

Dexter Chemical
BRONX, NEW YORK

Site Management Plan

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Appendix 6

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**OM & M MANUAL
VOLUME I**

**DEXTER CHEMICAL LLC
845 EDGEWATER ROAD
BRONX, NEW YORK**

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1. Monitoring Equipment PID Manual
2. As-Built Treatment System Components and Operation & Maintenance Manual

SYSTEM OM & M MANUAL

**DEXTER CHEMICAL LLC
845 EDGEWATER ROAD
BRONX, NEW YORK**

1.0 INTRODUCTION

Dexter Chemical LLC (Dexter) is submitting this revised operation, maintenance and monitoring (OM&M) manual, Volumes I, II, III and IV, under the December 4, 2003 Voluntary Cleanup Program Agreement (VCA) between Dexter and the New York State Department of Conservation (NYSDEC). This revised OM&M manual is being submitted in accordance with the February 2004 Remedial Action Work Plan (RAW) for the site originally approved by NYSDEC on November 3, 2005. This revised OM&M Manual covers the originally approved system and enhanced groundwater extraction and treatment capability, approved by NYSDEC. **Figure 1** shows the site location on the United States Geological Survey (USGS) Central Park, New York quadrangle.

This revised OM&M manual presents a scope of work to implement operations, maintenance and monitoring activities for the approved/enhanced air sparging and soil vapor extraction (AS/SVE) remedy for Area A and Area I at the site. A site map showing the approximate treatment area location is provided as **Figure 2**. An AS/SVE pilot test conducted in Area A in June 2004 indicated that AS/SVE was a viable remedial option for the site. Additional enhancements to the system, including, primarily dewatering, were described in the July 7, 2006 (Progress Report #9) report submission to NYSDEC. The NYSDEC case manager subsequently approved these enhancements. This OM&M Plan has been completed in accordance with the requirements of section 6.2 of the Technical Guidance for Site Investigation and Remediation (DER-10).

2.0 SITE DESCRIPTION

The site is located at 819-845 Edgewater Road and 810-842 Whittier Street, Bronx, New York. The facility consists of six (6) buildings formerly owned by Dexter Chemical Corporation on approximately two (2) acres. The property is located in an industrial/manufacturing district of Hunts Point, Bronx, New York. Industrial facilities are located north and south of the property. A scrap metal yard is located to the east (across Edgewater road) and residential apartments and a sheet metal company are located west of the subject property, across Whittier Street.

The site is located on a flat coastal peninsula. The estimated elevation is between 20 and 25 feet above mean sea level. The nearest surface water body is the Bronx River, located approximately 1,000 feet east of the site. Ground water was encountered between 2 (area A) to 12 feet (Area I) below grade, across the site.

The regional geology in the vicinity of the site is of the Paleozoic Era, Ordovician System, consisting of shale and limestone stratified sequences and the Manhattan Formation, with undivided pelitic schists and amphibolite.

The soil encountered at the site through sampling activities generally consists of fill material historically placed to raise the topographic elevation of the property to its current grade. The fill material included silty soil, some sand and clay, cinders, coal fragments, gravel and debris (concrete, glass, wood, and brick fragments). This material can be classified as historic fill which contains Polynuclear Aromatic Hydrocarbons (PAHs) (i.e. Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene) and Priority Pollutant Metals (PPM). A distinct organic layer described as meadow mat by the field geologists was encountered at approximately 13 to 16 feet. This layer is indicative of native soil for the area.

3.0 SITE REMEDIAL ACTION

3.1 Description of Remedial Action

As described in the Whitman Remedial Action Workplan, and supplemental Progress Report #9, a joint Groundwater (dewatering) extraction/Air Sparge/Soil Vapor Extraction (AS/SVE) system will be used to remediate soils and groundwater in both Area A and Area I.

3.1.1 Area A Design

An area plan illustrating the as-built layout of the air sparging, vapor extraction and dewatering points (recovery wells (RW)) and piping is provided as **Figure 4** (Area A) and **Figure 5** (Area I). The as-built SVE/RW well head and construction detail is provided as **Figure 6**. The as-built air sparge well head and construction detail is provided as **Figure 7**.

Due to the shallow water table in Area A, (approximately 4 feet below grade) the treatment system consists of twelve horizontal SVE laterals HRZ-1A through HRZ-12A installed above the water table. These laterals consist of two inch screened schedule 40 PVC of various lengths (8 to 30 feet long) and configurations (as shown on **Figure 4**). Each horizontal SVE lateral is then

individually piped and connected to solid PVC piping run underground to the manifold area in the northwest portion of the building (see **Figure 4** for manifold area location). Each individual above ground riser from each horizontal SVE lateral is manifolded to a main trunk line which runs to the treatment shed SVE blowers (for vapor phase treatment of extracted vapors). Each riser from each horizontal lateral contains a vacuum gauge, air flow/vacuum control valve and sampling port to allow individual adjustment, operation and monitoring. Each individual riser from each horizontal SVE lateral at the manifold contains a subgrade condensate trap (condensate trap as-built construction detail provided as **Figure 8**) to allow for the removal of moisture buildup within the SVE piping, which could otherwise reduce effective horizontal lateral performance. The

Area A includes three shallow six-inch diameter screened PVC sumps (Sump 1 through Sump 3) installed to depths of approximately four feet below grade designed to dewater the horizontal trenches (where the horizontal SVE laterals and subsurface system piping is located) to prevent groundwater buildup which could otherwise reduce effective horizontal SVE lateral performance. Each sump contains a sealed pitless adapter connected to a subsurface water line to allow dewatering. The subsurface water lines from each sump are individually piped and connected to solid PVC piping run underground to the manifold area. Each individual above ground riser is then manifolded to a main trunk line which runs to the treatment shed storage tank (to allow treatment of the dewatered groundwater). Each riser from each sump line contains a pressure gauge, flow control valve and sampling port to allow individual adjustment, operation and monitoring. Submersible ½ hp electric Grundfos pumps are installed in each sump to conduct dewatering. The pumps operate using automatic float controls installed within each sump. If the high water level float is tripped within the sump (increased groundwater level in sump), the pump turns on. Once the pump in each sump dewateres the area, the water level drops, the low level float is tripped, and the pump turns off.

Area A also includes eight four-inch diameter screened PVC dual phase recovery (dewatering and SVE) vertical wells (SVE/RW-1A through SVE/RW-8A) installed to total depths of approximately 14.5-17 feet below grade, each with 10 feet of screen (see **Figure 4** for locations). These vertical SVE wells are designed to supplement SVE capture of sparge air and

increase removal of subsurface vapors at depth following dewatering of the treatment areas. The dewatering wells are designed to dewater actively treated portions of Area A (as appropriate) to prevent elevated groundwater levels and mounding which could otherwise reduce effective horizontal lateral and vertical SVE performance (due to the potential for groundwater entrainment in the SVE piping).

Each dual phase extraction well contains a dedicated SVE line (which runs back to the manifold area) and a dedicated water line (installed via sealed pittless adapter connection to the well) which runs back to the manifold area. Each wellhead is sealed with a Campbell seal (an adjustable gripping gasket at the wellhead which seats around pump float and power control wiring) to maximize SVE vacuum seal. The subsurface water lines from each dewatering well are individually piped and connected to solid PVC piping run underground to the manifold area. Each individual above ground water line riser is then manifolded to a main trunk line which runs to the treatment shed storage tank (to allow treatment of the dewatered groundwater). Each riser from each water line contains a pressure gauge, flow control valve and sampling port to allow individual adjustment, operation and monitoring. Submersible ½ hp electric Grundfos pumps are installed in each dewatering well (as required depending on the portion of the area to be treated) to conduct dewatering. The pumps operate using automatic float controls installed within each well.

Each individual above ground riser from each vertical SVE well line is manifolded to a main trunk line which runs to the treatment shed SVE blowers (for vapor phase treatment of extracted vapors). Each riser from each vertical SVE well contains a vacuum gauge, air flow /vacuum control valve and sampling port to allow individual adjustment, operation and monitoring. Each individual riser from each vertical SVE well at the manifold contains a subgrade condensate trap to allow for the removal of moisture buildup within the SVE piping, which could otherwise reduce effective vertical SVE well performance.

Area A contains fifteen air sparge wells, (AS-1A through AS-15) as shown on **Figure 4**. The sparge wells are installed to depths of approximately 15 to 20 feet below grade, and constructed of schedule 40 PVC with 3 to 4 feet of screened interval at the bottom of each sparge well. Each sparge well is piped individually underground with ½ inch diameter pressure rated

Nylon-11 tubing which is run back to the manifold area. Each individual above ground air sparge riser is then manifolded to a main trunk line which runs to the treatment shed air sparge compressor (which is the source of sparge air injection into each sparge well). Each riser from each sparge line contains a pressure gauge, flow control valve, air flow gauge, pressure regulator and check valve (to prevent sparge air and groundwater blow-back on shutdown) to allow individual adjustment, operation and monitoring.

Testing and monitoring of the system operation in Area A following the initiation of startup (May 2009) has resulted in the following nominal operation:

1. SVE radius of influence performance, operation, capture of sparge air and maximum vapor removal is optimized at vacuum levels that result during treatment of approximately $\frac{1}{2}$ of Area A (and approximately $\frac{1}{2}$ of the treatment points, accordingly) at a time. That is, approximately five to six horizontal SVE laterals, three to four vertical dual phase extractions wells (three to four $\frac{1}{2}$ hp Grundfos pumps operating in the dewatering wells at one time, accordingly), one to three of the dewatering sumps (with one to three $\frac{1}{2}$ hp Grundfos pumps operating in the dewatering sumps at one time, accordingly), and five to seven sparge wells, all operating at one time.
2. As such, treatment of the upgradient (western) half of Area A (and treatment points located in that upgradient half of Area A) was conducted over the last three quarters (May 2009 through December 2009) of 2009. When decreasing asymptotic trends in vapor removal rates were identified in December 2009, treatment of the downgradient half of Area A (eastern half) was later initiated in January 2010, and is currently (through October 2010) underway.

3.1.2 Area I Design

Data gathered from the Area A Pilot test has been utilized to extrapolate a remediation design for Area I based upon the relatively lower contaminant concentrations in Area I compared to Area A.

Based upon the soil borings completed in this AOC, groundwater generally occurs at 10 to 12 feet below ground surface. Soil borings also indicate that the soils within this AOC are generally consistent with those observed in Area A, consisting of fine to medium grained sediment as well as historic fill materials, including, brick, cinders and similar materials underlain at a depth of 17-19 feet by a natural meadow mat stratum. Accordingly, soil vapor extraction and air sparging will be similarly effective in this AOC as compared to Area A. Therefore, a combination SVE/AS injection and dewatering well network was installed to mitigate remaining VOCs within this AOC. Because groundwater occurs at greater depth in Area I, conventional vertical vapor extraction wells (only) will be utilized (versus the horizontal SVE cells of area A). A projected radius of venting influence of 15-20 feet has been estimated for design purposes. Likewise, since remaining soil contamination was observed below the top of the groundwater surface in several borings, air sparging will be utilized to liberate VOCs at depth and to provide an oxygen source for enhanced natural biological degradation.

Area I includes four-inch diameter (except SVE/RW-1I which required 2 inch diameter PVC due to large cobbles identified during installation necessitating a smaller diameter drill bit) screened PVC dual phase recovery (dewatering and SVE) vertical wells (SVE/RW-1I through SVE/RW-17I) installed to total depths of approximately 14 to 20 feet below grade, each with 10 feet of screen (see **Figure 5** for locations). The dewatering wells are designed to dewater actively treated portions of Area I (as appropriate) to prevent elevated groundwater levels and mounding which could otherwise reduce effective vertical SVE performance (due to the potential for groundwater entrainment in the SVE piping). As is the case for Area A, due to the heterogeneous subsurface layers, (silt, gravel, fill and sand layers), the deep SVE/dewatering well screens installed serve to act as subsurface pressure relief to reduce or eliminate the potential for air injected from the sparging wells to travel horizontally beneath heterogeneous subsurface layers (and be trapped beneath such layers) without being intercepted and captured by SVE (to reduce or prevent fugitive air sparge emissions to the surface).

Each dual phase extraction well contains a dedicated SVE line (which runs back to the manifold area) and a dedicated water line (installed via sealed pitless adapter connection to the

well) which runs back to the manifold area (see **Figure 5** for manifold area location). Each wellhead is sealed with a Campbell seal (an adjustable gripping gasket at the wellhead which seats around pump float and power control wiring) to maximize SVE vacuum seal. The subsurface water lines from each dewatering well are individually piped and connected to solid PVC piping run underground to the manifold area. Each individual above ground water line riser is then manifolded to a main trunk line which runs to the treatment shed storage tank (to allow treatment of the dewatered groundwater). Each riser from each water line contains a pressure gauge, flow control valve and sampling port to allow individual adjustment, operation and monitoring. Submersible ½ hp electric Grundfos pumps are installed in each dewatering well (as required depending on the portion of the area to be treated) to conduct dewatering. The pumps operate using automatic float controls installed within each well.

Each individual above ground riser from each vertical SVE well line is manifolded to a main trunk line which runs to the treatment shed SVE blowers (for vapor phase treatment of extracted vapors). Each riser from each vertical SVE well contains a vacuum gauge, air flow /vacuum control valve and sampling port to allow individual adjustment, operation and monitoring. Each individual riser from each vertical SVE well at the manifold contains a subgrade condensate trap to allow for the removal of moisture buildup within the SVE piping, which could otherwise reduce effective vertical SVE well performance.

Area I contains fifteen air sparge wells, (AS-1I through AS-15I) as shown on **Figure 5**. The sparge wells are installed to depths of approximately 15 to 20 feet below grade, and constructed of schedule 40 PVC with 3 to 5 feet of screened interval at the bottom of each sparge well. Each sparge well is piped individually underground with ½ inch diameter pressure rated Nylon-11 tubing which is run back to the manifold area. Each individual above ground air sparge riser is then manifolded to a main trunk line which runs to the treatment shed air sparge compressor (which is the source of sparge air injection into each sparge well). Each riser from each sparge line contains a pressure gauge, flow control valve, air flow gauge, pressure regulator and check valve (to prevent sparge air and groundwater blow-back on shutdown) to allow individual adjustment, operation and monitoring.

A design radius of influence (ROI) for the SVE and AS wells is 15 feet.

The groundwater extraction piping was connected to each SVE wellhead within Area I in the event that a similar approach to that presented for Area A is required to maximize contaminant vapor recovery (i.e. simultaneous SVE/groundwater dewatering).

3.1.3 Joint Treatment System

The treatment facility is centrally located to service both areas A and I, and is constructed within the Area B courtyard (see **Figure 3** for system shed locations). This area has adequate electrical power availability and is proximal to the facility's sanitary sewer collector which is needed for discharge of treated groundwater recovered from the remedial system(s). The as-built treated groundwater discharge (constructed in accordance with NYCDEP discharge permit/file # C-4265) schematic is provided as **Figure 3**.

3.1.4 Groundwater Treatment and Final System Design Considerations

Since the enhanced system increases the amount of groundwater to be treated from approximately 5 gpm under the former design to approximately 20 gpm under the enhanced design, more advanced groundwater treatment is required.

The as-built piping and instrumentation diagram for the SVE/AS, groundwater recovery and treatment system is provided in the full as-built and O&M manual provided as **Attachment 2**. The recovered groundwater stream is first routed to a 300 gallon holding tank. The groundwater is then pumped through four Total Suspended Solids (TSS) filters, and then through three 1,000 pound granular activated carbon (GAC) polishing vessels prior to discharge. The TSS filters reduce the frequency of GAC maintenance and cleaning.

The final system design was submitted to and approved by NYSDEC

3.1.5 SVE System

The general layout of the SVE unit includes a main 7.5 horsepower (hp) blower unit, moisture separators and an off-gas control device (two 500 pound vapor phase granular activated carbon (VGAC) vessels configured in series flow, with a provision for adding a catalytic oxidizer if needed)). An auxiliary 2.5 hp SVE blower is provided to target vapor extraction from the vertical SVE/groundwater recovery wells in Area A, and supplement overall extraction. The SVE blower units create a vacuum which is applied to designated extraction locations. A zone of influence is created around the extraction locations in which air and volatile organic vapors are drawn away from the soils and into the SVE piping network. The extracted soil vapor/air stream is channeled through the piping network into the moisture separator units. The pressure drop created within the moisture separators allows moisture within the air stream to precipitate out and collect in a reservoir within the separator. The precipitation collected within the moisture separators is discharged by pump into the 300 gallon holding tank. The resultant dry air streams are passed through the blower units and through the off-gas control device(s) with subsequent discharge to the atmosphere in accordance with Air Guide-1 (AG-1/DAR-1) discharge limits. A copy of the site specific air discharge limits are provided in **Attachment 3**.

As illustrated in **Attachment 1**, the SVE equipment includes the following:

1. Two 80 gallon knock-out tanks (one for each SVE blower) with automatic shutdown in the event of condensate pump-out failure
2. Explosion proof (xp) 7.5 hp blower rated at 300 scfm (main SVE blower) and xp 2.5 hp auxiliary blower rated at 60 scfm
3. Explosion proof transfer pumps
4. Off-gas control device (two 500 pound VGAC units in series flow)

The SVE system operates optimally with a vacuum level of 1 to 3 inches Hg at the withdrawal wells. These levels will vary through the treatment duration based on soil moisture levels and permeability. The system is equipped with operational interlocks which shut down

the process machinery if blower temperatures exceed specified limits or if excessive vacuum is produced.

3.1.6 Air sparge System

The layout of the air sparging system includes an air compressor and associated valves and pressure meters. As illustrated in **Attachment 1**, the AS compressor is a rotary vane 7.5 hp compressor rated at 50 scfm at a pressure of 20 psib. The manifold and piping is constructed of nylon/steel tubing. A pressure relief valve is installed immediately after the compressor to exhaust excess air from the manifold. A pressure regulating valve and a check valve are installed between the manifold and each well to prevent temporary high pressure in the screened interval from forcing air and water back into the manifold system after the system is shut off.

The AS system is also connected to the interlock, which will shut down the system in the event of excessive temperatures or pressures. In the event the SVE blower shuts down, the air sparge will also shut down via the electronic interlock system.

An autodialer calls out to the local system technician notifying him of the alarm/emergency condition.

