/60 Hz                      Z12 12 VDC</p>	<p>Cat. No.</p> <p>700-FSM3UU23                      700-FSM3UZ12</p>

700-FS Single Function High Performance Timing Relays

Description	SPDT	DPDT
	available mono-time ranges	Multi-time setting ranges
<p>22.5 mm Timing Relays</p>  <p>Supply voltages (A1/A2)</p> <p>Z12 12 VDC                      U23 24...48 VDC                      24...240 VAC, 50/60 Hz</p>	<p>Complete the Cat. No. with the corresponding identification ⊙ from the table on the next page.</p> <p>NOTE: Only the 700-FSA and 700-FSB are available with the "U" multi-time setting ranges (0.05s to 60h).</p>	<p>0.05 s...60 h</p> <p>(1s) 0.05...1 s                      (3s) 0.15...3 s                      (10s) 0.5...10 s                      (1mn) 0.05...1 min                      (3mn) 0.15...3 min                      (10mn) 0.5...10 min                      (1h) 0.05...1 h                      (3h) 0.15...3 h                      (10h) 0.5...10 h                      (60h) 3...60 h</p>
See 700-FS Timing Charts	Cat. No.	Cat. No.
<p>(A) On-delay                      The output contact changes state after the time delay is completed.</p>	<p>700-FSA3CU23                      700-FSA3FU23                      700-FSA3UU23                      700-FSA3U23                      700-FSA3⊙U23</p>	<p>700-FSA4UU23                      700-FSA4UZ12</p>
<p>(B) Off-delay                      Input power must be supplied to terminal (A1/A2) continuously. The output contact changes state when switch "S" is closed. When switch "S" is opened, the time delay begins. After the time delay is completed, the contact returns to shelf state.</p>	<p>700-FSB3CU23                      700-FSB3FU23                      700-FSB3UU23                      700-FSB3⊙Z12                      700-FSB3⊙U23</p>	<p>700-FSB4UU23                      700-FSB4UZ12</p>
<p>(C) On- and off-delay                      Input power must be supplied to terminal (A1/A2) continuously. The output contact changes state when switch "S" is closed and the time delay complete. When switch "S" is opened, the time delay begins again. After the time delay is completed, the contact returns to shelf state.</p>	<p>700-FSC3KU23                      700-FSC3LU23                      700-FSC3⊙Z12                      700-FSC3⊙U23</p>	—
<p>(D) One shot                      The output contact changes state when the relay is energized. The output contact returns to shelf state when the time delay is completed.</p>	<p>700-FSD3KU23                      700-FSD3LU23                      700-FSD3⊙Z12                      700-FSD3⊙U23</p>	—
<p>(E) Fleeting off-delay (Min. Pulse AC 50ms – DC 30ms)                      Input power must be supplied to terminal (A1/A2) continuously. The output contact changes state after closing and opening switch "S". After the time delay is completed, the contact returns to shelf state.</p>	<p>700-FSE3KU23                      700-FSE3LU23                      700-FSE3⊙Z12                      700-FSE3⊙U23</p>	—
<p>(F) Flasher (Repeat Cycle Starting with Pulse)                      The output contact changes state when power is applied. At the end of the time delay, the output contact returns to shelf state. This cycle continues until the power is removed.</p>	<p>700-FSF3KU23                      700-FSF3LU23                      700-FSF3⊙Z12                      700-FSF3⊙U23</p>	—

## GENERAL ACCESSORIES

### **Temperature Control**

Options are available to provide an optimal environment for your controls. Options include louvers, filter fans, heat exchangers, air conditioners, and electric heaters.

### **Floor Stand Kits**

Field or factory installation available on single door enclosures.

### **Drip Shield Kits**

Field or factory installation available on single or double door enclosures.

### **Electrical Interlocks**

Internal safety lockout while the enclosure contents are energized.

### **Corrosion Inhibitors**

Protect interior components from corrosion.

### **Hole Seals**

Used to seal extra conduit openings, pushbutton holes, or cutouts against dust, dirt, oil, and water.

### **Folding Shelves**

Can be used to support instruments and test equipment.

### **Terminal Kit Assemblies**

Provides an easy method to mount terminal blocks.

### **Pedestals**

Provides floor mounting for small to medium size enclosures.

### **Safety Lockouts**

Protect personnel and equipment by enabling multiple padlocks to be installed on a de-energized switch.

### **Touch-Up Paint**

Used to repair the finish of enclosures and panels.

### **Enclosure Stabilizers**

Provides stability to floor mounted enclosures which are not bolted to the floor.

### **Window Kits**

Available for many types of Hoffman enclosures.

### **Data Pocket Kits**

Convenient place for documentation.



Technical Data, Continued

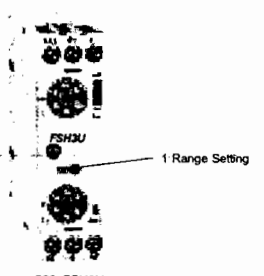
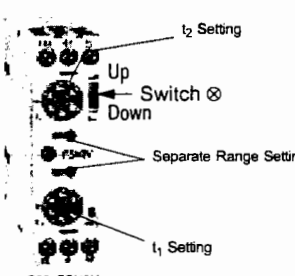
See 700-FS Timing Charts	SPDT	DPDT
	Cat. No.	Cat. No.
<b>(G) Flasher (Repeat Cycle Starting with Pause)</b> The output contact remains in the shelf state until the time delay is completed. When the time delay is completed, the contact changes state. This cycle continues until the power is removed.	700-FSG3KU23 700-FSG3LU23 700-FSG3○Z12 700-FSG3○U23	-
<b>(I) On-delay pulse generator</b> The output contact changes state when the time delay is completed. After 0.5s the contact opens.	700-FSI3KU23 700-FSI3LU23 700-FSI3○Z12 700-FSI3○U23	-
<b>(J) On-delay (pulse controlled) (Min. Pulse AC 50ms – DC 30ms)</b> Input power must be supplied to terminal (A1/A2) continuously. When switch "S" is closed, the time delay begins. The output contact changes state at the end of the time delay. The output contact returns to shelf state when the power to (A1/A2) is removed.	700-FSJ3KU23 700-FSJ3LU23 700-FSJ3○Z12 700-FSJ3○U23	-
<b>(K) One shot / watch dog (pulse controlled) (Min. Pulse AC 50ms – DC 30ms)</b> Input power must be supplied to terminal (A1/A2) continuously. When switch "S" is closed, the output contact changes state. The output contact will open when switch "S" is open for longer than the time setting.	700-FSK3KU23 700-FSK3LU23 700-FSK3○Z12 700-FSK3○U23	-
<b>(L) Pulse converter (Min. Pulse AC 50ms – DC 30ms)</b> Input power must be supplied to terminal (A1/A2) continuously. When switch "S" is closed, the output contact changes state. When the time delay is completed, the output contact returns to shelf state. The time "T" is not influenced by the duration of the control pulse.	700-FSL3KU23 700-FSL3LU23 700-FSL3○Z12 700-FSL3○U23	-