3.2 Goals of Remedial Action

The primary remedial objective for this system is to remove as much contamination as practical to reduce concentrations of residual contamination at this site. As demonstrated during the pilot study, it is anticipated that the installed Soil Vapor Extraction/Air Sparging (SVE/AS) system will be very effective at removing volatile BTEX compounds and moderately effective at removing the less volatile chlorinated benzene compounds. The groundwater extraction (dewatering) system will further reduce both volatile and semi-volatile components.

4.0 REMEDIATION SYSTEM PERFORMANCE MONITORING

4.1 Monitoring Plan

This monitoring plan describes the measures that will be taken to monitor the performance and effectiveness of the remedy at the site. Performance monitoring is the regular assessment of

physical and chemical parameters, to determine if the remedy is performing as designed. Effectiveness monitoring is the periodic chemical and physical analysis of ground water, soil and air to determine and/or confirm that the objectives of the remedy are being achieved.

4.2 Environmental Effectiveness Monitoring

4.2.1 General

Effectiveness monitoring will include the collection of ground water and soil samples to assess conditions in the vicinity of the remediation. SVE influent air sampling, pressure readings, vacuum readings, water table elevations, and estimated mass removal rates are used to monitor the effectiveness of the AS/SVE system. The effectiveness monitoring is collected monthly and reported quarterly to the NYSDEC. In addition ground water sampling is conducted to monitor system effectiveness.

4.2.2 Sampling Program

Ground water sampling will be conducted on a quarterly basis from sample points PZ-4, MW-6, MW-8, PZ-3 and SVE/RW-5A in Area A, and MW-3, MW-7, MW-11 and SVE/RW-13I in area I. Samples will be collected in accordance to NYSDEC Analytical Services Protocol (ASP) using EPA low-flow sampling methodology. Field analysis will be conducted for ground water pH, temperature, conductivity and dissolved oxygen.

SVE influent and effluent air samples will be collected monthly/quarterly and analyzed for volatiles via EPA Method TO-15. Water discharge will be sampled quarterly in accordance with the NYCDEP permit. Carbon changeouts are conducted quarterly at a minimum, or more frequently if required.

Upon determination that the SVE system operations should cease, soil and ground water samples will be collected to verify the effectiveness of the remediation. The soil samples will be collected from the following locations:

- | <u>Area A</u> | <u>Area I</u> |
|----------------------|----------------------|
| • A-104 (7-8') | • A1SB-17A (5.5-6') |
| • A-101 (7-8') | • A1SB-10A (7-7.5') |
| • A-105A (7-8') | • I-1 (7.5-8') |
| • 1SB-1 (7-9') | • A1SB-1B (10.5-11') |
| • 1SB-3 (7-8') | • A1SB-14 (7.5-8') |

- A-102A (7-8')
- I-104 (7-8')

Soil sampling will be performed in accordance with NYSDEC Sampling Guidelines and Protocols (September 1992). Soil samples for laboratory analysis will be collected using a direct push sampling device such as GeoProbe. Samples will be collected directly from the acetate-lined, stainless steel probe. Acetate liners will be disposed of after each use and the stainless steel probes will be decontaminated following standard procedures.

At each location, the sample core will be screened using a photoionization detector (PID) in six-inch intervals and the soil type will be recorded. Soil samples will be collected at the predetermined depths summarized above. A copy of the PID (and manufacturer's information) to be used for soil sample screening and SVE system off-gas monitoring is provided in **Attachment 1**.

Groundwater samples will be collected from the following locations:

- PZ-3, PZ-4
- MW-3, MW-6, MW-7, MW-8, MW-11
- SVE/RW-5A, SVE/RW-13I

Samples will be collected from each well and analyzed for VO+10 via EPA Method 624, including the site-specific chlorinated aromatics. Field analysis will be conducted for ground water pH, temperature, conductivity and dissolved oxygen.

All soil and ground water samples will be analyzed by a New York State Department of Health (NYSDOH) ELAP CLP certified laboratory.

4.3 On-Site Treatment Plant Performance Monitoring

The site performance monitoring will include the following elements:

- Estimate of the area and volume of the soil and ground water being treated;
- Sampling of the influent and effluent air and water streams;
- Measurement of water levels in site monitoring wells;
- Estimate of mass removal rates; and
- Evaluation of the performance monitoring in order to make recommendation for system adjustments as necessary.

The performance monitoring for each phase of the remediation (start-up, operation and shutdown) are described in the following sections.

4.3.1 System Start-Up and Testing

The startup phase began with the startup of the SVE system. This phase included approximately 7-10 days of manifold valving adjustments. These adjustments were used to optimize contaminant mass removal by increasing vacuum pressure on the wells/horizontal lines producing the highest contaminant concentrations while providing adequate coverage to capture sparged air and protect against vapor intrusion. During this period, flow measurements, vacuum readings and vapor concentrations were recorded daily from the manifold line and from the effluent. Baseline sampling of subsurface pressure, PID readings, water levels and dissolved oxygen (DO) are to be conducted prior to startup of Area "I" (area "A" has already been started as of May 2009).

After the SVE system is optimized, the air sparging system was started. AS startup continued for an additional 7-10 days of valving adjustments. During this period, injection and extraction rates, pressures, depth-to-water and vapor concentrations were monitored hourly at first and then daily. Other startup monitoring will include visual observation for water bubbling and indoor vapor concentrations.

Based on the pilot study results, initial AS air pressure and flow was introduced at 1 scfm per well at 5 psi in Area "A". The low flow rate is necessitated by the observation of bubbling water and odors at higher flow rates during the pilot study. If any bubbling is observed in monitoring points or if any noticeable odors or VOC vapors are detected in the ambient air, the air pressure and flow will be reduced until the detection effects are eliminated during startup of each area (i.e. Area "I" which has not yet been started as of July 2010). Since no bubbling or vapors were observed during the start up phase of Area "A", the air sparge flow rate was increased nominally to approximately 1 to 4 cfm per sparge well at 6 to 10 psib

4.3.2 Operational Phase

Performance monitoring will be conducted on a monthly basis to assure the SVE/AS system is working properly, evaluate the vapor recovery rate, and determine when system shutdown post-remedial sampling should be performed. The following performance indicators will be collected monthly:

- Air sparging and extraction flow rates.
- Sparging pressure and vacuum reading from venting monitoring points and manifold.
- Laboratory analysis of the extracted vapor stream for VO+10.
- Field monitoring of vapor concentrations in venting monitoring points and effluent discharge using a Photo Ionization Detector (PID) or a Flame Ionization Detector (FID).
- Estimated mass removal rates.
- Estimated cumulative VOC mass removed.
- Scaled site plans with vacuum pressures and monitoring point vapor concentrations.
- Changes in water table elevations.
- Estimated zone of influence for SVE and AS wells.

Results of the SVE/AS effectiveness monitoring will be reported on a quarterly basis to the NYSDEC.

4.3.3 Endpoint and Shutdown / Final System Optimization

The system monitoring data will be reviewed to determine the effectiveness of the AS/SVE system and determine when the system operation should cease. Information reviewed will include the system performance monitoring data, VOC removal rates over time and contaminant distribution in vent gas over time. Final system optimization (prior to shutdown) is then achieved by evaluating the monthly system performance data. For example, individual PID readings are collected from each SVE extraction point on a monthly basis. Those points that do not show elevated levels via PID are shut off, and focus on those SVE points with elevated PID levels is conducted to maximize (optimize) contaminant removal rates. In addition, the system is pulsed to remove the final practical mass of contaminant prior to shutdown. When asymptotic

behavior is observed in the cumulative mass removal and effluent VOC concentrations, the following actions will be undertaken to increase mass removal:

- Adjusting flow and vacuum rates to wells with higher concentrations
- Pulse the air sparge system with periodic shutdowns

When asymptotic behavior persists for a period of three months following these actions, a proposal to shut the system down will be submitted to NYSDEC with the next regularly scheduled progress report. If the proposal is approved the SVE/AS system will thereafter be shut down and the conditions monitored for rebound. If no rebound effect is observed, NYSDEC will be petitioned to permanently shut down and decommission the treatment system. If the proposal is not approved, operation of the SVE/AS system will recommence.

The system testing described above will be conducted if, in the course of the SVE/AS system lifetime, significant changes are made to the system, and the system restarted.

4.4 System Operation: Routine Operation Procedures

4.4.1 SVE System

1. Upon arrival the technician will document time, temperature, and weather conditions in log book.
2. Check gate to ensure site is secure and that emergency contact information is visible.
3. Document in log book if system is running, if not trouble shoot and document why the system shut down.
4. Record SVE vacuum, monitoring point vacuum/pressure and influent/effluent temperatures, and system influent vacuum and carbon vessel psi readings (Carbon Treatment).
5. Collect system effluent cfm reading (Kurz) and influent/effluent concentrations (PID/FID).
6. Bail water traps.
7. Collect influent concentrations and individual riser concentrations (PID/FID)
8. Make adjustments to manifold to maximize system mass removal rates.

9. Collect departure influent concentrations (PID/FID), cfm (Kurz), vacuum readings, and psi (carbon) and temperature readings.
10. Complete system data sheet.

4.4.2 AS Unit

1. Check AS hose integrity.
2. Collect psi readings from gauges at each manifold point.
3. Shut down compressor and remove condensate from collection jars.
4. Restart compressor and ensure all points are functioning (compressor is not dead heading at any point).
5. Complete system data sheet.

4.4.3 Ground Water (Dewatering) Treatment System

1. Check system for leaks.
2. Ensure all floats and emergency shut offs are properly working.
3. Check discharge outfall for water clarity and any obstructions.
4. Collect psi readings from prior to carbon unit one, after carbon unit 1, and after carbon unit 2. If psi readings are greater than 10 between units backwash the vessels.
5. Document system flow rate and total flow, and make adjustments if necessary.
6. Complete system data sheet.

4.4.4 System Operation: Routine Equipment Maintenance

4.4.4.1 Inspections and Maintenance

4.4.4.1.1 Operating Records

Operating records recorded by the technician for each system O&M site visit will be kept in a waterproof sleeve and visible at first entrance into the treatment shed. The system operating log will include the following:

Liquid Phase

- Ground water discharge rate (gpm) and total flow into carbon
- GAC pressure readings
- Date of last carbon change
- TSS pressure readings before/after change out

SVE/AS

- AS system pressure readings
- SVE system influent cfm reading
- SVE system vacuum at influent port
- Total VOC influent concentration (PID/FID).
- Total Effluent concentration (PID/FID).
- Calculated percent efficiency of off-gas treatment
- System influent/effluent temperatures (including Pre and Post Carbon Units)
- Date of last carbon change (if applicable)
- Test Air Sparge Interlock

In addition, a log book will be kept on site which will be signed and dated at each visit. The technician will describe the system's condition on arrival and departure for each O&M visit, weather conditions, service and/or repairs done to the system, and make note of any unusual conditions at the site.

4.4.4.2 Monthly Check List

The monthly check list will include all maintenance/site inspection activities listed. The check list will be completed, dated and signed by the designated technician. Completed check lists will be stored in a binder on site.

4.4.4.3 Quarterly Check List

The quarterly check list will include all activities listed in the monthly check with the addition of the following:

- Service blower as per manufacture's specifications
- Use amperage meter to test draw on blower and adjust system vacuum if necessary
- Test system starter motors by pushing the test button to ensure they will trip in the event of an overload
- Check integrity and tightness of all electrical wiring

4.4.4.4 Yearly Check List

The yearly check list will include all activities in the quarterly checklist. In addition the technician will review all records from that year to ensure that all records are complete and accurate. After review the technician will add any necessary activities to the monthly, quarterly, and annual check lists.

4.4.5 Preventative Maintenance Schedules

System maintenance will be conducted on a monthly basis during the site visit. Any additional maintenance time will be scheduled as needed.

4.4.6 Disposal of Spent Carbon

Spent carbon from the off-gas treatment and liquid phase treatment systems will be removed and sent for recycling at a permitted reactivation facility. Documentation of proper disposal will be submitted with the annual Site Management Report.

4.4.7 System Operation: Non-Routine Equipment Maintenance

Non-routine equipment maintenance and repair will be performed as needed during system operation. Any components that need replacement or repair will be completed in a timely fashion.

4.5 Analytical Program

All field activities will follow the NYSDEC Sampling Guidelines & Protocols (September 1992).

4.5.1 Field Instruments

The PID will be calibrated with known gas concentrations daily in the field. In the event that the instrument fails to meet calibration procedures, a replacement will be obtained. Information regarding PID operation is presented in **Attachment 1**.

4.5.2 Sample Custody

Field measurements and sample locations will be recorded. Following the sample collection, the sample will be labeled and stored in a laboratory provided cooler. The samples will be delivered by Whitman personnel or laboratory courier to the laboratory under a chain-of-custody.

4.5.3 Analytical Parameters and Methods

Soil and ground water samples will be analyzed for the parameters outlined in Section 6.2 using the following methods:

<u>Parameter</u>	<u>Analysis Method</u>
VOCs	EPA 624 (groundwater) EPA Method 8260 (soil)

4.5.4 Laboratory Certification and Data Format

Soil and ground water sample analyses will be performed by a NYSDOH accredited laboratory. The laboratory will provide NYSDEC Analytical Services Protocol (ASP) Category B reduced deliverables.

4.6 Evaluation of Monitoring Results

The historic monitoring data will be used as a base point to evaluate the effectiveness of the AS/SVE treatment system. All sampling results will be evaluated in relation to the historic sampling results to determine if the concentrations show a clear downward trend, or no

statistically discernable trend. This trend will be used to determine the AS/SVE system's effectiveness, and if additional remedial measures are required.

The sampling frequency for all wells will be quarterly.

SVE influent and effluent air samples will be collected monthly/quarterly (as required) and used to estimate the cumulative VOC removal. In addition the results will be used to determine when flow or vacuum rates need to be adjusted, to pulse the system with periodic shutdowns, or when the results warrant a proposal to the NYSDEC to shut down the system.

5.0 SITE MAINTENANCE

5.1 Maintenance Activities

System maintenance/site inspection will be conducted on a monthly basis by the site technician. During the inspection/maintenance visit the employee will conduct the following activities:

- Check the treatment shed door and lock to ensure proper operation.
- Check and replace when necessary all posted warning signs.
- Ensure the emergency contacts/contact numbers are correct and updated when necessary.
- Check and replace light bulbs when necessary.
- Check all emergency shut off devices and clean/repair when necessary.
- Conduct general housekeeping of work area.
- Look for air/water leaks and repair piping when necessary.
- Grease fittings on SVE Blower.
- Check all belts for correct tightness and adjust/replace when necessary.
- Check water traps and bail when necessary.
- Check and replace Total Suspended Solids (TSS) filters when necessary.
- Clean and check proper operation of flow meter.
- Check all PSI/Vacuum gauges and replace when necessary.
- Check all floats and high water shutoffs for proper operation.
- Check recovery wells for proper seals and security.

5.2 Inspections and Maintenance

5.2.1 Operating Records

Operating records will be kept in a waterproof sleeve and visible at first entrance into the treatment shed. The system operating log will include the following:

Liquid Phase

- Ground water discharge rate (gpm) and total flow into carbon
- GAC pressure readings
- Date of last carbon change
- TSS pressure readings before/after change out

AS/SVE

- AS system pressure readings
- SVE system influent cfm reading
- SVE system vacuum at influent port
- Total VOC influent concentration (PID/FID).
- Total Effluent concentration (PID/FID).
- System influent/effluent temperatures (Catalytic Unit, if applicable)
- Date of last carbon change (if applicable)
- Test Air Sparge Interlock

In addition, a log book will be kept on site which will be signed and dated at each visit. Each technician will describe the system's condition on arrival and departure, weather conditions, service and/or repairs done to the system, and make note of any unusual conditions at the site. Check integrity and tightness of all electrical wiring

6.0 REPORTS

Dexter will provide sampling and system monitoring reports to the NYSDEC in quarterly monitoring reports.

Site Evaluation Reports will be provided annually following the quarter when annual samples are taken. Each annual report will also contain an updated ground water contour map.

Proposals for modifying sampling frequencies will be made in Progress Reports or Annual Reports as appropriate.

7.0 CITIZEN PARTICIPATION

The NYSDEC received no comments during the public comment period (August 15, 2005 to September 14, 2005) for "Public Comments Requested on the Remedial Action Work Plan for Dexter Chemical. LLC, Bronx, NY". A letter of approval dated November 3, 2005 was issued by the NYDEC for the Dexter Chemical Remedial Action Work Plan: For Soil and Ground water at Area "A" and Area "I".

Dexter will periodically undertake the preparation and distribution of a fact sheet to adjacent property owners and other interested groups as determined necessary by the NYSDEC.

8.0 PERSONNEL

All remedial system technicians will be trained in the standard field operating procedures stated in this manual in accordance with Whitman policy. Upon the completion of all required training the qualified system technician will report directly to the project manager.

All Whitman employees will receive safety training, be OSHA 40 hour certified, and maintain current OSHA 8 hour refresher certification.

9.0 EMERGENCY CONTINGENCY PLAN

The SVE/AS treatment system will have automatic emergency shut offs. The SVE blower will automatically shut down if the preset high temperature shut off level is reached. The AS system will be equipped with an interlock which will not allow the sparge compressor to run independent of the SVE blower. In addition, the AS will also have a high pressure relief valve. If any unusual noise or odor is encountered a designated Dexter Chemical employee will immediately shut down the treatment system and contact Whitman.

The ground water treatment system will be checked weekly for leaks or high pressure readings. If at any time a leak or high pressure readings is detected a Dexter employee will immediately shut down the SVE/AS and ground water treatment system and contact Whitman. If leak occurs prior to carbon treatment personnel in the area of the spill will:

- Shut down the treatment system
- Inform the Site Supervisor and Whitman immediately
- Determine if adequate protective equipment is available to enter the area of the spill
- Get spill kit materials

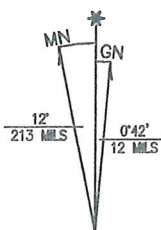
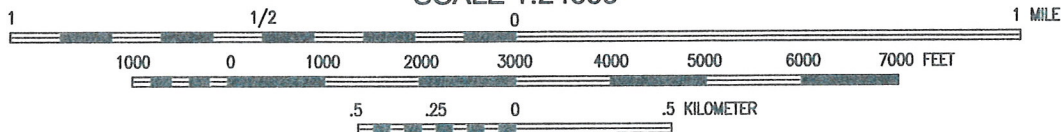
- Identify the source of the spill
- Contain, absorb and recover spilled ground water in proper containers
- Dispose of spilled materials properly, according to local, state and federal regulations

A 24 hour emergency contact number for Whitman, as well as Dexter Chemical LLC, will be visibly posted on the treatment system.