○ Mono-Time Ranges

Complete the Cat. No. with mono-time range identification

Time ranges	0.05...1 s	0.15...3 s	0.5...10 s	1.5...30 s	0.05...1 min	0.15...3 min	
○	A	B	C	D	E	F	
Time ranges	0.5...10 min	1.5...30 min	0.05...1 h	0.15...3 h	0.5...10 h	3.0...60 h	0.05 s...60 h
○	G	H	I	J	K	L	U



700-FSH Special Function Flasher (repeat cycle starting with pulse or pause) Timing Relays

Description		SPDT
 <p>700-FSH3U</p>	 <p>700-FSH3V</p>	<p><b>Multi-time setting ranges</b></p> <p>U 0.05s...60 h (1 Range Setting)</p> <p>V 0.05s...60 h (2 Range Settings)</p> <p>(1s) 0.05...1 s</p> <p>(3s) 0.15...3 s</p> <p>(10s) 0.5...10 s</p> <p>(1mn) 0.05...1 min</p> <p>(3mn) 0.15...3 min</p> <p>(10mn) 0.5...10 min</p> <p>(1h) 0.05...1 h</p> <p>(3h) 0.15...3 h</p> <p>(10h) 0.5...10 h</p> <p>(60h) 3...60 h</p>
<p><b>Supply voltages (A1/A2)</b></p> <p>Z12 12 VDC</p> <p>U23 24...48 VDC</p> <p>24...240 VAC, 50/60 Hz</p>		
See 700-FS Timing Charts		Cat. No.
<p><b>(H) Flasher (repeat cycle starting with pulse or pause)</b> The repeat cycle timer permits different settings for on and off times. The following operating modes are possible:</p> <ul style="list-style-type: none"> <li>- Oscillating mode; repeat cycle starts with voltage applied at A1 and B1, and continues to repeat until voltage is off.</li> <li>- One cycle mode; started by energizing B1 with voltage on A1 and A2.</li> <li>- Output starts with pulse or pause (switch ⊗ Up or Down).</li> <li>- 700-FSH3U provides (1) range setting for t<sub>1</sub> and t<sub>2</sub>.</li> <li>- 700-FSH3V provides (2) range settings for t<sub>1</sub> and t<sub>2</sub>.</li> </ul>		<p>700-FSH3UU23</p> <p>700-FSH3VU23</p> <p>700-FSH3UZ12</p> <p>700-FSH3VZ12</p>
Supply voltage controlled, Oscillating Mode starting with pause – Switch ⊗ is Up		
Supply voltage controlled, Oscillating Mode starting with pulse – Switch ⊗ is Down		
Pulse controlled, output starts with pulse (Min. Pulse AC 50ms – DC 30ms) – Switch ⊗ is Up		
Pulse controlled, output starts with pulse (Min. Pulse AC 50ms – DC 30ms) – Switch ⊗ is Down		



NOTE: If B1 is pulsed, a one full time cycle consisting of t<sub>1</sub> and t<sub>2</sub> is completed.

## Technical Data, Continued

### 700-FSQ Special Function Off-Delay without Supply Voltage Timing Relays

Description	 SPDT	 DPDT
<b>Supply voltages (A1/A2)</b> U18 24...240 V AC 50/60 Hz 24...240 V DC	<b>Multi-time setting range, Q 0.15 s...10 min</b> (2.5s) 0.15...2.5 s (10s) 0.5...10 s (80s) 4...80 s (10mn) 0.5...10 min	
See 700-FS Timing Charts	<b>Cat. No.</b>	<b>Cat. No.</b>
<b>(Q) Off-delay without supply voltage (true off-delay)</b> When the input power is turned on, the output contact changes state. When the power is removed, the time delay begins. The output contact returns to shelf state at the end of the time delay.	700-FSQ3QU18	700-FSQ4QU18

### 700-FSY Special Function Star Delta Timing Relays

Description	 2 NO
	<b>Available mono-time ranges</b> Complete the Cat. No. with the corresponding identification ○ from the table below.
<b>Supply voltages (A1/A2)</b> U23 24...48 VDC 24...240 VAC, 50/60 Hz	<b>Cat. No.</b>
<b>(Y) Star-delta timing relay</b> When power is applied, the output contact 17/18(Y) changes state. After the time setting, the output contact 17/18(Y) returns to shelf state. After the fixed time (50 to 60 ms), the output contact 17/28Δ changes state. Both output contacts return to shelf state whenever the power is removed.	700-FSY2DU23 700-FSY2○U23

#### ○ Mono-Time Ranges

Complete the Cat. No. with mono-time range identification. For 700-FSY relays only.

Time ranges	0.5...10 s	1.5...30 s	0.05...1 min	0.15...3 min	0.5...10 min
○	C	D	E	F	G

## Specifications

#### Time characteristics (according to VDE 0435, Part 2021)

Setting accuracy	± 5% of full scale
Repeatability	± 0.2% of the setting values
Tolerance	voltage: ± 0.001%/°ΔU temperature: ± 0.025%/°C

#### Supply

Supply voltages	24...48 VDC and 24...240VAC, 50/60 Hz (dual voltage)
Voltage tolerance	-20% to +20% (DC), -15% to +10% (AC)
Power consumption	0.5 W at 24 VDC, 5 VA at 240 VAC
Time energized	100%
Reset time	50 ms
Voltage isolation	≤ 20 ms without reset (supply voltage)
Cable length - (supply voltage control)	max. 250 m (800 ft)

#### Pulse control (B1)

Pulse duration	≥ 50 ms (AC), ≥ 30 ms (DC)
Input voltage	Supply voltage range
Input current	1 mA
Cable length	max. 250 m (800 ft) without parallel load between B1 and A2 max. 50 m (160 ft) with load (< 3 kΩ) between B1 and A2

## Specifications, Continued

### Outputs

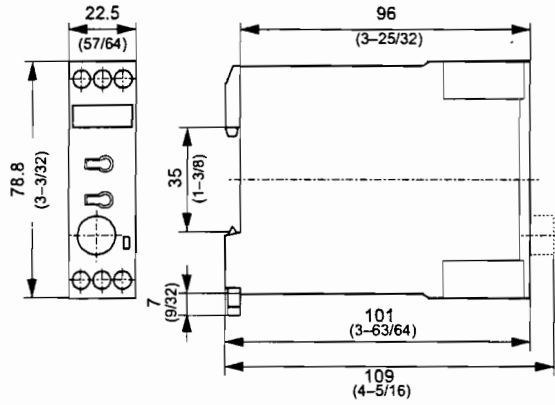
Contact type	Relay as changeover switch		
Switching capacity	Voltage: 440 VAC according to IEC 947-5-1: 3 A/440 VAC (inductive load, AC 14) 1 A/24 VDC (inductive load, DC 13) according to UL 508: 1.5 A/250 VAC (B300)	Current $I_{th}$ : 8 A  3 A/250 VAC (inductive load, AC 15)  3 A/120 VAC (B300)	Power: 2000 VA
Short-circuit protection	10 A gL (Fast Blow Fuse)		
Life	mechanical: 30 Mil. of operations electrical operations: 4 Mil. at 1 A/250 VAC, $\cos \varphi = 1$ 1.5 Mil. at 1 A/250 VAC, $\cos \varphi = 0.3$ 0.5 Mil. at 6 A/24 VDC, resistive 2 Mil. at 0.2 A/230 VDC, resistive 1 Mil. at 0.2 A/110 VDC, L/R = 20 ms		
State indicator	1 LED, combination signal		
Setting accuracy	$\pm 5\%$ of full scale		

### General Data

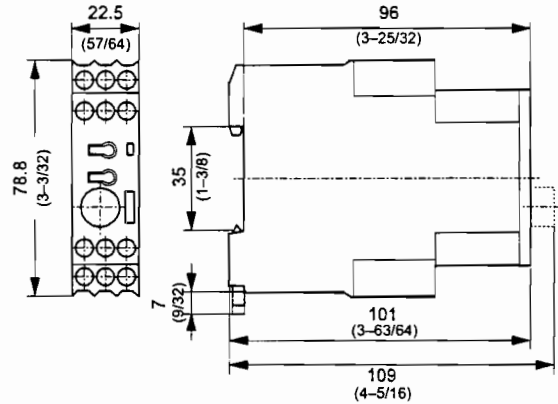
Insulation characteristics	2 kVAC/50 Hz test voltage according to VDE 0435 and 6 kV 1.2/50 $\mu$ s surge voltage according to IEC 947-1 between all inputs and outputs
EMC/Interference immunity	Performance of following requirements: Surge capacity of the supply voltage according to IEC 1000-4-5: 4 kV 1.2/50 $\mu$ s Burst according to IEC 1000-4-4: 6 kV 6/50 ns ESD discharge according to IEC 1000-4-2: Contact 8 kV, air 8 kV Electromagnetical HF field according to IEC 801-3 and conducted electromagnetical HF signal according to IEC 801-6: Level 3
EMC/Emission	Electromagnetical fields according to EN 55 022: class B
Safe isolation	according to VDE 106, part 101
Climatic withstand	56 Cycles (24 h) at 25...40°C and 95% rel. humidity according to IEC 68-2-30 and IEC 68-2-3
Vibration resistance	4 g in 3 axis at 10...500 Hz, test FC according to IEC 68-2-6
Shock resistance	50 g according to IEC 68-2-27
Protection class	Enclosure: IP 40 IP 30 (Single-function) Terminal: IP 20 according to IEC 947-1
Weight	100 g
Approval	UL, C-UL, Germanischer Lloyd, CE Certified
Ambient temperature	Open: -25°C ... +60°C Enclosed: -25°C ... +45°C Storage: -40°C ... +85°C
Terminals	Screw terminal M3.5 for Posidrive Number.2, Philips and slotted screws Number.2. suitable for power screwdriver. Rated tightening torque 8.8 LB-IN 0.8 Nm (max. 1.2 Nm) Dual-chamber system for terminal cross-sections of 1 x 0.5 mm <sup>2</sup> ... 2 x 2.5 mm <sup>2</sup> (solid) or stranded 2 x 2.5 mm <sup>2</sup> (flexible with sleeve), AWG 20 to 14. Finger protection according to VDE 0106
Mounting	Front mounting; For snap-on mounting on DIN rail 35 mm or screw fixing by adapter and 2 screws M4
Disposal	Synthetic material without dioxin according to EC/EFTA notification Number. 93/0141/D - electrical contacts with cadmium

### Approximate Dimensions

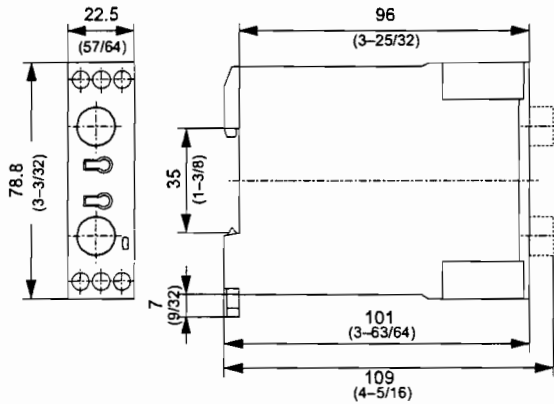
Dimensions are shown in millimeters (inches).  
 Dimensions are not intended to be used for  
 manufacturing purposes.



700-FS (1 C/O)

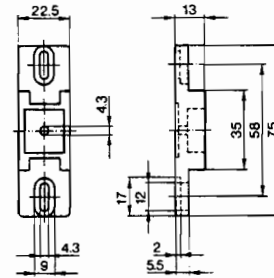


700-FS (2 C/O)



700-FSH3V...