Emergency phone numbers, map, and directions to the nearest hospital can be found in the site Health and Safety Plan (HASP) for Dexter Chemical LLC, Bronx, NY (see SMP Appendix 7 for HASP).



SCALE 1:24000



UTM GRID AND 1981 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



QUADRANGLE LOCATION

DEXTER CHEMICAL CORPORATION
845 EDGEWATER ROAD
BRONX, NEW YORK

SITE LOCATION ON USGS
CENTRAL PARK, N.Y. QUADRANGLE

ORIGINAL BY:

M.H.

DRAWN BY:

R.R.

DRAWING NO:

970910MAP

CHECKED BY:

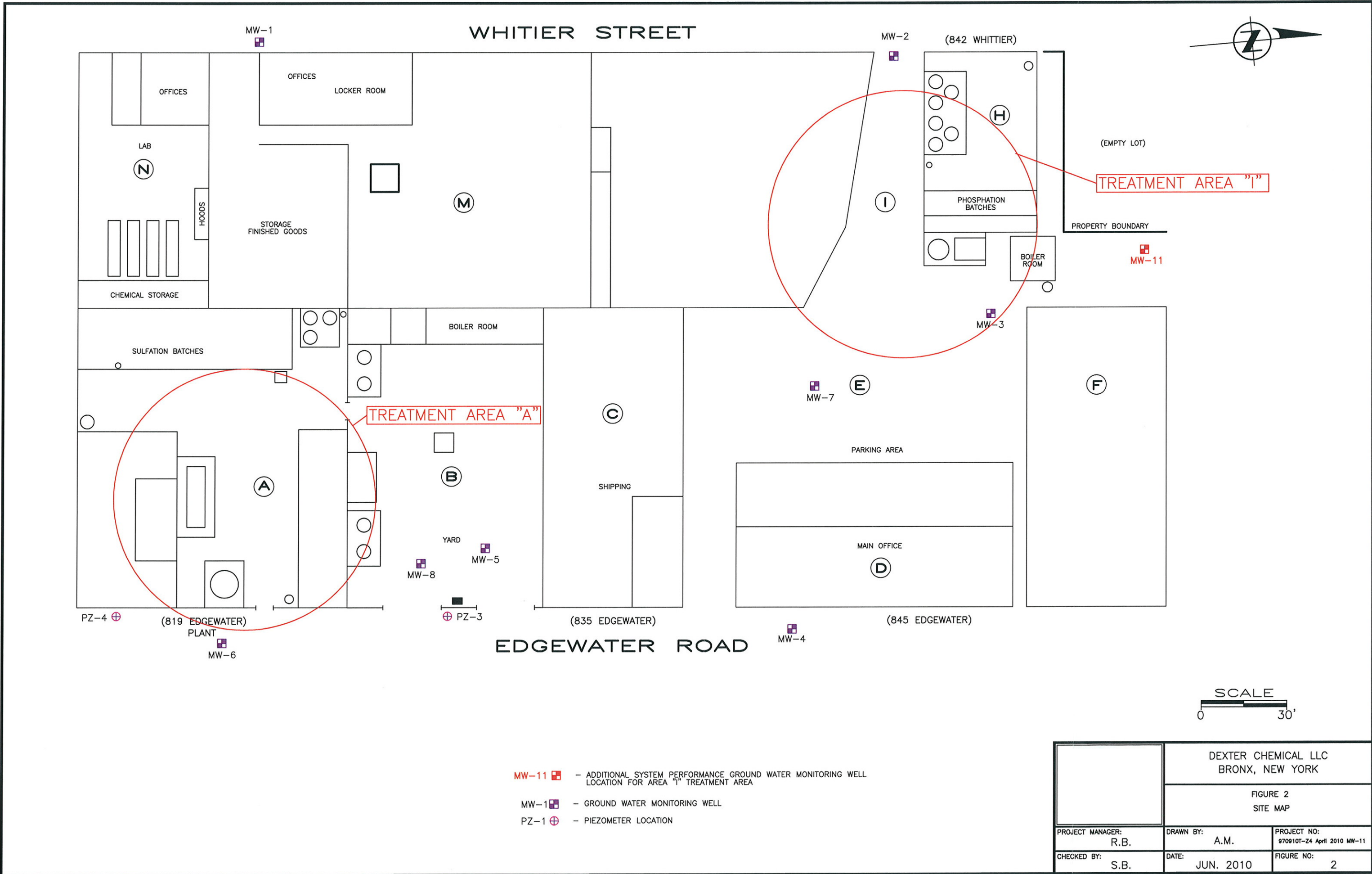
M.H.

DATE:

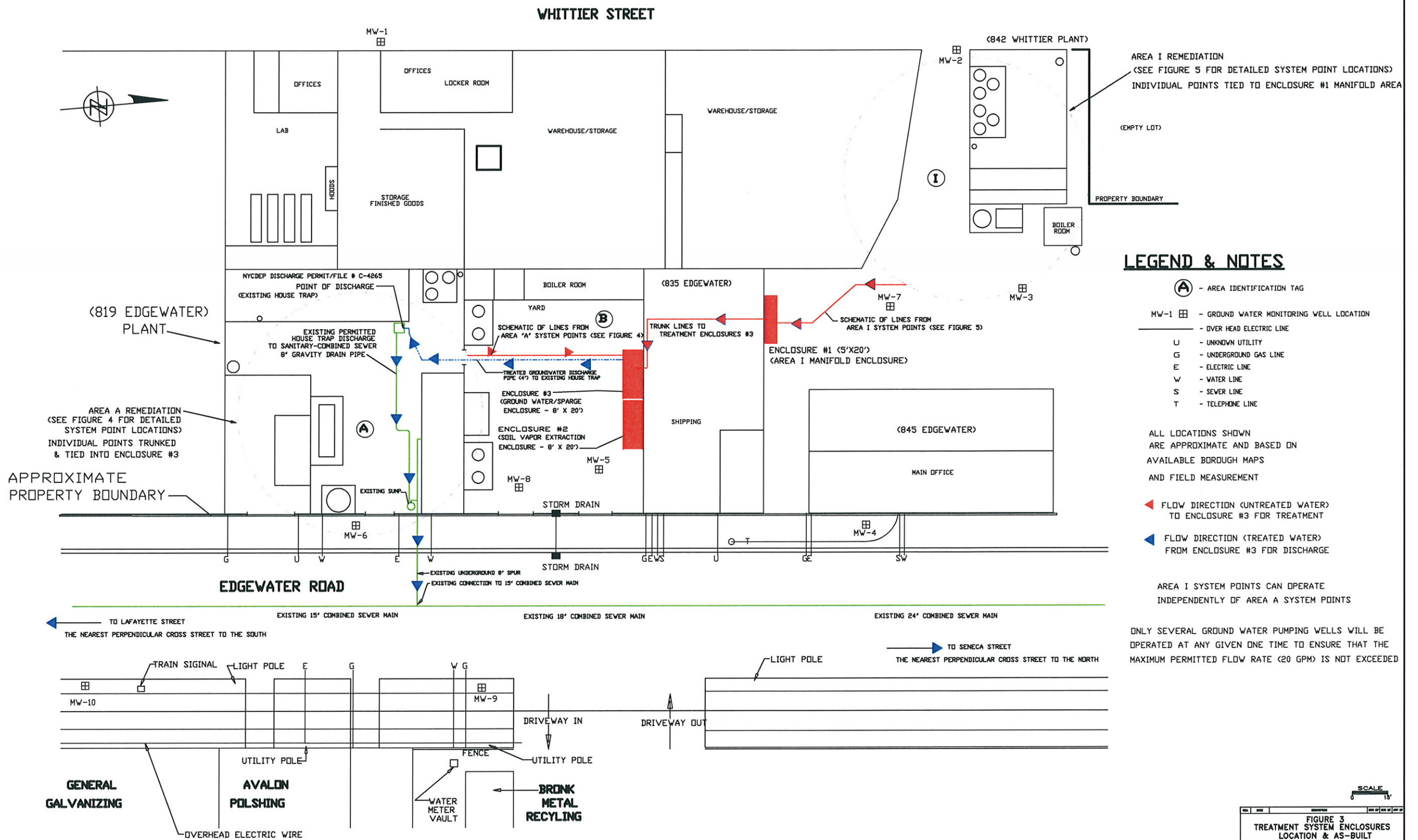
DECEMBER 2005

FIGURE NO:

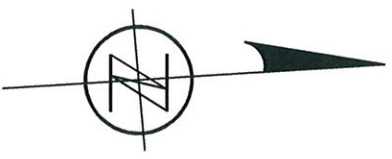
1



DEXTER CHEMICAL LLC BRONX, NEW YORK		
FIGURE 2 SITE MAP		
PROJECT MANAGER: R.B.	DRAWN BY: A.M.	PROJECT NO: 970910T-Z4 April 2010 MW-11
CHECKED BY: S.B.	DATE: JUN. 2010	FIGURE NO: 2



EDGEWATER BUILDING



AIR SPARGE MANIFOLD
RECOVERY/GW MANIFOLD
HORIZONTAL SVE MANIFOLD
VERTICAL SVE MANIFOLD
SYSTEM TRUNK LINES AND

UNDERGROUND ELECTRICAL
TO TREATMENT SYSTEM
ENCLOSURES IN COURTYARD

OFFICES

EDGEWATER AVENUE

LEGEND

90 OR TEE FOR SLOTTED HORIZONTAL PIPING CONNECTIONS
2" SOLID EXTRACTION PIPING - RUN BACK TO MANIFOLD AREA - NOT SHOWN ON FIGURE (CONSTRUCT/CONNECT AS NECESSARY)
2" TEE/CROSS CONNECTION FOR SLOTTED TO SOLID EXTRACTION PIPING CELL/RUN
HRZSVE-6A HORIZONTAL SOIL VAPOR EXTRACTION PIPING CELL
2" HORIZONTAL SOIL VAPOR EXTRACTION PIPING (0.010") - 10 slot
PIPING ENCAPS - (2" SLIP)

VM-2 VAPOR/SVE/OTHER MONITORING POINT (DO NOT TIE IN TO PIPING RUNS)
AS-14A AIR SPARGING WELL LOCATION
SVE/RV-7A GROUNDWATER RECOVERY AND VERTICAL SOIL VAPOR EXTRACTION WELL LOCATION
SUMP-1 SUMP
GW LINES
SVE LINES
AS LINES
UNDERGROUND ELECTRIC POWER/CONTROL CONDUIT/WIRING FROM PUMPS (2 CONDUITS PER LINE)

ALL LOCATIONS SHOWN ARE APPROXIMATE

TRENCH BOUNDARIES - TYPICAL APPROXIMATE

SCALE - 1" = 5 FEET
SCALE
0 5' 10'

DEXTER CHEMICAL LLC
BRONX, NEW YORK

REMEDIAL DESIGN LAYOUT
AREA A

ORIGINAL BY: M.P.	DRAWN BY: R.R.	DRAWING NO: as-built a InProg
CHECKED BY: E.S.	DATE: MAY 2005	FIGURE NO: 4



LEGEND

- ⊕ AS WELL LOCATION
- ⊕ SVE/GROUNDWATER RECOVERY WELL LOCATION

ALL LOCATIONS SHOWN ARE APPROXIMATE

- AS LINES
- GW LINES
- SVE LINES
- UNDERGROUND ELECTRIC POWER/CONTROL WIRING TO/FROM RECOVERY WELLS (2 CONDUITS/WIRE SETS PER LINE SHOWN)

- AIR SPARGE MANIFOLD AREA WITH TRUNK LINE TO TREATMENT BLDGS.
- GW MANIFOLD AREA WITH TRUNK LINE TO TREATMENT BLDGS.
- SVE MANIFOLD AREA WITH TRUNK LINE TO TREATMENT BLDGS.

POWER/CONTROL WIRING MANIFOLD AREA WITH TRUNK LINES TO MAIN POWER SUPPLY & TREATMENT BLDGS. ABOVE GROUND ALONG BUILDING WALL

WHITTIER STREET

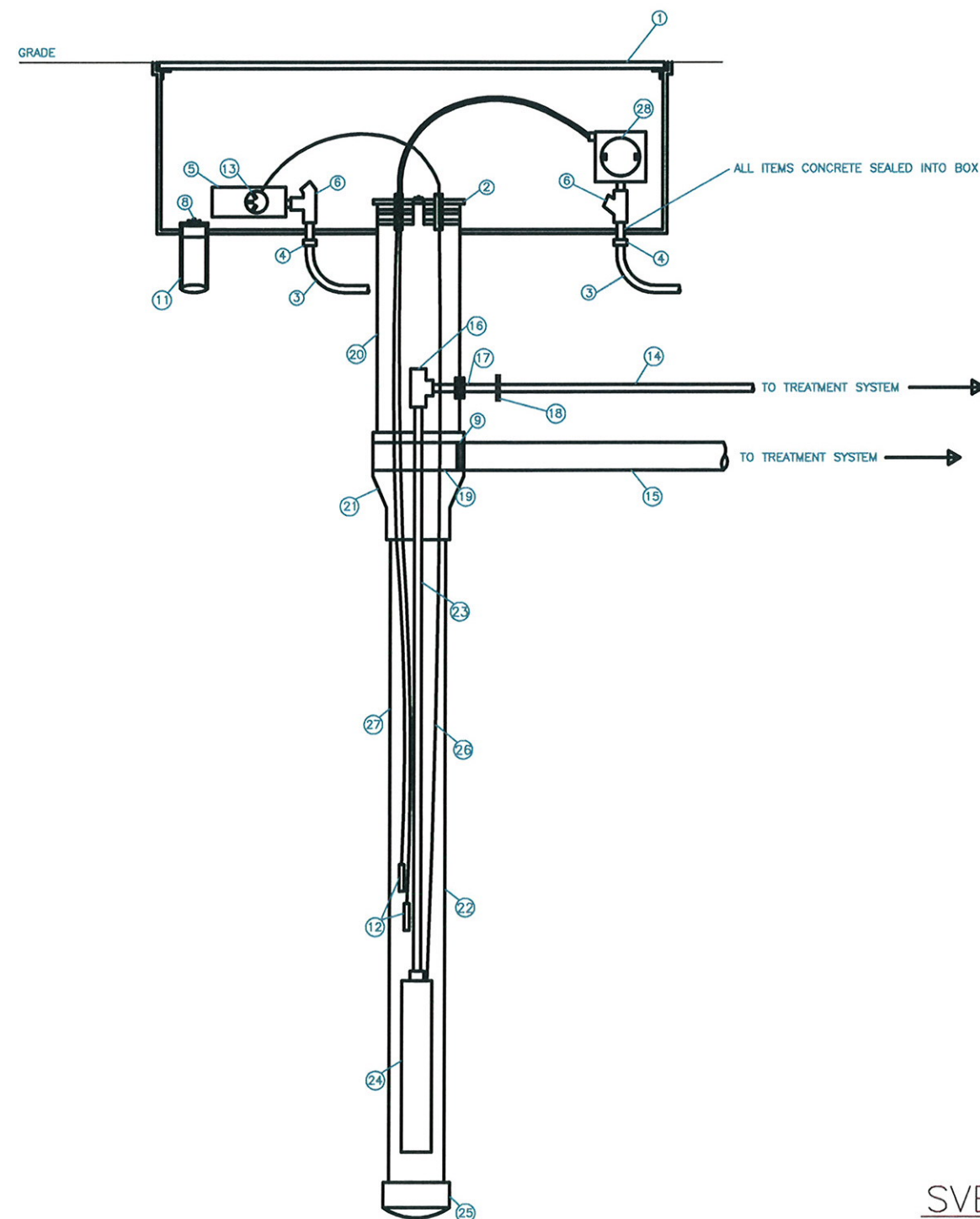
BUILDING EDGE & FORMER STRUCTURES

AREA I COURTYARD & ALLEY AREA

BUILDING EDGE

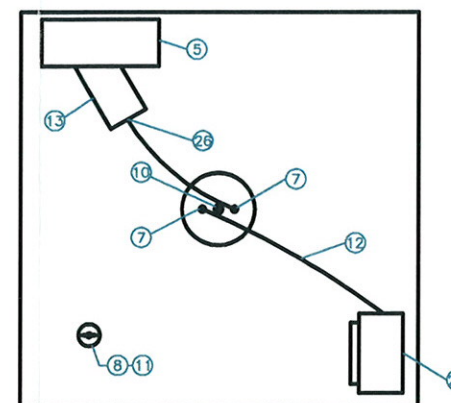


DEXTER CHEMICAL LLC BRONX, NEW YORK		
REMEDIAL DESIGN AREA I LAYOUT		
ORIGINAL BY: M.P.	DRAWN BY: M.S.	DRAWING NO: asbuilt i final
CHECKED BY: E.S.	DATE: JUNE 2006	FIGURE NO: 5