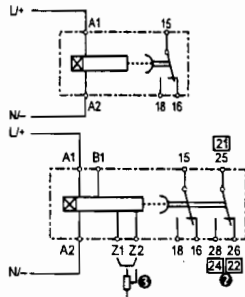
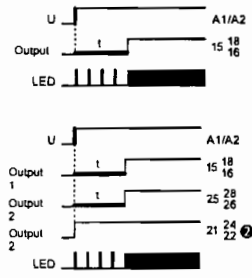
For panel mounting, Use the 199-FSA Panel Mounting Adapter.



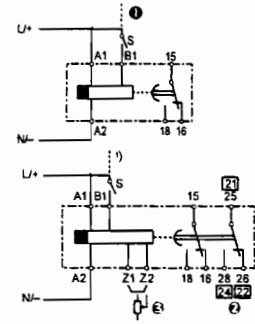
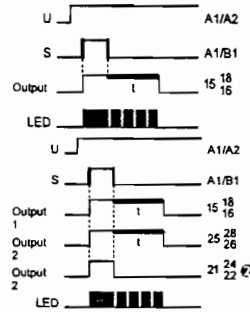
199-FSA

### Timing Charts, Single Function

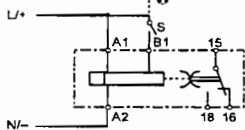
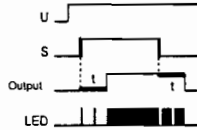
(A) On-delay



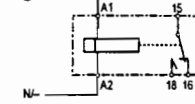
(B) Off-delay



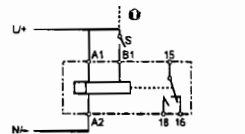
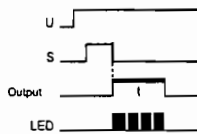
(C) On-and-Off-delay



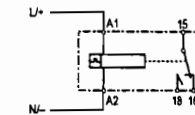
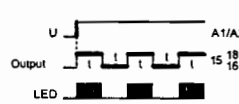
(D) One shot



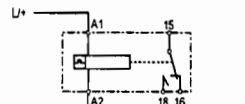
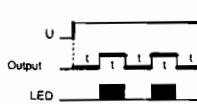
(E) Fleeting off-delay (Min. Pulse AC 50ms – DC 30ms)



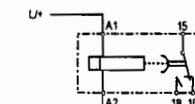
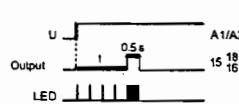
(F) Flasher (Repeat cycle starting with pulse)



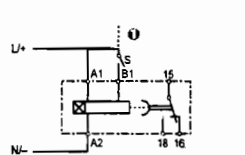
(G) Flasher (Repeat cycle starting with pause)



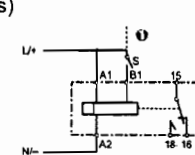
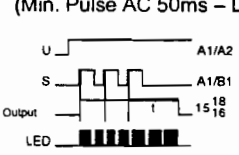
(I) On-delay pulse generator



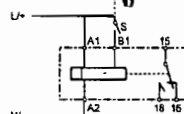
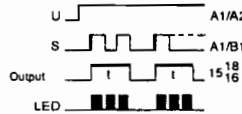
(J) On-delay (pulse controlled) (Min. Pulse AC 50ms – DC 30ms)



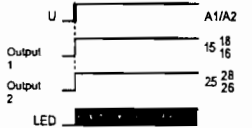
(K) One shot/watch dog (pulse controlled) (Min. Pulse AC 50ms – DC 30ms)



(L) Pulse converter



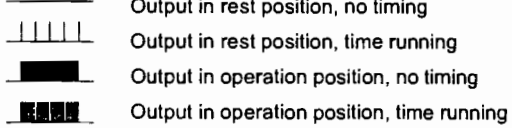
(On) ON-Function



(Off) OFF-Function



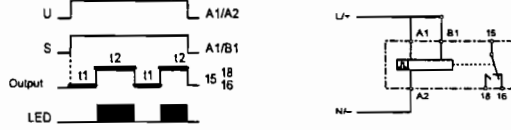
Cleverly designed function display LED (Green)



- ① A voltage other than the supply voltage can also be used at B1.
- ② Output 2, selectable as instantaneous contact with sliding switch (⊗) on front panel (instantaneous when switch is down, timed when switch is up).
- ③ Bridge or potentiometer 10 kΩ, min. 0.25 W (low voltage) for external time setting. Set timer dial to 0.0.

## Timing Charts, Special Function

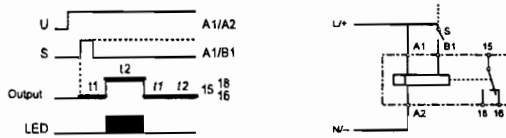
**(H) Flasher repeat cycle timer – Switch “X” is Up**  
 Supply voltage connected to A1 and B1.  
 Oscillating Mode starting with pause.



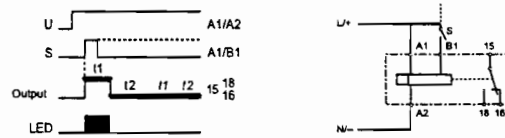
**(H) Flasher repeat cycle timer – Switch “X” is Down**  
 Supply voltage connected to A1 and B1.  
 Oscillating Mode starting with pulse.



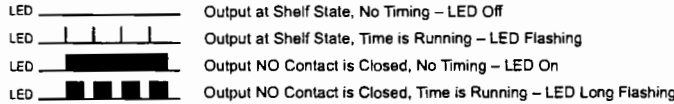
**(H) Flasher repeat cycle timer – Switch “X” is Up**  
 Pulse controlled, output starts with pause  
 (Min. Pulse AC 50ms – DC 30ms)  
 One Cycle Mode



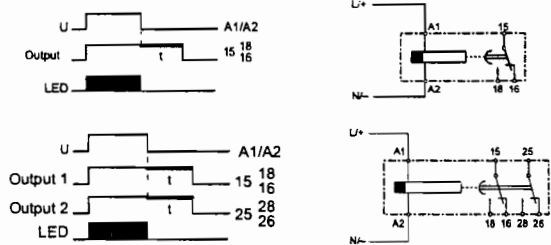
**(H) Flasher repeat cycle timer – Switch “X” is Down**  
 Pulse controlled, output starts with pulse  
 (Min. Pulse AC 50ms – DC 30ms)  
 One Cycle Mode