SVE/RECOVERY WELLHEAD DETAIL
SIDE VIEW
NOT TO SCALE

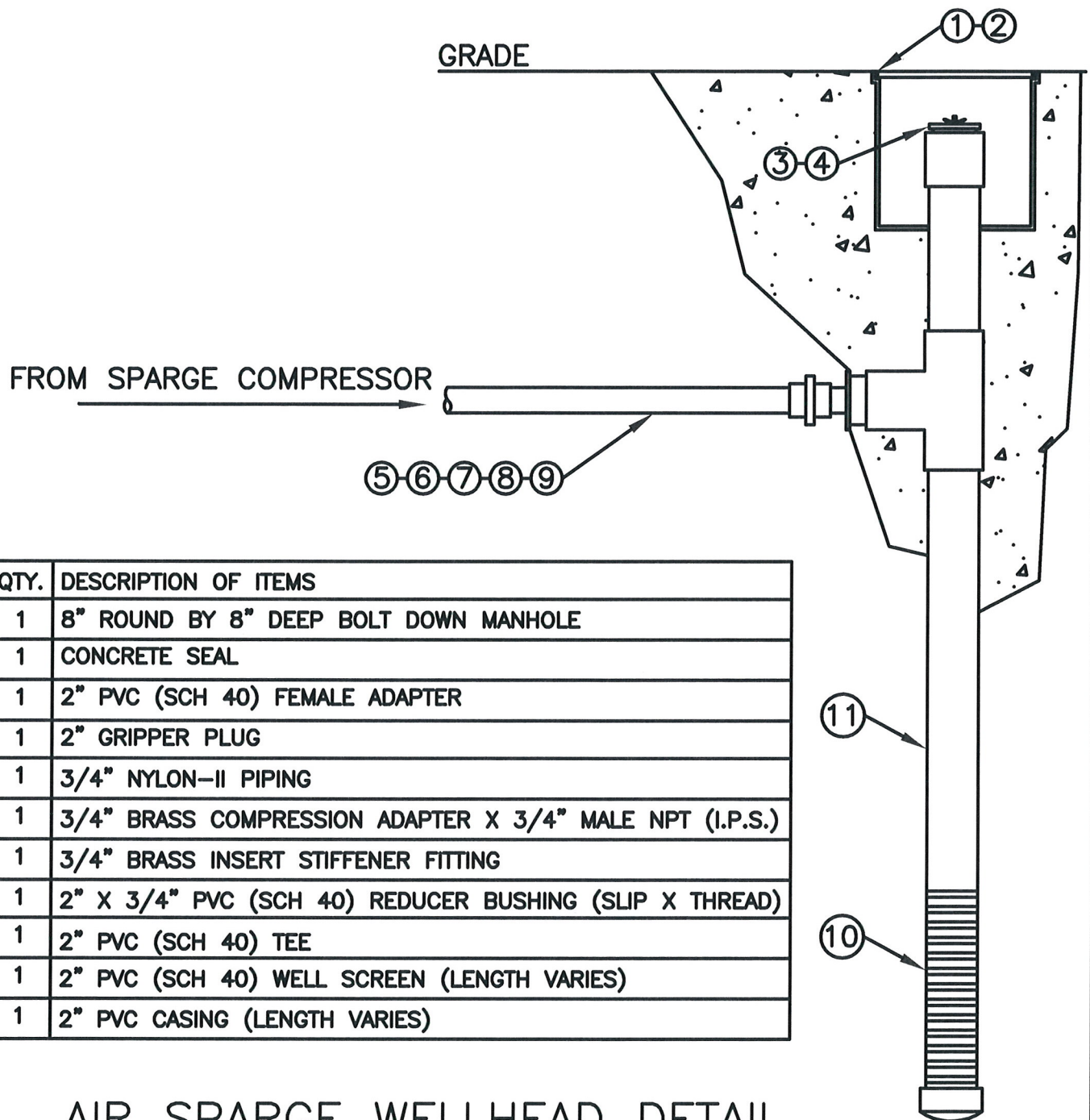
TYPICAL OF 8 (AREA A)
TYPICAL OF 17 (AREA I)



SVE/RECOVERY WELLHEAD DETAIL
PLAN VIEW
NOT TO SCALE

QTY.	DESCRIPTION OF ITEMS
1	30"X30" STEEL MANHOLE
2	6" CAMBELL WELL SEAL
3	3/4" ELEC. 90 SWEEP
4	3/4" ELEC. UNION
5	KILLARK GRSS J-BOX
6	EYS SEALING ELBOW
7	3/4" WATER TIGHT STRIAN
8	2" GRIPPER PLUG
9	2" PVC FEMALE ADAPTER
10	1 1/4" WATER TIGHT SEAL (GRIPPER)
11	2" VACUUM MONITORING POINT
12	PROBE WIRE (WATER LEVEL CONTROL)
13	TWIST LOCK RECEPTACLE (CLASS I GROUP D)
14	1 1/2" FLUSH JOINT PVC PIPE (LENGTH VARIES) (WATER LINE)
15	2" FLUSH JOINT PVC PIPE (LENGTH VARIES) (SVE LINE)
16	1" BRASS PITLESS ADAPTER
17	1" X 6" LONG STAINLESS STEEL NIPPLE
18	1 1/2" SLIP X 1" FEMALE THREAD PVC REDUCER
19	6" X 2" PVC SADDLE
20	6" PVC SOLID WELL CASING (LENGTH VARIES)
21	6" X 4" PVC BELL REDUCER
22	4" PVC WELL SCREEN (LENGTH VARIES)
23	1" POLY (LENGTH VARIES)
24	GRUNDFOS SUBMERSIBLE PUMP (230 VOLT SINGLE PHASE)
25	4" PVC WELL BOTTOM
26	TWIST LOCK PLUG (CLASS I GROUP D) WITH POWER CORD FOR SUBMERSIBLE PUMP
27	4" PVC WELL CASING (LENGTH VARIES)
28	GRSS BOX

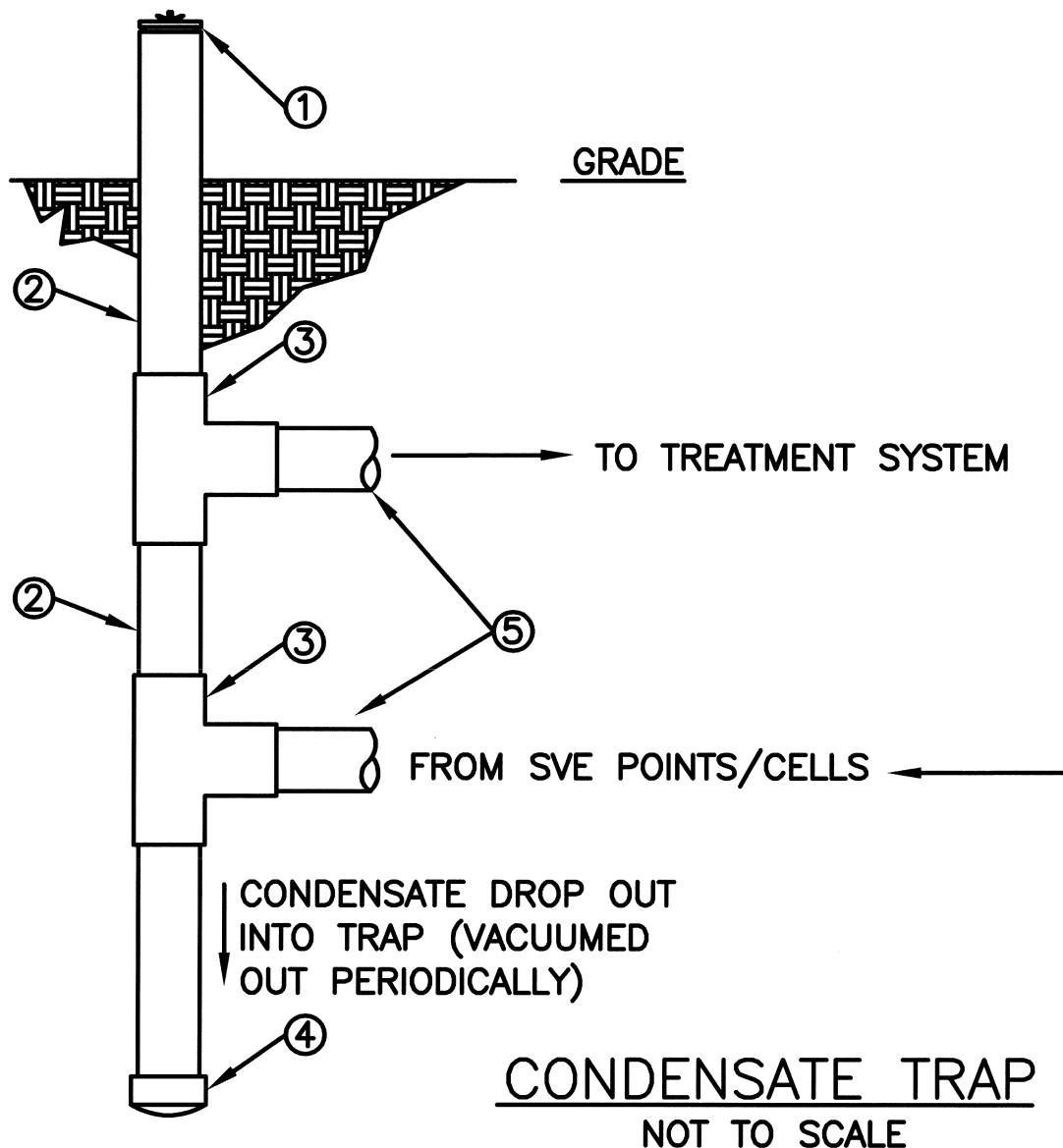
DEXTER						
AS-BUILT SVE/RECOVERY WELLHEAD DETAIL						
SIZE	DRAWN BY	ORIGINAL BY	CHECKED BY	DATE	PROJECT NO.	FIGURE
C	D.V.	E.H.	E.H.	JUNE 09	970910	6



AIR SPARGE WELLHEAD DETAIL NOT TO SCALE

TYPICAL OF
15 (AREA A)
15 (AREA I)

		DEXTER	
		AS-BUILT AIR SPARGE WELLHEAD (TWO INCH WELL) DETAIL	
PROJECT MANAGER: E.H.		DRAWN BY: DV	PROJECT NO: 970910
CHECKED BY: E.H.		DATE: JUNE 09	FIGURE NO: 7



①	QTY.	DESCRIPTION OF ITEMS
1	1	4" GRIPPER PLUG
2	—	4" PVC PIPE (SCH 40) (LENGTH VARIES)
3	2	4" X 4" X 2" PVC REDUCING TEE (SCH 40)
4	1	4" PVC SLIP CAP (SCH 40)
5	—	2" PVC PIPE (SCH 40) (LENGTH VARIES)

TYPICAL OF
 8 VERTICAL SVE (AREA A)
 12 HORIZONTAL SVE (AREA A)
 17 VERTICAL SVE (AREA I)

			DEXTER		
			AS-BUILT SVE CONDENSATE TRAP DETAIL		
PROJECT MANAGER:		DRAWN BY:		PROJECT NO:	
E.H.		DV		970910	
CHECKED BY:		DATE:		FIGURE NO:	
E.H.		JUNE 09		8	

ATTACHMENTS

ATTACHMENT 1
PID INFORMATION



MiniRAE 2000

Using the

MiniRAE 2000 &

ppbRAE PID

Firmware v. 1.20 (rev C)

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Training Agenda:

- MiniRAE 2000 & ppbRAE features
- Turning on the MiniRAE 2000 & ppbRAE
- Recommended Daily Start-up Procedure
- User modes & displays
- Alarm modes
- Programming displays
- Calibration

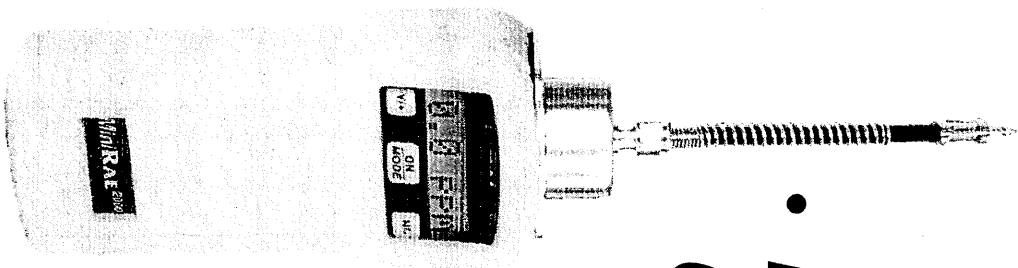
The Hazardous Environment Detection Company

The Hazardous Environment Detection Company

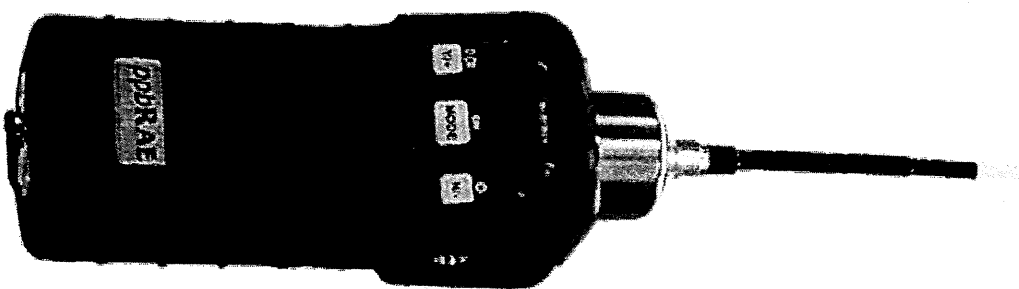


MiniRAE 2000/ppbRAE

- **MiniRAE 2000:
0.1-10,000 ppm**



- **ppbRAE: 1-9999
ppb/ 0.1-2000 ppm**





iRAE 2000: Internal Pump

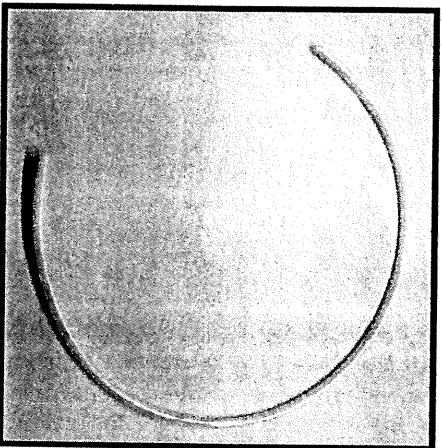
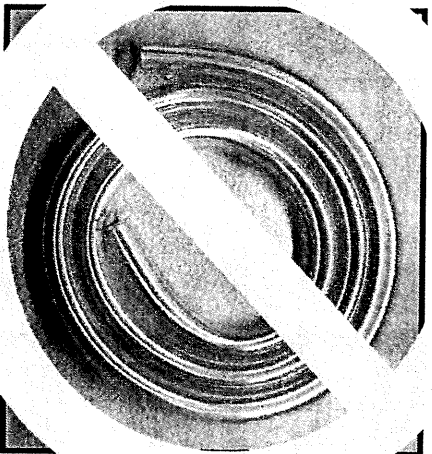
- 500 cc/min makes remote sampling easy
- Sample draw over 100 feet!
- Use external white liquid water trap for added protection
- Pump stall feature: when moisture is detected or when pump is blocked the pump will shut off, protecting the MiniRAE 2000 from potential damage
- Runs 10 hours with pump
- Only use Teflon tubing

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MinIRAE 2000: Tubing



- **Never Use Tygon tubing!**
 - Absorbs chemicals like a “sponge”
 - Reduces ppm readout when chemicals exist
 - Causes “false positives” when chemicals don’t exist
- **Always use Teflon or similar non-reactive tubing**
 - Will not absorb chemicals but might get coated
 - Clean with anhydrous methanol if it gets dirty



RAE 2000: External Prefilter

- Use the white external prefilter in high moisture environments like rain and saturated headspace sampling.
- Replace filter when it looks very dirty or when it introduces PID drift.
- Replace filter when in pump alarm with the filter on and you can clear the pump alarm with the filter off.
- Consider eliminating external prefilter & internal C-filter when measuring high-boiling/flashpoint chemicals (phenols, CWA)



MinirAE 2000: Reliability

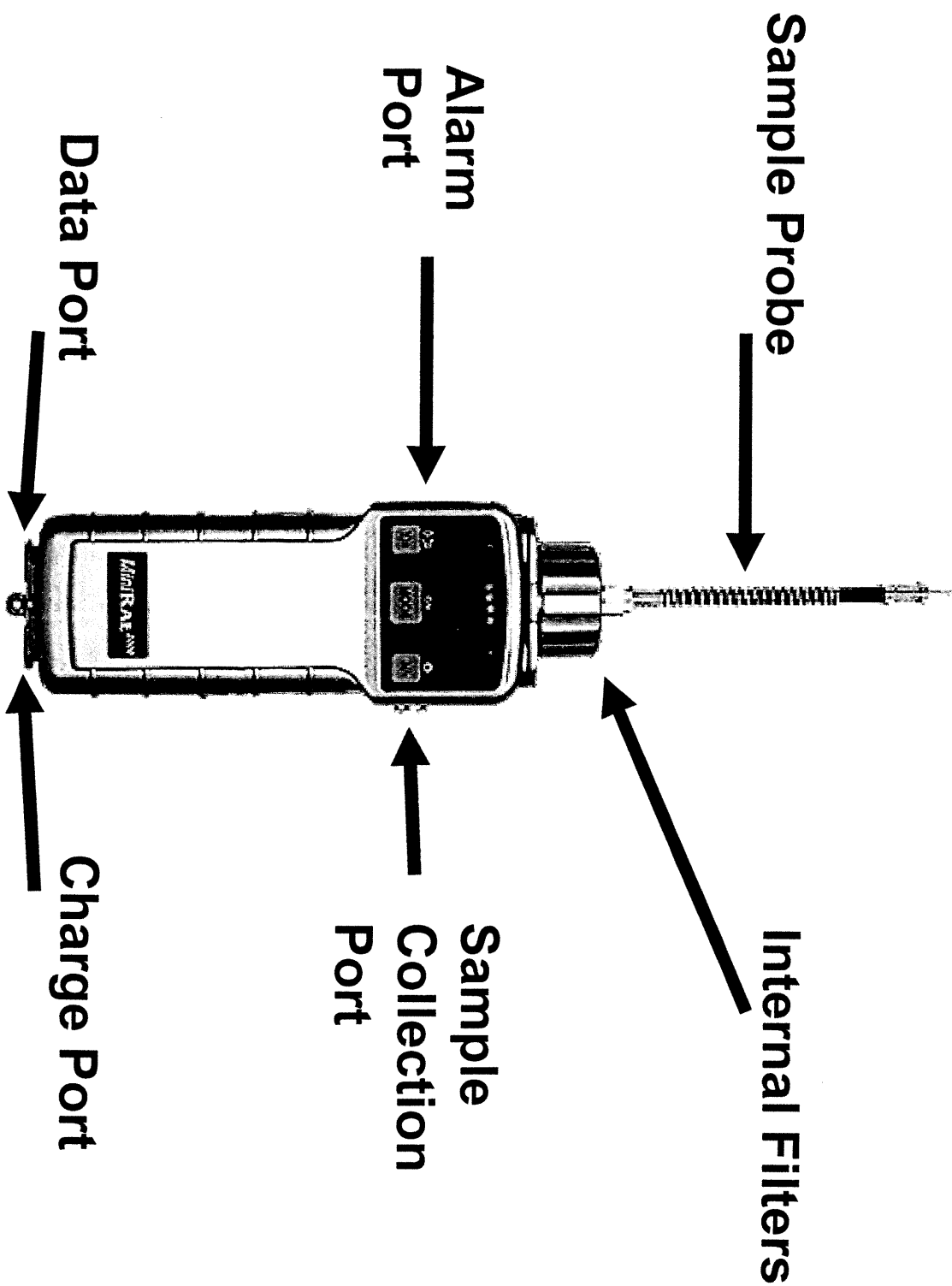
- Extremely rugged for extensive field use
- Weather Proof Case with gasketed case breaks
- Temperature range of 14°F to 113°F (-10°C to 40°C)
- 4-Way power: NiMH, Alkaline or run continuously on 110 VAC and 12 VDC
- RFI protection against radio interference
- Intrinsically safe: Class I, Division I, Groups A, B, C, D