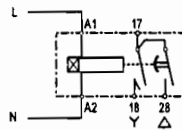
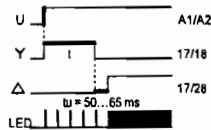
### LED Operation Chart – Green LED



### (Q) Off-delay without supply voltage (True Off-Delay)



### (Y) Star-Delta



2 NO with Common

### Wiring Connections

- 17 Common
- 18 Y
- 28 Δ

## Applications

Sequence	Description	Wiring Diagram
<b>On-Delay (A)</b> Switch (X) Down, (Contact 21-24/22) is Instantaneous 700-FSM DPDT Only Delayed Motor Starting	Pushing the Start Button energizes A1. After the time delay, Motor 1M will start	

## Applications, Continued

Sequence	Description	Wiring Diagram
<b>Flasher (Repeat Cycle Starting with Pause) (G)</b> Turning On an Alarm Horn After a Time Delay	When Limit Switch (1LS) closes, the Timer TR will be energized. The Horn will not sound until the time setting is completed.	
<b>On-Delay Pulse Generator (I)</b> Turning On or Off a Latching Contactor for Lighting	The Selector Switch will energize the daylight sensor. The Contact (1DL) closes due to darkness and the Timer (1TR) will time out, and then close contact 1TR to send a pulse (0.5s) to the Latching Contactor to turn on the lights. When daylight comes, the switch 1DL will switch back and energize 2TR after a time delay. The 2TR contact will pulse closed (0.5s) to reset the lighting contactor. If the signals to 1DL are short, the 1TR and 2TR contacts will not pulse.	
<b>On-Delay (Pulse Controlled) (J)</b> Pulse Starts The On-Delay that Turns On a Motor	A1 and A2 must be energized continuously. A pulse or input from the "ON" Pressure Switch starts the On-Delay. After the delay is complete, the Motor 1M will start. A signal from the "Reset" Pressure Switch turns the Motor 1M off. The delay prevents short off times.	
<b>One Shot/Watch Dog (Pulse Controlled) (K)</b> Conveyor Keeps Running Only As Long As a Package is Sensed Every Time Setting (5 Min)	A1 and A2 must be energized continuously. A pulse must be received every time setting (or sooner) to maintain the Motor 1M running. This could be an energy saver, because the Motor 1M will turn off if the Photo SW is open for a period of time.	

### Applications, Continued

Sequence	Description	Wiring Diagram
<b>Pulse Converter (L)</b> Pulses Are Turned Into a Set or Predetermined Output	When the Photo Switch closes the first time, the contact TR closes to energize Motor 1M for the predetermined time setting. The timer will not be reset by the opening or pulsing of the Photo SW until the time delay is completed. Time setting is 0.05s to 10h.	
<b>Off-Delay Without Supply Voltage (Q) (True Off-Delay)</b>	A1 and A2 do not require continuous power for the off-delay time setting to be completed. Turning the switch to On will energize Motor 1M. When the switch is turned to Off, or the power is removed, Motor 1M will remain on for the time delay setting	
<b>Star-Delta (Y)</b> Starting a Star-Delta Motor	Pushing the Start Button energizes the relay CR and the timer TR. Both will hold in through CR. Contact 17-18 will close energizing the Star Contact (Y), and starting the motor for the predetermined time. Then contact 17-18 will open and 50ms to 65ms later contact 17-28 will close to energize the Delta Contact (Δ).	



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## Applications, Continued

Sequence	Description	Wiring Diagram
<p><b>Pulse Converter (L)</b> Pulses Are Turned Into a Set or Predetermined Output</p>	<p>When the Photo Switch closes the first time, the contact TR closes to energize Motor 1M for the predetermined time setting. The timer will not be reset by the opening or pulsing of the Photo SW until the time delay is completed. Time setting is 0.05s to 10h.</p>	
<p><b>Off-Delay Without Supply Voltage (Q)</b> (True Off-Delay)</p>	<p>A1 and A2 do not require continuous power for the off-delay time setting to be completed. Turning the switch to On will energize Motor 1M. When the switch is turned to Off, or the power is removed, Motor 1M will remain on for the time delay setting.</p>	
<p><b>Star-Delta (Y)</b> Starting a Star-Delta Motor</p>	<p>Pushing the Start Button energizes the relay CR and the timer TR. Both will hold in through CR. Contact 17-18 will close energizing the Star Contact (Y), and starting the motor for the predetermined time. Then contact 17-18 will open and 50ms to 65ms later contact 17-28 will close to energize the Delta Contact (Δ).</p>	



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Publication 700-2.17 April 1998

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## SECTION 9

# SYSTEM DRAWINGS



- LEGEND**
- 1. 1" PUMP
  - 2. 2" PUMP
  - 3. 3" PUMP
  - 4. 4" PUMP
  - 5. 5" PUMP
  - 6. 6" PUMP
  - 7. 7" PUMP
  - 8. 8" PUMP
  - 9. 9" PUMP
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  - 99. 99" PUMP
  - 100. 100" PUMP

**BISCO Environmental**

SVE & GROUNDWATER TREATMENT SKIDS  
PROCESS & INSTRUMENTATION DIAGRAM

DATE: 11/2/04  
SCALE: AS SHOWN  
PROJECT: 11757(MP-01)

1 2 3 4 5 6 7 8

D C B A

D C B A

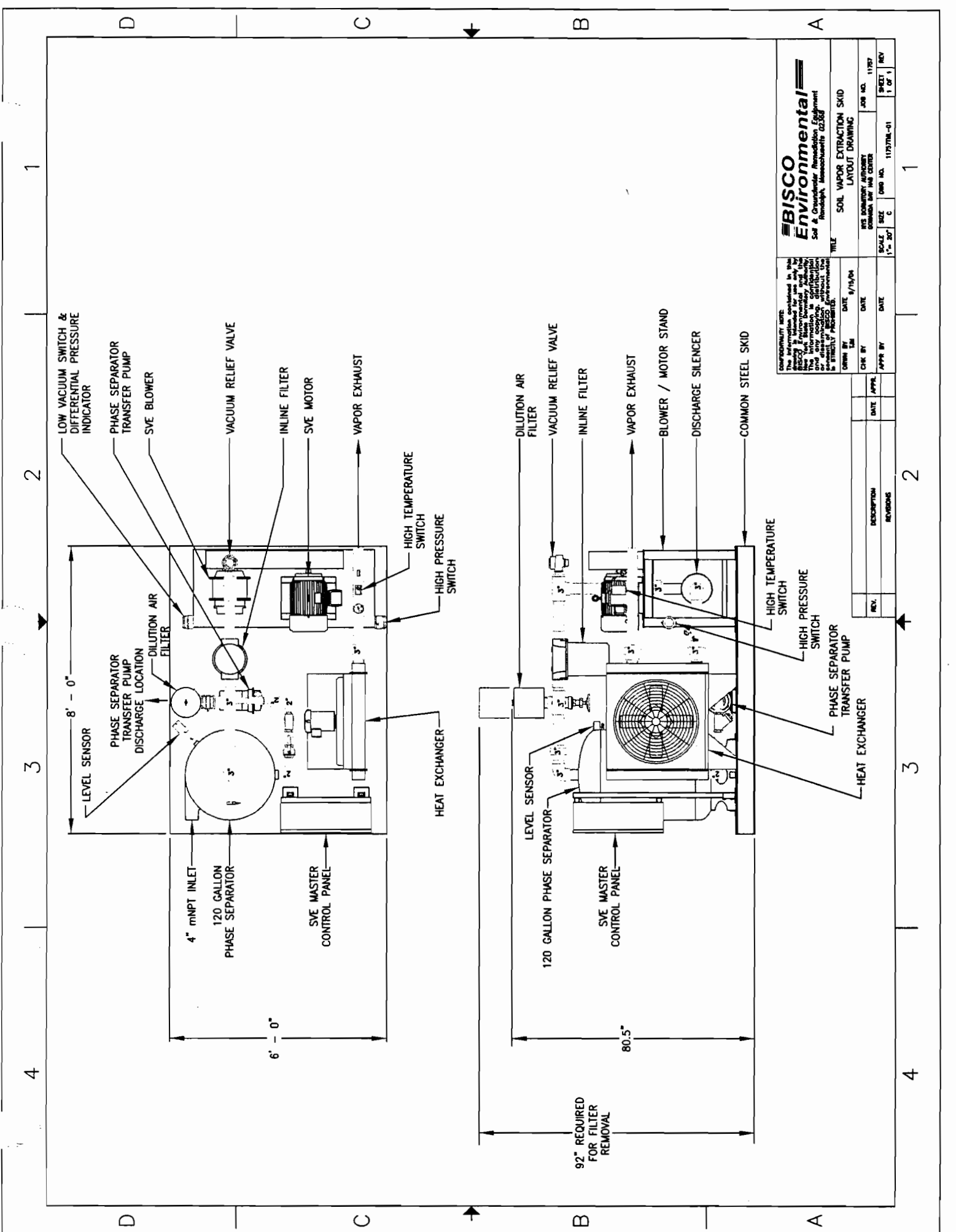
<b>INTERLOCK SCHEDULE - Groundwater Treatment System</b>	
<b>DESIGNATION</b>	<b>FUNCTION</b>
LSHH-301	TP-301 OFF, SV-601 CLOSED, B-501 OFF W/ 30 MIN DELAY
LSH-301	TP-301 ON
LSL-301	TP-301 OFF
PSH-401	TP-301 OFF, SV-601 CLOSED, B-501 OFF W/ 30 MIN DELAY
PSH-501	TP-301 OFF, SV-601 CLOSED, B-501 OFF W/ 30 MIN DELAY
PSL-501	TP-301 OFF, SV-601 CLOSED, B-501 OFF
LSHH-501	TP-301 OFF, SV-601 CLOSED, B-501 OFF W/ 30 MIN DELAY
LSH-501	TP-501 ON
LSL-501	TP-501 OFF
EMERGENCY STOP	TP-301 OFF, B-501 OFF, TP-501 OFF, SV-601 CLOSE
NOTES	PSL-501 WILL HAVE A 10 SEC TIME DELAY

<b>INTERLOCK SCHEDULE - Soil Vapor Extraction System</b>	
<b>DESIGNATION</b>	<b>FUNCTION</b>
LSHH-101	B-101 OFF, HE-201 OFF
LSH-101	TP-101 ON
LSL-101	TP-101 OFF
VSL-101	B-101 OFF, HE-201 OFF
PSH-101	B-101 OFF, HE-201 OFF
TSH-201	B-101 OFF, HE-201 OFF
GWT ALARM	TP-101 OFF
EMERGENCY STOP	B-101 OFF, HE-201 OFF, TP-101 OFF
NOTES	VSL-101 WILL HAVE A 10 SEC TIME DELAY

**INTERLOCK SCHEDULE - Soil Vapor Extraction System**

<b>DESIGNATION</b>	<b>FUNCTION</b>
LSHH-101	B-101 OFF, HE-201 OFF
LSH-101	TP-101 ON
LSL-101	TP-101 OFF
VSL-101	B-101 OFF, HE-201 OFF
PSH-101	B-101 OFF, HE-201 OFF
TSH-201	B-101 OFF, HE-201 OFF
GWT ALARM	TP-101 OFF
EMERGENCY STOP	B-101 OFF, HE-201 OFF, TP-101 OFF
NOTES	VSL-101 WILL HAVE A 10 SEC TIME DELAY

<b>INTERLOCK SCHEDULE - Groundwater Treatment System</b>	
<b>DESIGNATION</b>	<b>FUNCTION</b>
LSHH-301	TP-301 OFF, SV-601 CLOSED, B-501 OFF W/ 30 MIN DELAY
LSH-301	TP-301 ON
LSL-301	TP-301 OFF
PSH-401	TP-301 OFF, SV-601 CLOSED, B-501 OFF W/ 30 MIN DELAY
PSH-501	TP-301 OFF, SV-601 CLOSED, B-501 OFF W/ 30 MIN DELAY
PSL-501	TP-301 OFF, SV-601 CLOSED, B-501 OFF
LSHH-501	TP-301 OFF, SV-601 CLOSED, B-501 OFF W/ 30 MIN DELAY
LSH-501	TP-501 ON
LSL-501	TP-501 OFF
EMERGENCY STOP	TP-301 OFF, B-501 OFF, TP-501 OFF, SV-601 CLOSE
NOTES	PSL-501 WILL HAVE A 10 SEC TIME DELAY