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RAE 2000: Physical Description

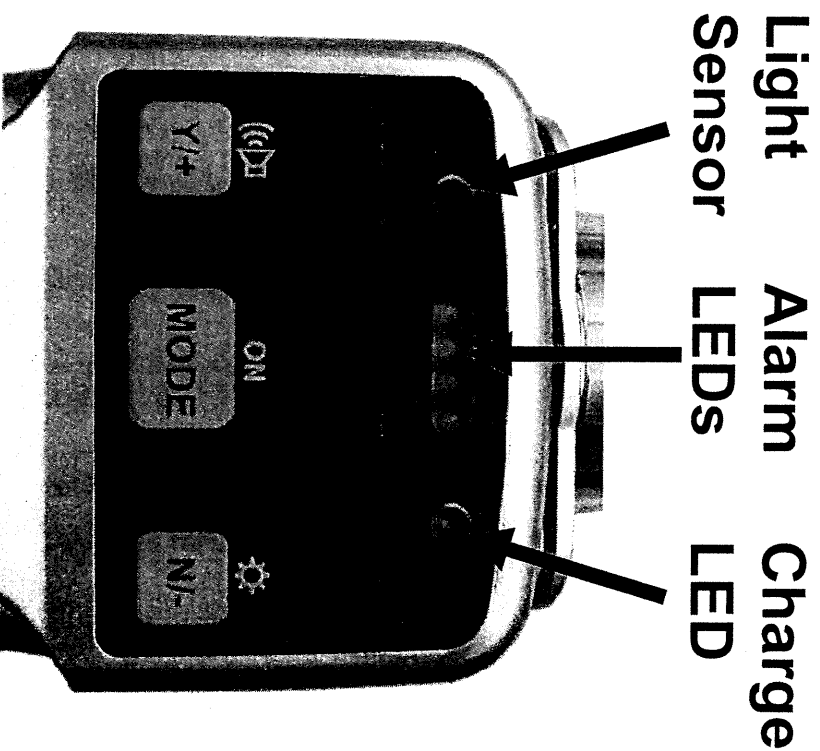


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MinirAE 2000: Faceplate

- Three buttons on a sealed membrane faceplate:
 - Y/+ (horn): clears & tests alarms
 - N/- (light): turns on manual backlight for 60 seconds
 - MODE (on)





Start-up: Turning On

- Unplug MiniRAE 2000/ppbRAE from charger
- Hold "MODE" Key to turn on
- Alarm will beep once
- Watch display screen for configuration messages.
- Warm-up will take approximately 30 seconds



RAE 2000: Survey/Hygiene Mode

The MiniRAE 2000 and ppbRAE have two main operating modes:

- **Survey Mode:** the factory default mode. After warm-up the pump shuts off and "Ready" is displayed.
- **Hygiene Mode:** for health and safety applications. After warm-up the meter samples continuously (similar to MultiRAE & AreaRAE).

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RAE 2000: Survey Mode

- A discrete sampling mode can easily start/stop datalogging for many points
- Perfect for drum or headspace sampling



Survey Displays

**Ready/Instantaneous reading
Stop?**

**Advance to next
screen with
“Mode” key**

Avg: shows average reading
Peak: holds highest reading

Run Time:

Battery Voltage & Shut-Off

Date/Time/Temperature: (MiniRAE 2000 Only)

Log On/Off? Starts Manual Datalog

Cancel/Show Background: ppbRAE only

PC comm?

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Survey Mode: Ready Screen

Ready...

- After warm-up the pump will stop and display will read “Ready...” The MiniRAE is in stand-by mode ready for sampling.
- To start sampling push the “Y” key

Site ID = Drum 043

- The Site ID screen will increase by one digit every time that the MiniRAE is started and stopped in Survey Mode.



Survey Mode: Ready Screen

Gas = Isobutylene

- The “Gas =” screen shows the Correction Factor (CF) Gas currently in use.
- Stop sampling in survey mode by pressing the mode key. The display will show “Stop ?”

Stop ?

- Pressing “Y” will stop sampling and return to the “Ready” screen.

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Start-up: Lamp Alarm

0.0 Lamp

“Lamp” display along with audible alarm indicates that PID lamp has failed to light

If after a few minutes the “Lamp” message remains, turn off MiniRAE 2000 and restart

If after restart “Lamp” message disappears, MiniRAE 2000 is ready for use

If after restart “Lamp” message remains, the PID needs service

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Start-up: Pump Check

0.0 Pump

Every time the MiniRAE 2000 is used it is important to check pump flow

Block the probe inlet, the MiniRAE 2000 will go into alarm and display "Pump"

Reset pump alarm by pressing the "Y" key

If pump does not go into alarm, check for leaks in the probe or service pump

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Survey Mode: Alarms

50.0 ppm

The MiniRAE 2000 will beep twice per second when the low alarm has been exceeded.

The MiniRAE 2000 will beep three times per second when the low alarm has been exceeded.

Press "Y/+" key to clear if latching alarm.

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Survey Mode: Peak Clearing

Peak 78.0 ppm

Press the “Y” key once during the “Peak” display

Reset Peak?

Pressing the “Y” key once during the “Reset Peak?” screen will clear the Peak Hold feature

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Hygiene Mode: Datalog Indicator

0.0 L ppm

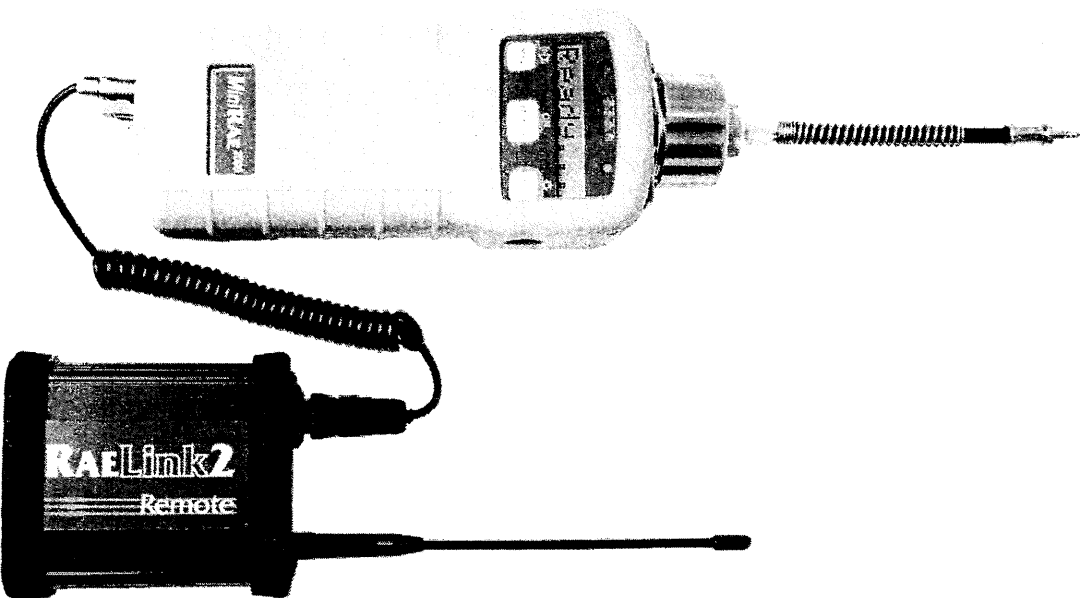
- The small “L” indicates that the MiniRAE 2000 is datalogging.



Hygiene Mode: Wireless Indicator

0.0 T ppm

- The small "T" indicates that the MiniRAE 2000 or ppbRAE is communicating to a host computer running ProRAE Remote software via the optional wireless RAElink modem.



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ppbRAE: Canceled Background

0.0 + ppm

- The ppbRAE has the ability to cancel the background without recalibration.
- When background is canceled, alarms are still based upon actual levels. Datalogging records actual levels.
- The small “++” indicates that the background has been canceled.

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MultIRAE 2000: Hygiene Mode

- A continuous sampling mode for health & safety applications like confined space entry.
- Alarms are just like those on the MultIRAE, QRAE and ToxiRAE



Hygiene Displays

Instantaneous reading

TWA: Time Weighted Average

STEL: Short Term Exposure Limit (displays "*" unit 15 minutes of run time have elapsed)***

Peak: holds highest reading Advance to next

Run Time screen with

Battery Voltage "Mode" key

Date/Time/Temperature: (MiniRAE 2000 only)

Log On/Off? Starts Manual Datalog

Cancel/Show Background: (ppbRAE only)

Gas= Correction Factor Gas (MiniRAE 2000 only)

PC comm?

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Hygiene Mode: High Alarm

9999 High

“High” display along with 3 beep audible alarm, flashing alarm LEDs and flashing display backlight indicates that the High alarm setpoint has been exceeded.

Press “Y/+” key to clear if latching alarm.



Hygiene Mode: Low Alarm

50.0 Low

“Low” display along with 2 beep audible alarm, flashing alarm LEDs and flashing display backlight indicates that the Low alarm setpoint has been exceeded. Press “Y/+” key to clear if latching alarm.



Hygiene Mode: STEL Alarm

50.0 STEL

“STEL” display along with 1 beep per second audible alarm, flashing alarm LEDs and flashing display backlight indicates that the Short Term Exposure alarm setpoint has been exceeded.

This alarm will only clear if the average concentration dips below the STEL alarm setpoint or the PID is turned off.



Hygiene Mode: TWA Alarm

50.0 TWA

“TWA” display along with 1 beep per second audible alarm, flashing alarm LEDs and flashing display backlight indicates that the Time Weighted Average alarm setpoint has been exceeded.

This alarm will only clear if the average concentration dips below the TWA alarm setpoint or the PID is turned off.

The Hazardous Environment Detection Company



Hygiene Mode: Pump Alarm

0.0 Pump

“Pump” display along with 3 beep audible alarm indicates that pump has stopped due to line clog or a clogged sample port.

Pump alarm is a latching alarm

Press “Y/+” key to clear alarm and restart pump



Hygiene Mode: Battery Alarm

0.0 Bat

A flashing “Bat” display along with a 1 beep alarm every 10 seconds indicates that the battery voltage is low and MiniRAE 2000 or ppbRAE will shut down in 20-30 minutes

Full battery is over 4.8 volts

Low Bat alarm at 4.4 volts

Shut down at 4.2 volts

The Hazardous Environment Detection Company



Getting Into Programming

The Hazardous Environment Detection Company

- Hold “MODE” and “N/-” keys for 5 sec. to get in *Programming Mode*
- If MiniRAE 2000 asks a question “?”
 - Answer “Y” or “N”
- To Accept or Escape
 - Use “MODE” Key
 - repeatedly pushing the “MODE” key will always eventually return user to main display



Programming Menus

- Calibrate/select Gas? (alarms are silenced *when in this menu*)
- Change alarm limits?
- View/change datalog?
- Change monitor setup?
- Choose (Y) to accept or (N) to move on

If you get lost, refer to Appendix A-1 in

MiniRAE 2000 Manual

The Hazardous Environment Detection Company



Calibrate Monitor?

- Fresh air/Zero cal?
 - Make sure air is clean or use Charcoal filter
- Span cal?
 - From v1.20 on, ppbRAEs do not use an electronic zero, so make sure to use a VOC Zeroing tube or Ultra-zero air
 - Refer to TN-150 for ppbRAE zeroing
- Span cal?



*Choose (Y) to accept or (N) to move on,
MODE to escape*



Basic Span Calibration

Cal gas = Isobutylene

Span value = 0100.0

These two screens **MUST** match the type and concentration of cal gas used (MiniRAE is ppm, ppbRAE in ppb)

If they do not, reset the MiniRAE to "Cal Memory 0" under the "Select Cal Memory" menu.

The Hazardous Environment Detection Company



Basic Span Calibration

Apply gas now!

Attach calibration hose to MiniRAE 2000
and make sure it is tight

Turn on calibration gas and it will be
automatically detected by the MiniRAE
Follow instructions on screen

Disconnect regulator when finished
calibration

The Hazardous Environment Detection Company



Basic Span Calibration

NO Gas!

If you get this screen check for gas flow
Try span calibration again after you
have verified that the gas is correct and
is flowing properly through the regulator
Press [Y/+] if gas is OK to override the
message and start the calibration

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Matched Flow Calibration

***For best accuracy a matched flow
calibration is required!***

- Use matched flow regulator
- Fill Tedlar bag with calibration gas and then draw down with MiniRAE 2000
- Use “T” or open tube connection with excess flow

***ppbRAE always requires matched flow
calibration!***

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Calibrate Monitor?

- Select cal memory?
 - For most uses, leave on “Cal Memory 0”, which is for Isobutylene calibration and optional correction factors
 - Changing the cal memory lets you calibrate using a gas other than Isobutylene
 - Lets you load 7 frequently used gases
 - **For advanced users only**

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Calibrate Monitor?

- Change span value? (*NOTE: the value in the ppbRAE is in parts per billion not ppm! 10000 ppb = 10 ppm*)
- Modify cal memory?
 - *Changes Measurement Gas name, Correction Factor **AND ALARM POINT***
- Change correction factor?
Choose (Y) to accept or (N) to move on, MODE to escape



Change Alarm Limits?

- High limit?
- Low limit?
- STEL limit?
- TWA limit?

– *These values are set to the default values for each gas selected under “Modify Cal Memory” but can be modified in these menus.*

*Choose (Y) to accept or (N) to move on,
MODE to escape*

The Hazardous Environment Detection Company



View/Change Datalog?

- Reset Peak? (not in ppbRAE)
- View data?
- Clear data?
- Change data period?
- Change average type?

*Choose (Y) to accept or (N) to move on,
MODE to escape*



Change Monitor Setup?

- Change Op Mode? *Survey or Hygiene*
- Change Site ID?
- Change User ID?
- Change Alarm Mode? *Reset or Latched*
- Change User Mode? *Program/Display*
- Change Date?
- Change Time?

*Choose (Y) to accept or (N) to move on,
MODE to escape*



Change Monitor Setup?

- Change Lamp? (9.8, 10.6, 11.7 eV)
 - *ppbRAE 10.6 eV only*
- Change Lamp Duty Cycle?
 - For self-cleaning during continuous operation
 - Pump runs then turns off, the lamp remains on to clean the sensor and lamp surface
 - When concentration exceeds 2 ppm the pump runs continuously until the concentration drops
 - Set to 30-100%. Time on in a 10 second interval. If set to 30% then on 3 seconds off 7 seconds. If set to 50% then on 5 off 5 seconds.
 - Will reduce loss of span sensitivity to <5% running 24/7 for over 90 days in backgrounds of <10 ppm (Refer to TN-165)



Change Monitor Setup?

- Change Unit? (*ppm or mg/m³*)
- Change Pump Speed? (*ppbRAE only*)
- Change Dilution Ratio? (*M2K only*)
- Change Output? (*DAC or Alarm*)
- Change DAC range? (*20, 200, 2000, 10k ppm*)
- Set Temperature Unit? (*°C or °F*)

*Choose (Y) to accept or (N) to move on,
MODE to escape*

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Power Off

- Hold Mode Key for full 5 seconds
- Audible alarm will beep and display will read "Power-down in ...5 seconds"
- Leave MiniRAE 2000 on charger when not in use



Smart Charging

Deep Discharge?

- Plug 12 VDC charger into charge port
- The screen will display "Deep Discharge?" for 10 sec.
 - *Pushing "N/-" will initiate charging*
 - *Don't push anything and the unit will switch to charge in 10 sec.*
 - *Full charge can take up to 8 hours*
 - *Deep Discharge is not necessary for Nickel Metal Hydride batteries in MiniRAE 2000 or ppbRAE*

The Hazardous Environment Detection Company



RAE 2000: Self-Cleaning

Patented RAE Systems Breakthrough!

- Lamp runs for 4 hours during charging
- Generates small amounts of ozone which helps to scrub sensor and lamp clean
- With probe removed user will see the sensor glow purple during charging
- Does not decrease lamp life
- Drastically increases PID stability and reduces requirement for cleaning (Refer to TN-165)

The Hazardous Environment Detection Company

The Hazardous Environment Detection Company



Maintenance

- Clean PID Lamp & Sensor
 - When display creeps upwards after good zero
 - When PID responds to moisture
 - When movement of PID results in response on display

Clean Sensor

Bias Electrode

No dirt build-up to foster a decrease in airspace resistance

Dirty Sensor

Bias Electrode



Dirt build-up absorbs water and breaks down airspace resistance leading to sensor "leakage" or moisture response



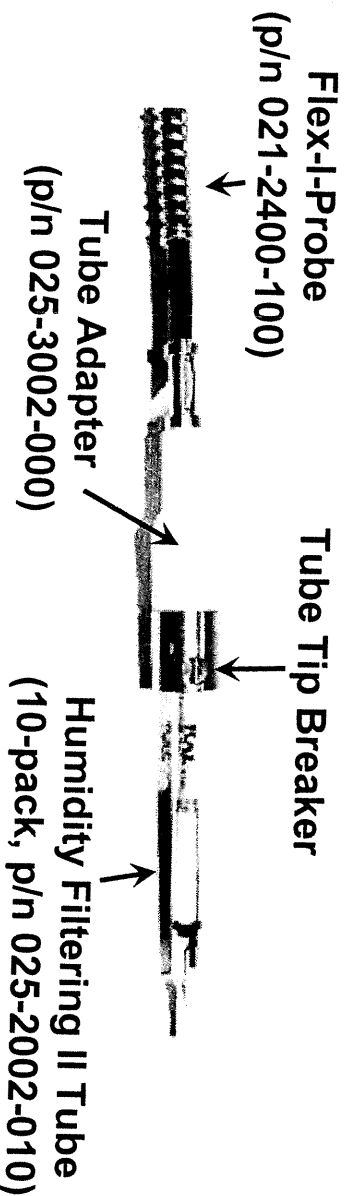
Maintenance

- **How to Clean PID Sensor**
 - Always clean sample probe and replace or clean filters FIRST! If PID holds a stable zero after this step then further cleaning may not be necessary
 - Use anhydrous methanol (Lamp cleaning solution)
 - Clean lamp face with lens tissue
 - Clean sensor by immersion in cleaning solution
 - Ultrasonic Cleaner (Jewelry cleaner) for 15 min. cleans much better than just dipping in
- **Drying the PID Sensor**
 - Let air dry overnight
 - Warm air (not hot) will speed drying

The Hazardous Environment Detection Company



Humidity Filtering II Tubes



- Temporary relief for a dirty sensor
- Dries sample gas for about 1/2 hour
- Measure VOCs; multiple sample use OK
- Useful for gasoline and chlorinated solvents
- **CAUTION:** May cause low response for some compounds or at low temperature or concentration

The Hazardous Environment Detection Company

The Hazardous Environment Detection Company



Configuration from Computer Datalogging

The Hazardous Environment Detection Company



Questions?