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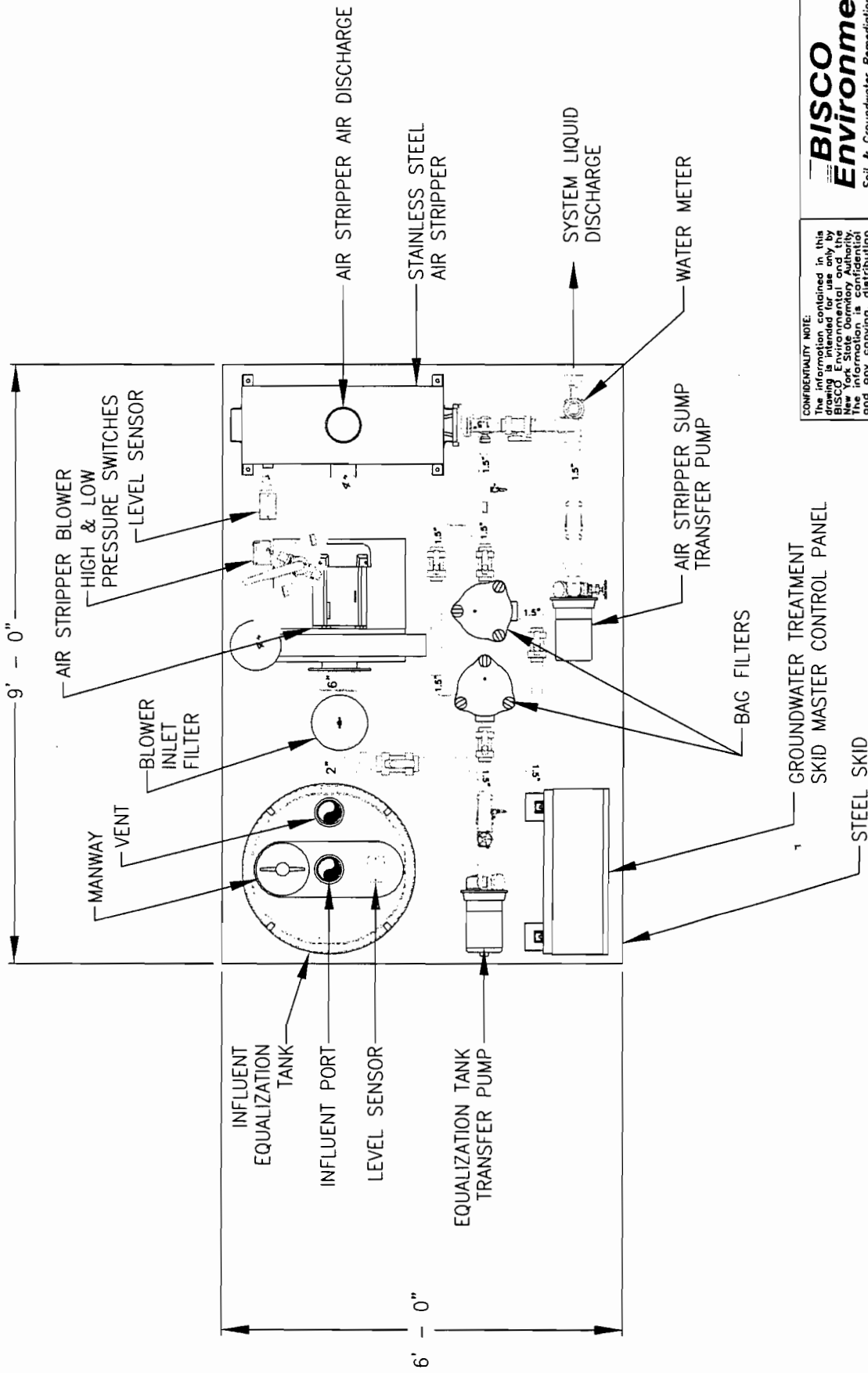
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 JOB NO. 11757  
 SHEET 1 OF 1

DATE	DESCRIPTION	REVISIONS

DATE	APPL	DATE	CHK BY	DATE	APPV BY

DATE: 8/15/04  
 JOB NO. 11757  
 SHEET 1 OF 1





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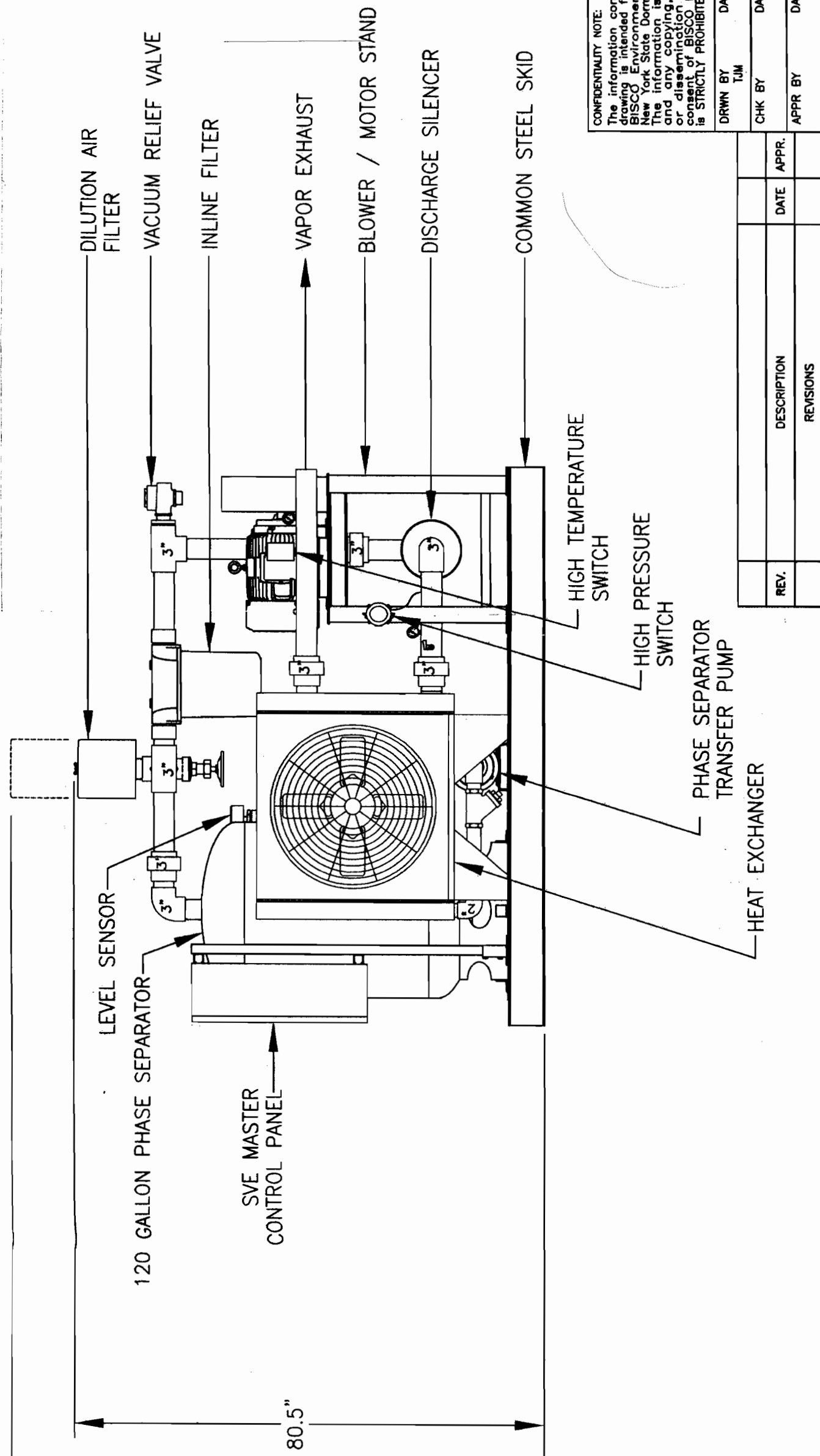
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TITLE: GROUNDWATER TREATMENT SKID STRUCTURAL LAYOUT  
 JOB NO. 11757  
 NYS DORMITORY AUTHORITY  
 GOWANDA DAY HUB CENTER