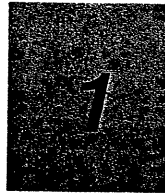
Service: 888-723-4800

Sales: 877-723-2878

ATTACHMENT 2

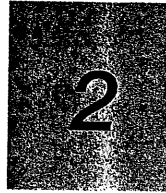
FULL SYSTEM AS-BUILT and O&M MANUAL

1



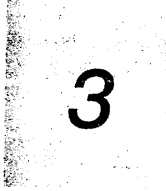
Warranty Information

4



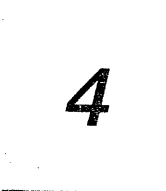
Electrical Prints

37



Mechanical Prints

43



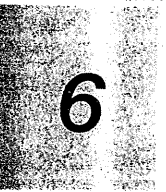
Startup Procedure

49



Carbon

61



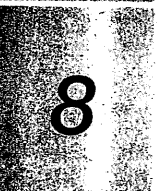
Blowers

111



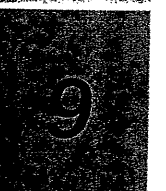
Instruments

143



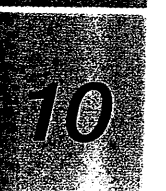
Filters

172

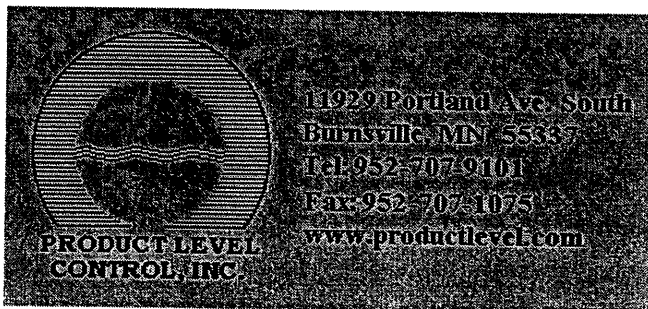


Water Pumps

203



Air Water Separator



Warranty/Customer Support Policy

WARRANTY POLICY. PLC warrants the equipment manufactured by PLC, and not by others, to be free from defects in workmanship and material under normal use and service for a period of one (1) year from date of delivery. Use or service with corrosive or abrasive chemicals or materials is not deemed normal. Components manufactured by others, including expendable items, are warranted only in accordance with the warranty, if any, issued by such other manufacturer. Upon written notice from BUYER specifying the particular defect or defects, PLC will correct without charge any workmanship which is demonstrated to PLC's satisfaction to have been defective at time of installation or erection and will repair or replace without charge, f.o.b. PLC's factory, parts which upon inspection are found defective under normal use within the warranty period above stated. All work of removal and reinstallation or installation of parts, whether or not found defective and shipping charges for defective or replacement parts shall be at the sole expense of BUYER. The foregoing warranty shall not apply to (i) work done or materials furnished by others or (ii) equipment altered by others, unless such repairs or alterations were specifically agreed to in writing by an officer of PLC. All routine maintenance, such as lubrication, adjustments and replacement of expendable items and production consumables and the like are the responsibility of the BUYER. THE WARRANTY HEREIN IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES WHATSOEVER, AND SPECIFICALLY THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, PLC SHALL NOT BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES WHATSOEVER WITH RESPECT TO EQUIPMENT MANUFACTURED OR SUPPLIED BY, OR SERVICES RENDERED BY, PLC.

Limitations of Warranties

1. All invoices are paid consistent with PLC's Terms and Conditions including having no balances past due.
2. All parts returned for warranty will be evaluated either by PLC or the Manufacturer to be determined if covered under warranty or not covered.

Warranty Claim

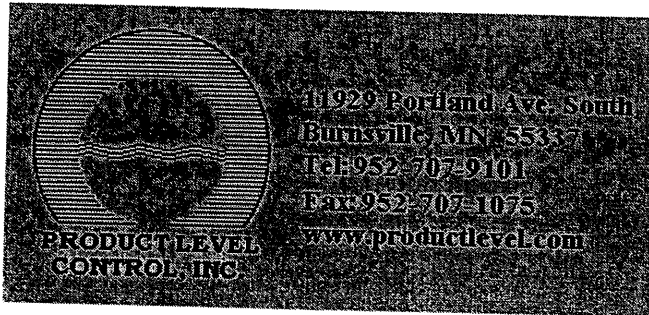
- PLC will work quickly to resolve warranty claims. PLC requires notification of any equipment or part failure at time of occurrence and failure to do so may disqualify the warranty claim.
- On failed components, call PLC for a Return Material Authorization (RMA) number and PLC will immediately send a replacement part or act as a customer representative on any manufacturer warranty. PLC will forward an invoice at time of shipment. The BUYER must return the suspect part using the RMA number and PLC or the component manufacturer will make a final determination if the part is covered under warranty. If the part is covered under warranty, a credit will be issued; otherwise it is the BUYER's responsibility to pay the invoice.
- On system/equipment warranty, PLC will work closely with BUYER and take what we feel is appropriate action to bring the system/equipment up to compliance to the agreed specifications. No charges will be assessed to the customer for repairs needed to bring the system up to the agreed specifications. PLC will charge the customer if: 1) changes need to be made beyond what was specified 2) the system was incorrectly installed or 3) the equipment was subjected to extraordinary conditions.

Customer Support (post Warranty period)

For equipment and systems beyond the warranty period, upon request, PLC will provide a quotation for the BUYER 's approval. Our sales representative can provide a quotation.

APPLICABLE LAWS

All rights and obligations of the parties hereto shall be governed by and enforced in accordance with the laws of the State of Minnesota including the Minnesota Uniform Commercial Code. Any disputes under this agreement, including breach of performance hereof, shall be litigated and venued in the state or federal courts located in Hennepin County, Minnesota. PLC and BUYER hereby submit to the personal jurisdiction of such courts.



Start Up/Service

Product Level Control, Inc. (PLC) inspects and tests all equipment before shipping to assure all performance requirements are met. It is the responsibility of the BUYER to make certain the equipment is installed properly and completely. The BUYER can request assistance from Product Level Control, Inc. for start-up services or operation and maintenance at normal service rates. Current Service Rates are listed below.

SERVICE/LABOR RATES

	Service/Travel First 8 hours	Service/Travel Overtime
Monday through Friday	Technician \$85/hr.	Technician \$125/hr
Monday through Friday	Engineer \$100/hr.	Engineer \$150/hr

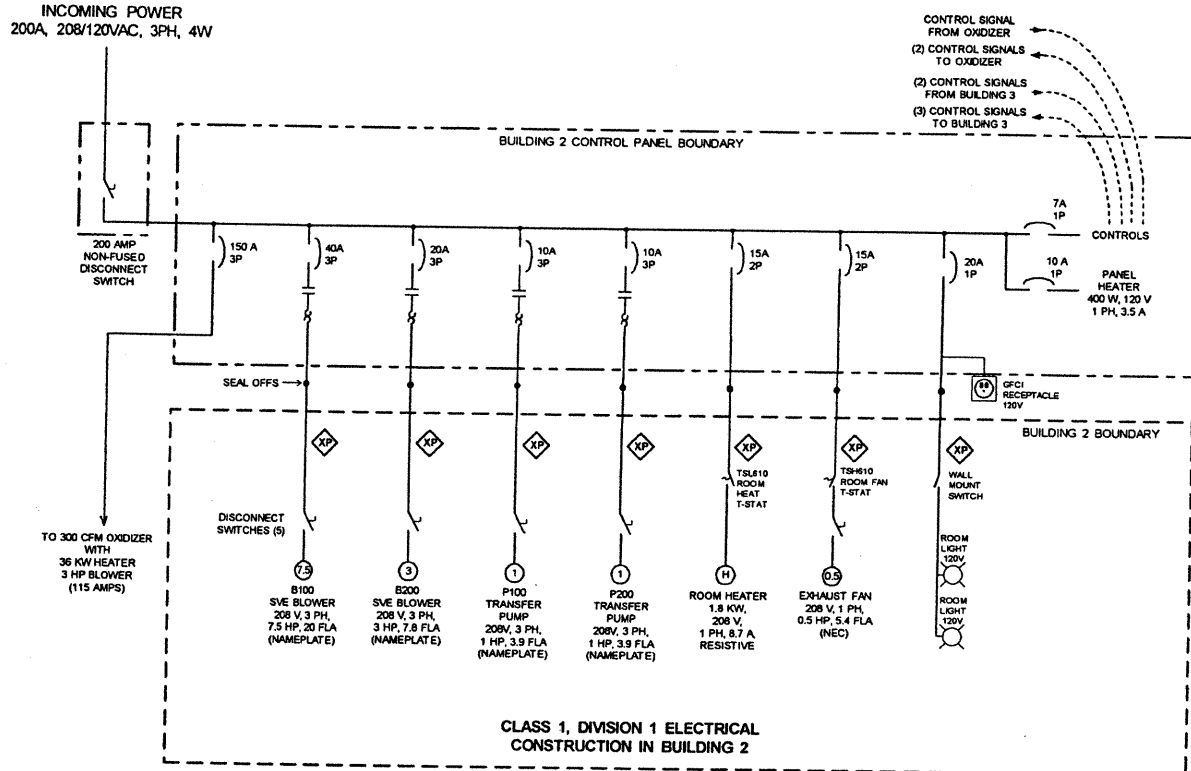
Product Level Control Inc. serviceman will present a daily log of time worked/traveled for signature by the BUYER'S representative.

Travel expenses are in addition to the Service/Labor rates.

Time is defined as door to door.

If the BUYER requests serviceman to stay over weekend/holiday to be available on the following workday the BUYER will be billed 8 hours per day at the service rate for each weekend/holiday plus expenses.

INCOMING POWER
200A, 208/120VAC, 3PH, 4W



PRODUCTION
DRAWING

DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 2 PROD

1. 10

None

FCU

08/01/08

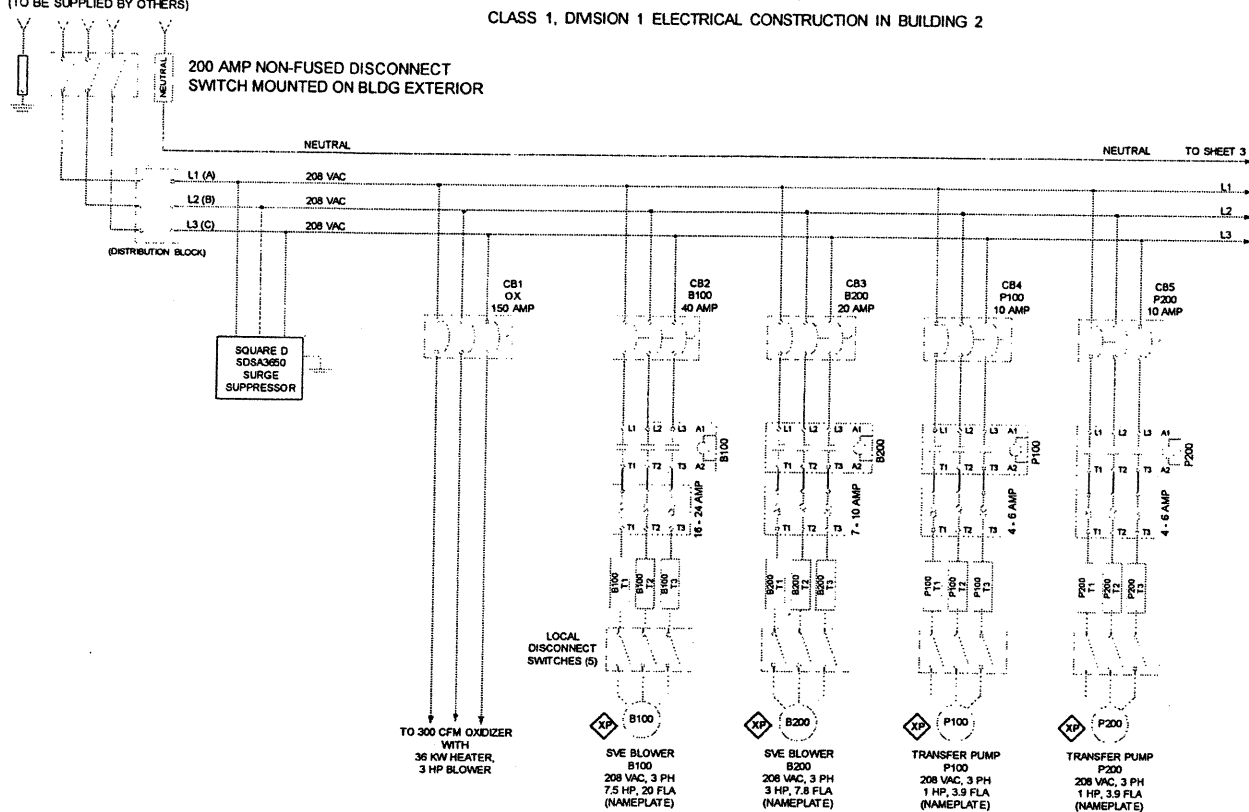
2007-014

BLDG 2 SINGLE LINE POWER DIAGRAM

208/120 VAC, 200 AMP, 4 WIRE,
3 PHASE, 60HZ POWER
(TO BE SUPPLIED BY OTHERS)

SOIL VAPOR EXTRACTION (BLDG 2) CONTROL SYSTEM

CLASS 1, DIVISION 1 ELECTRICAL CONSTRUCTION IN BUILDING 2



PRODUCTION
DRAWING



DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 2 PROD

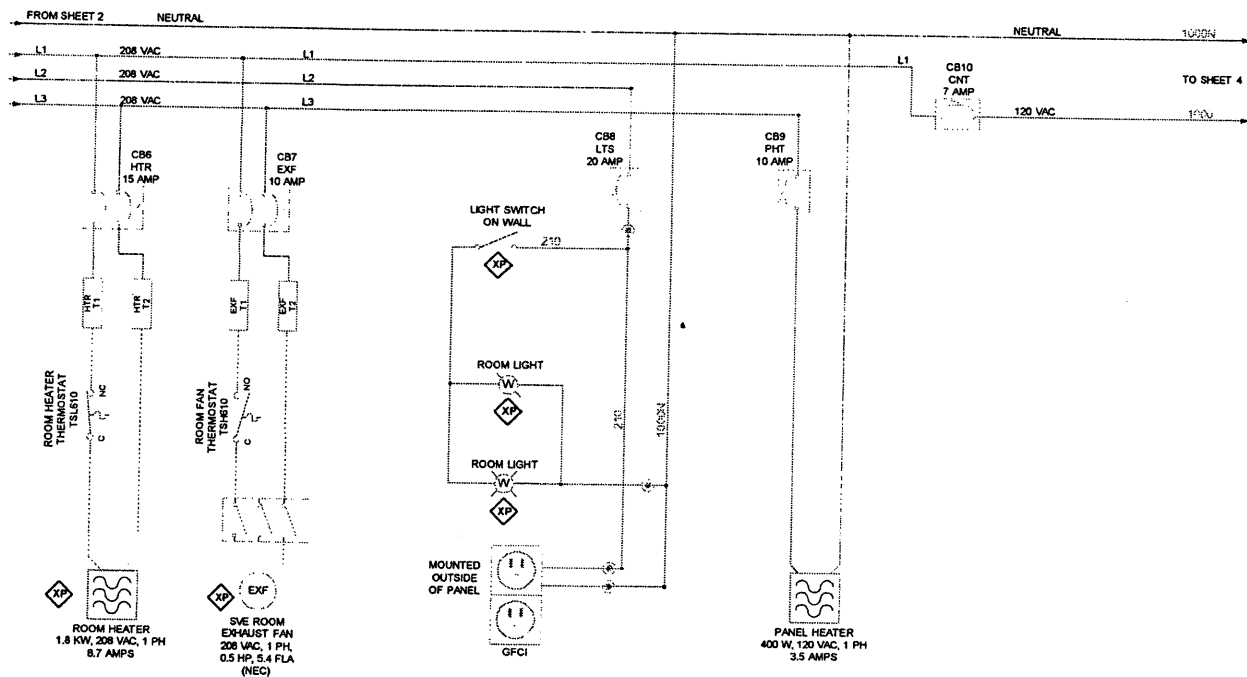
2-10

None

FCU

08/01/08

POWER DISTRIBUTION



PRODUCTION
DRAWING



DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 2 PROD

3-10

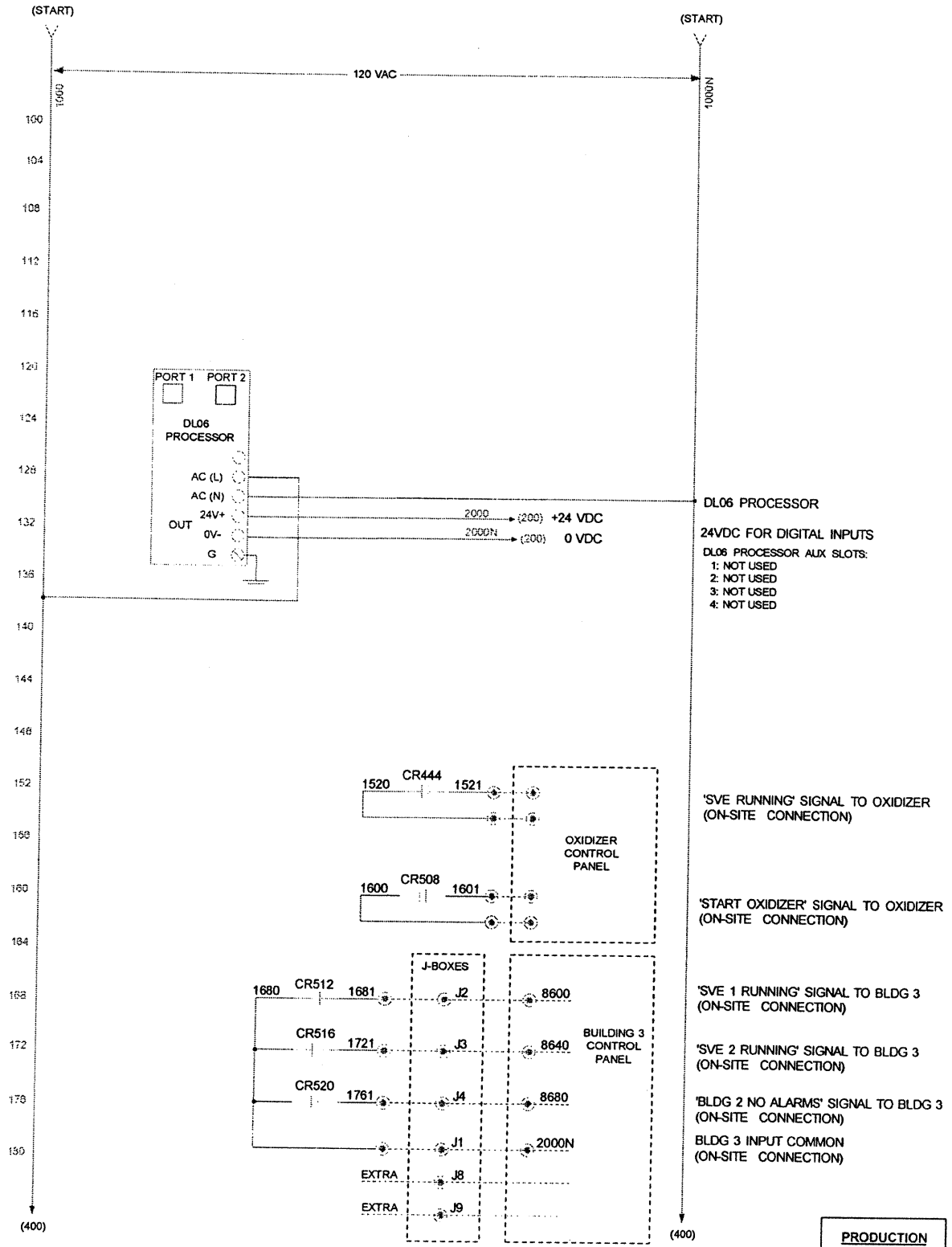
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FCU

08/01/08

2007-014

POWER DISTRIBUTION



DEXTER CHEMICAL
BRONX, NY

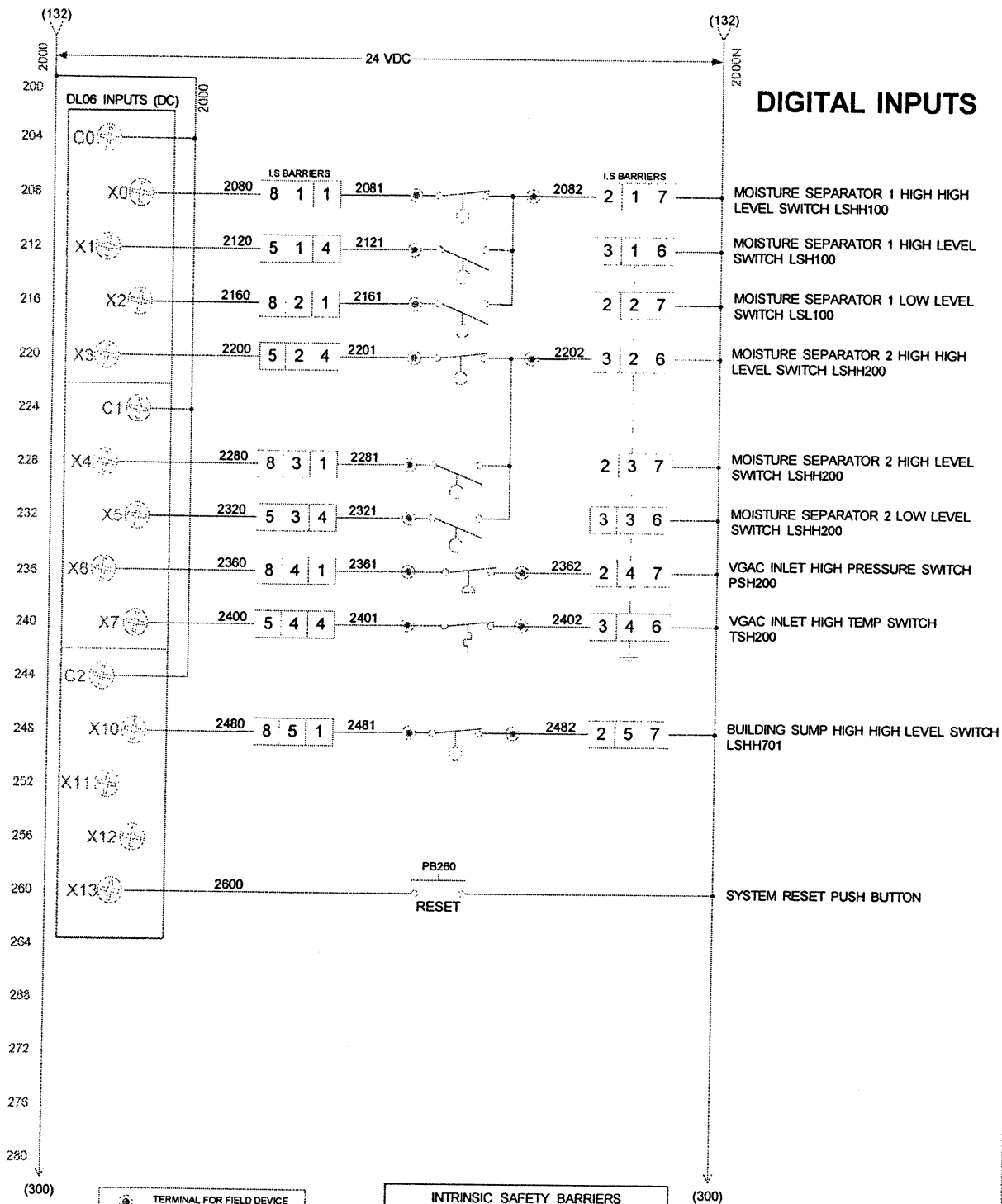
2007-014

07-014 BLDG 2 PROD 0

4 10 None

FCU 08/01/08

PLC & COMMUNICATION WIRING



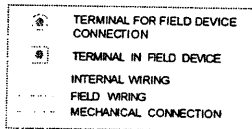
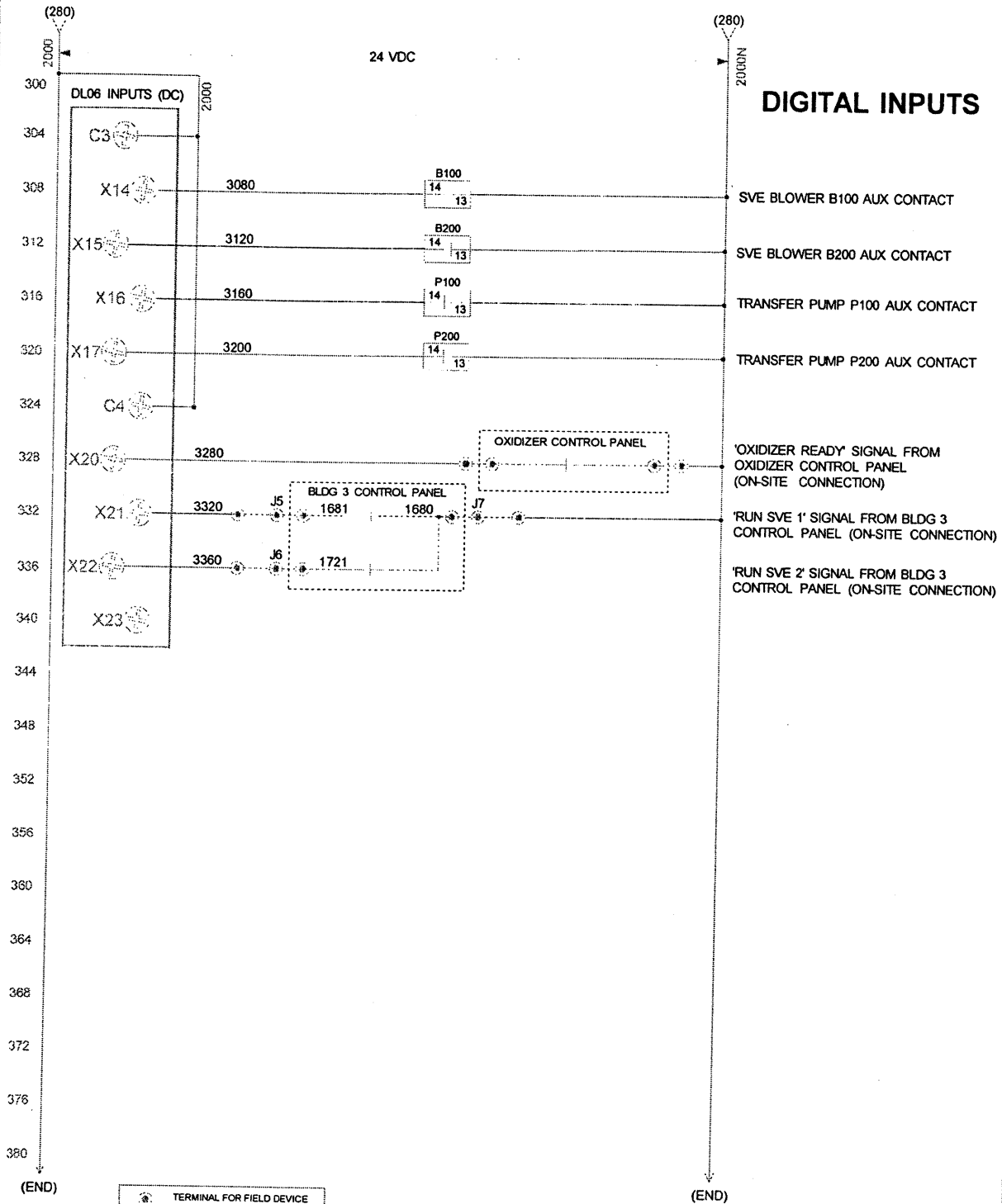
**PRODUCTION
DRAWING**



DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 2 PROD 0
REV 5 10 None
FCU 08/01/08

2007-014 INTRINSIC DC INPUTS



**PRODUCTION
DRAWING**

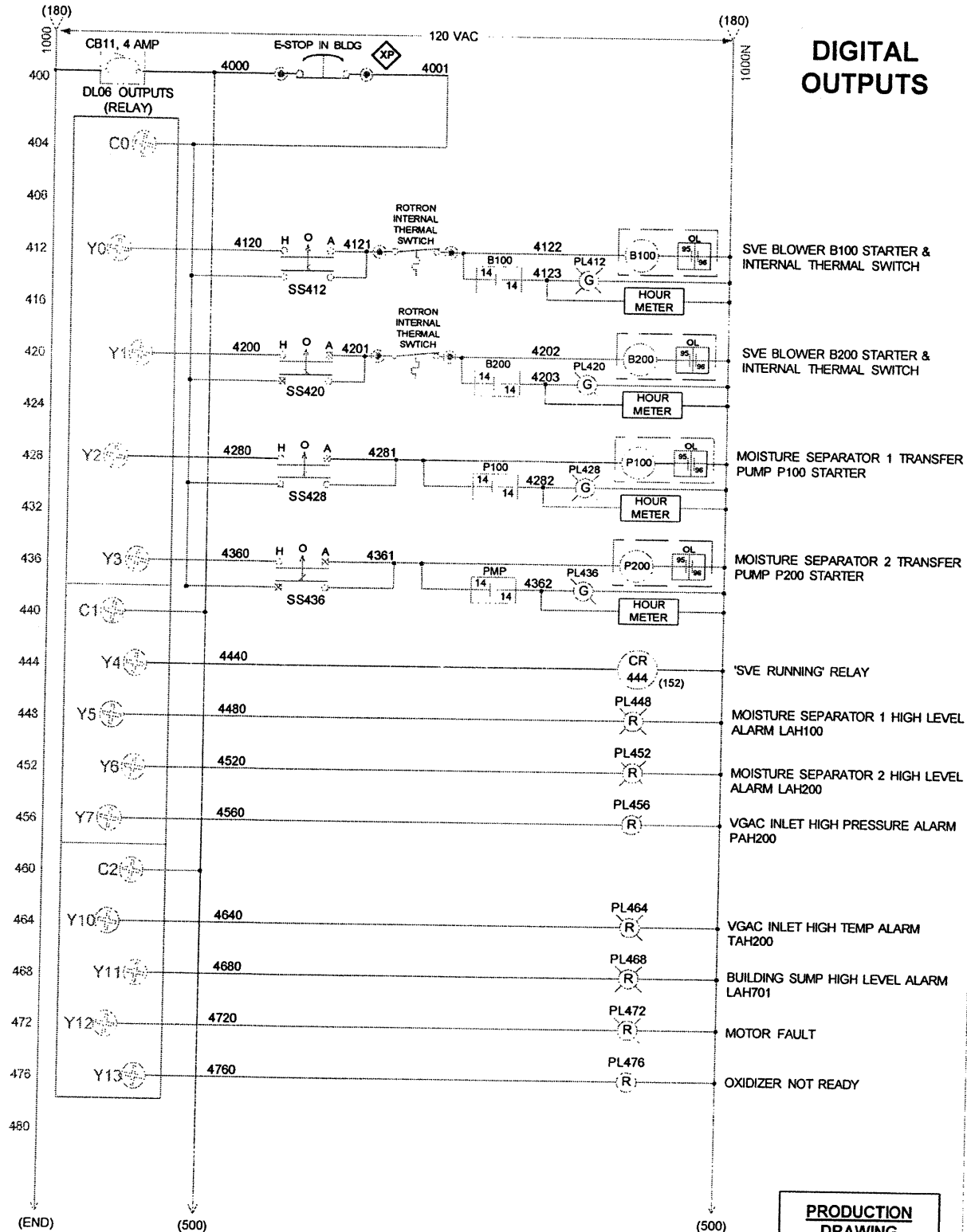
DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 2 PROD 0
 6 10 None
 FCU 08/01/08
 GENERAL DC INPUTS

3:49:03 PM 8/12/2008

DIGITAL OUTPUTS

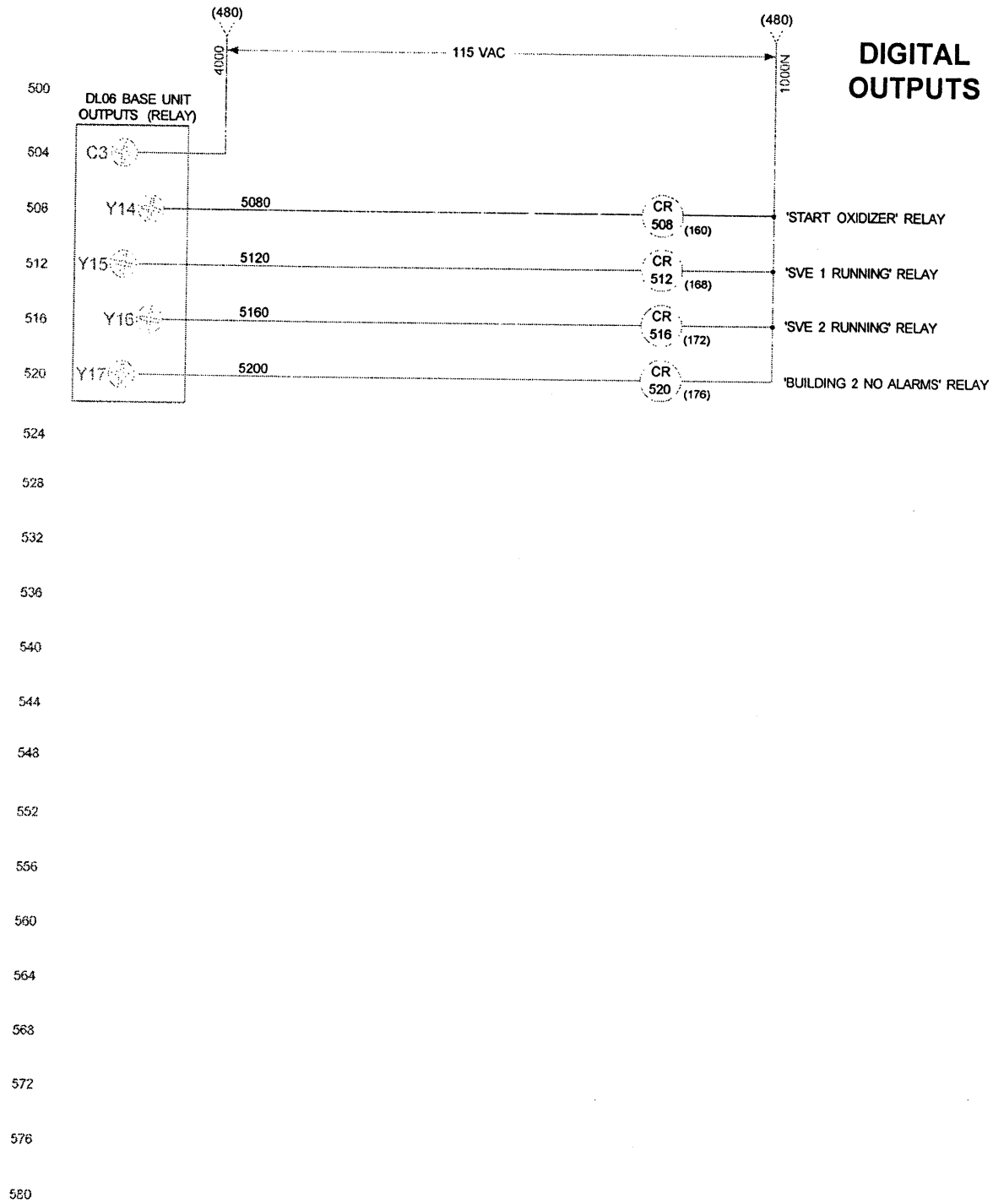


○ TERMINAL FOR FIELD DEVICE CONNECTION
 ● TERMINAL IN FIELD DEVICE
 — INTERNAL WIRING
 - - - FIELD WIRING
 — MECHANICAL CONNECTION