SCALE: 1"=20"  
 SIZE: B  
 DWG NO.: 11757TML-02  
 SHEET: 1 OF 1  
 REV: 1

REV.	DESCRIPTION	DATE	APPR.

DRWN BY: TJM DATE: 9/14/04  
 CHK BY: DATE: DATE: DATE:  
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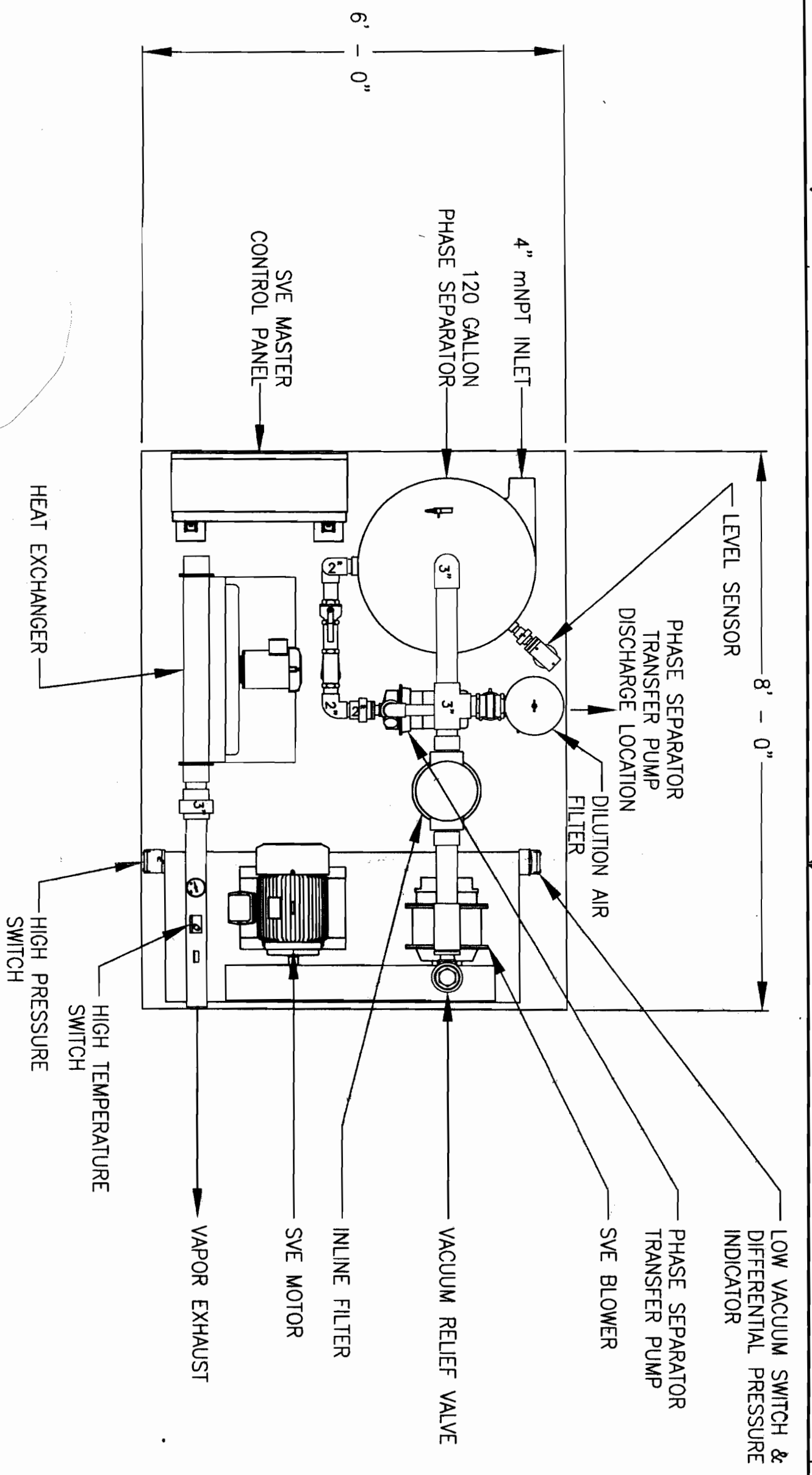
JOB NO.: 11757

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SHEET 1 OF 1

REV.	DESCRIPTION	DATE	APPR.

REV.	DESCRIPTION	DATE	APPR.



PATCH  
 LINE