DEXTER CHEMICAL
BRONX, NY

2007-014 120 VAC DIGITAL OUTPUTS

07-014 BLDG 2 PROD 0
 7 10 None
 FCU 08/01/08



DIGITAL OUTPUTS

(480) TERMINAL FOR FIELD DEVICE CONNECTION
 (480N) TERMINAL IN FIELD DEVICE
 INTERNAL WIRING
 FIELD WIRING
 MECHANICAL CONNECTION

**PRODUCTION
DRAWING**



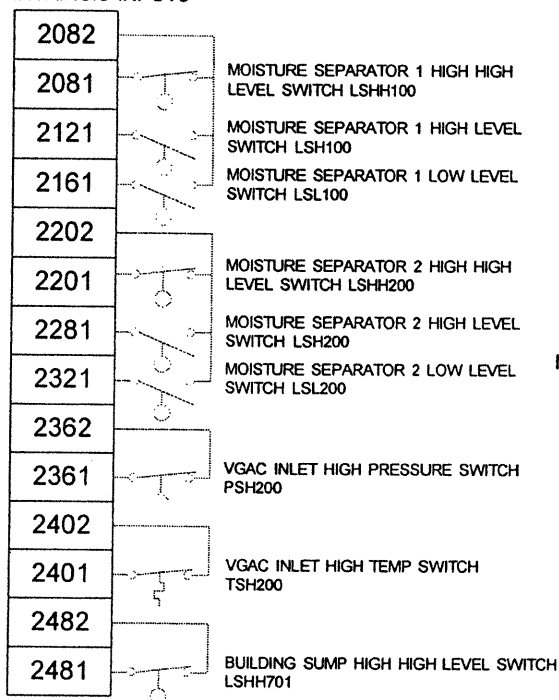
DEXTER CHEMICAL
BRONX, NY

2007-014

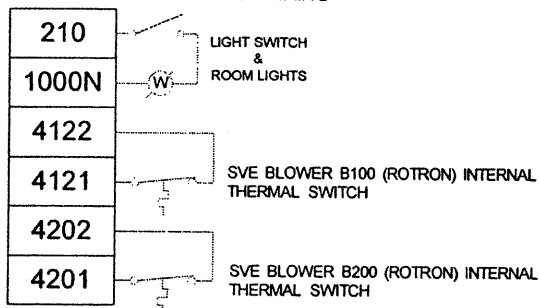
07-014 BLDG 2 PROD 0
 8 10 None
 FCU 08/01/08
 120 VAC DIGITAL OUTPUTS

CONNECTION DIAGRAM FOR FIELD DEVICES

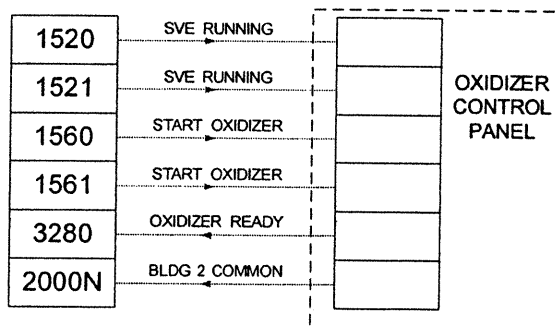
INTRINSIC INPUTS



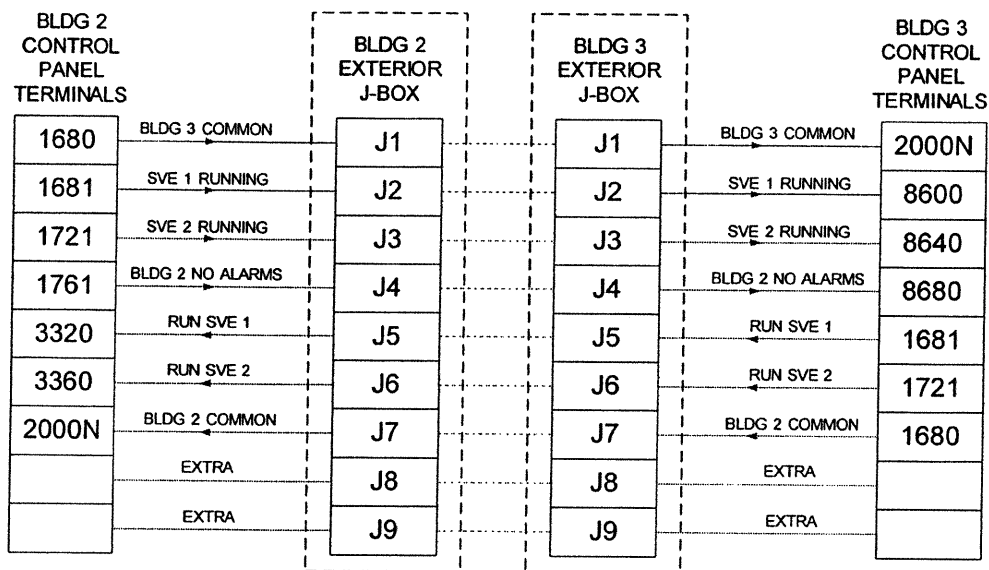
NON-INTRINSIC 120 VAC WIRING



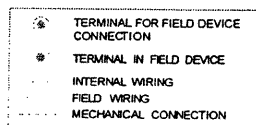
NON-INTRINSIC 24 VDC INTER PANEL WIRING ON-SITE CONNECTIONS



INTER-PANEL 24 VDC CONTROL WIRING



**PRODUCTION
DRAWING**



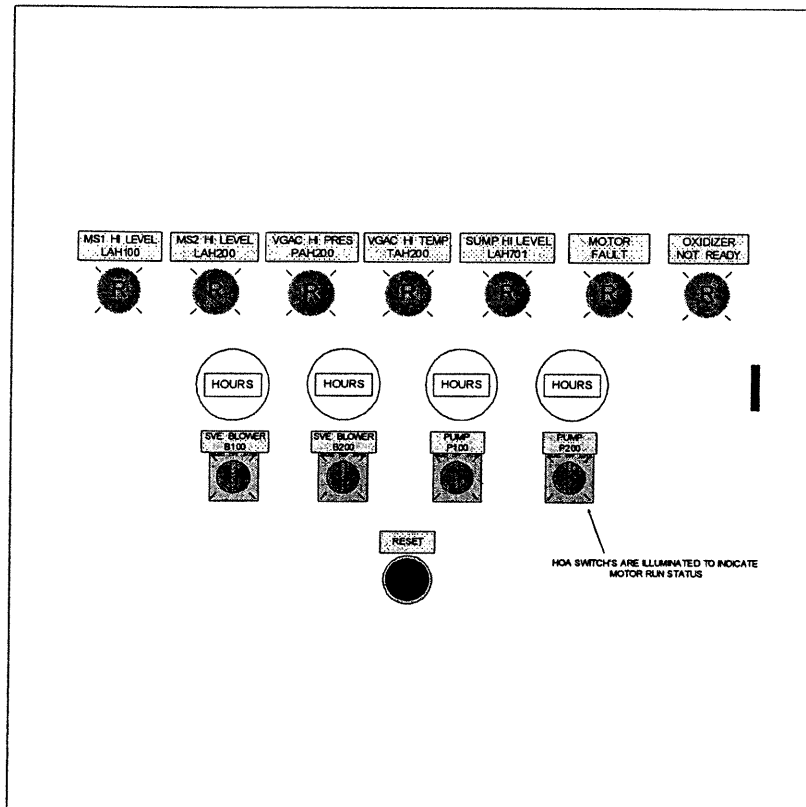
DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 2 PROD
Rev: 9.14.10
FCU
08/01/08
None
FIELD CONNECTIONS

BLDG 2 CONTROL PANEL FRONT VIEW

NOTE: CONTROL PANEL TO BE NEMA 4, LOCKABLE
CONTROLS SHOWN ON INTERNAL SWING-OUT PANEL
(ENCLOSURE DOOR DEAD-FRONT, LOCKABLE, MOUNTED OUTSIDE BLDG 2)



DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 2 PROD

0

10 10

NONE

FCU

08/01/08

2007-014

DOOR LAYOUT DRAWING

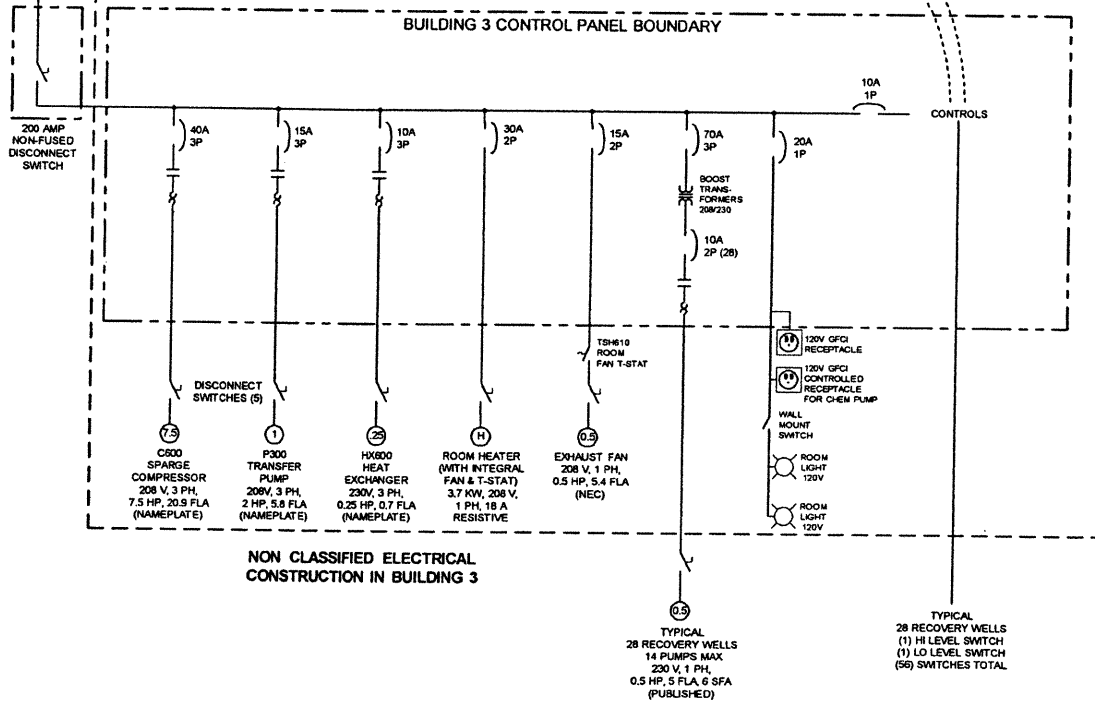
3:49:03 PM 8/12/2008

INCOMING POWER
150A, 208/120VAC, 3PH, 4W

(2) CONTROL SIGNALS
TO BUILDING 2
(3) CONTROL SIGNALS
FROM BUILDING 2

BUILDING 3 BOUNDARY

BUILDING 3 CONTROL PANEL BOUNDARY



PRODUCTION
DRAWING



DEXTER CHEMICAL

BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1

1-23

None

FCU

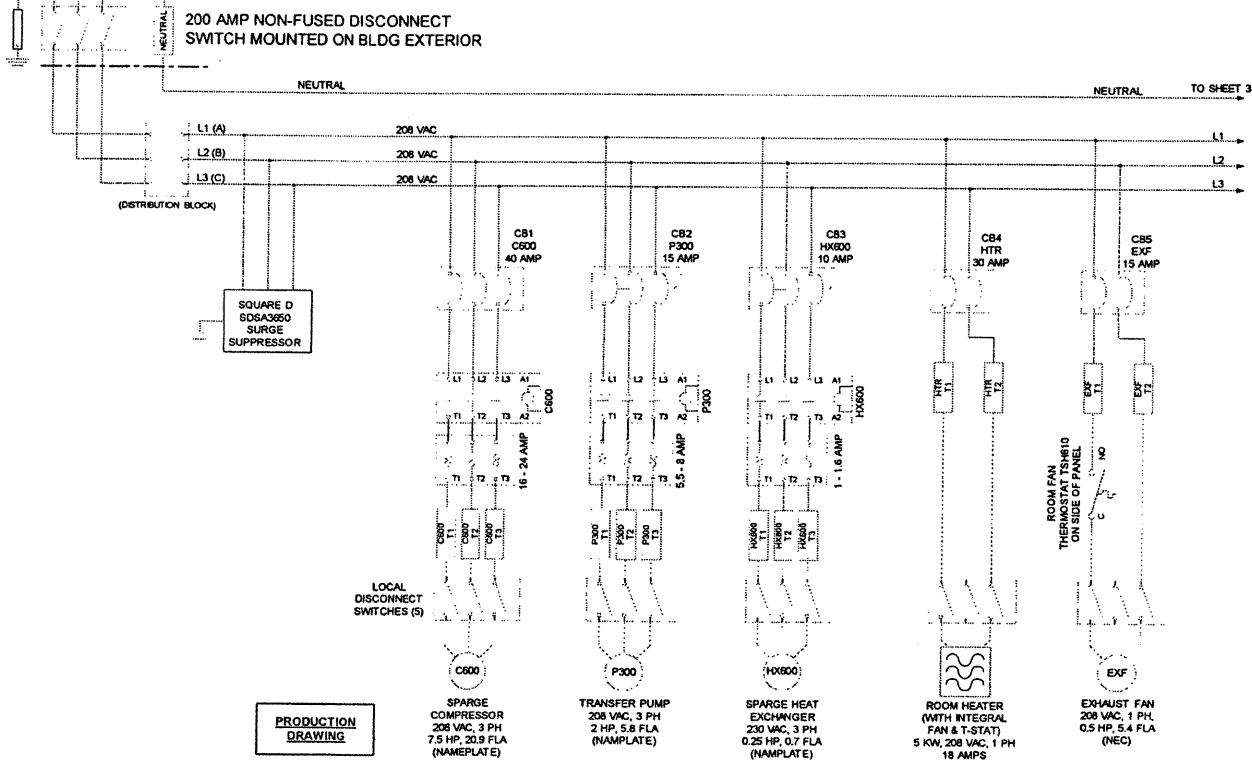
08/01/08

BLDG 3 SINGLE LINE POWER DIAGRAM

208/120 VAC, 150 AMP, 4 WIRE,
3 PHASE, 60 HZ POWER
(TO BE SUPPLIED BY OTHERS)

GROUND WATER TREATMENT (BLDG 3) CONTROL SYSTEM

NON-CLASSIFIED ELECTRICAL CONSTRUCTION IN BUILDING 3



DEXTER CHEMICAL

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2007-014

07-014 BLDG 3 PROD REV1

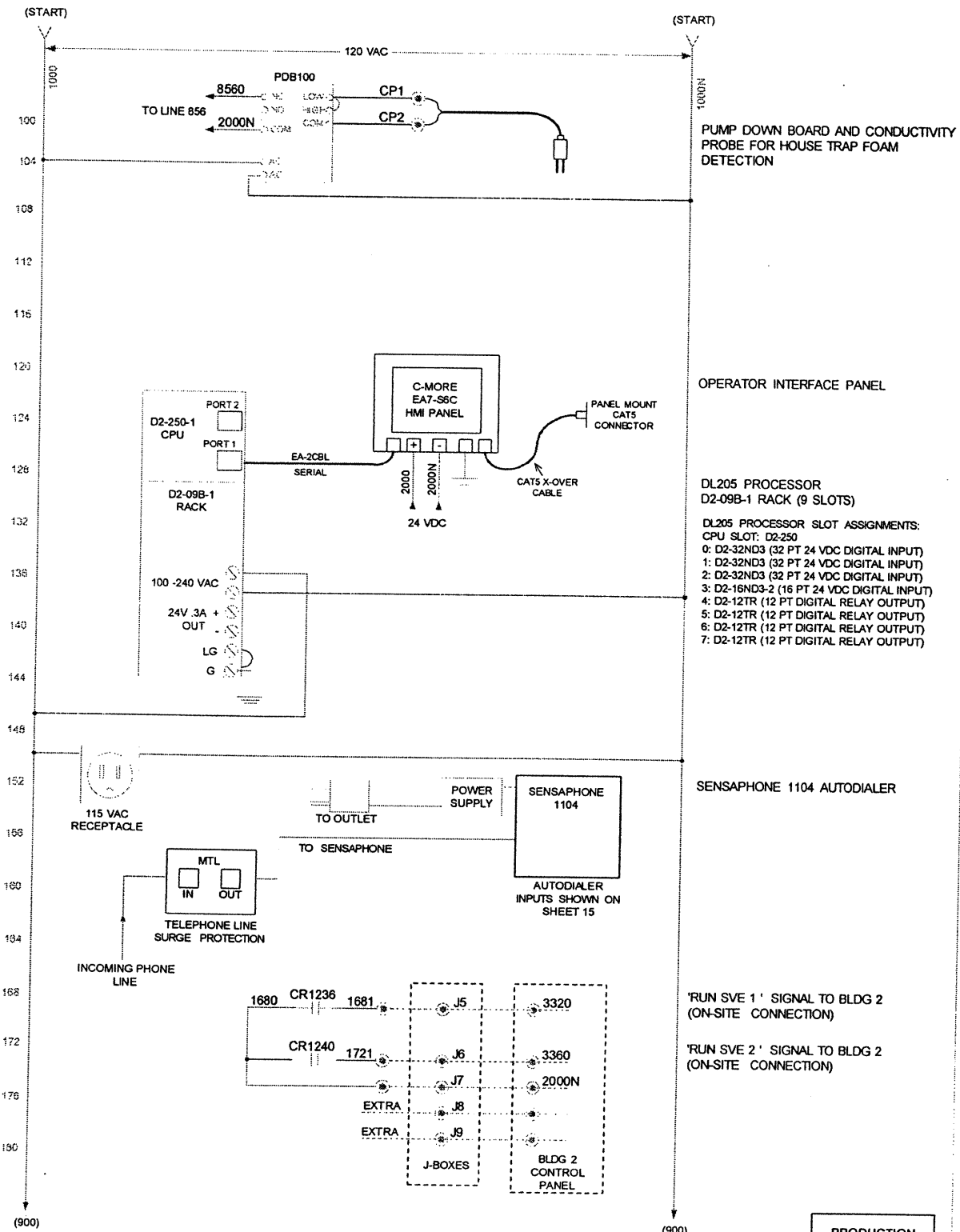
2-23

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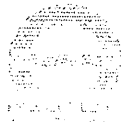
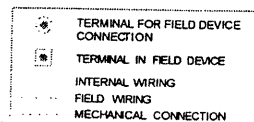
FCU

08/01/08

POWER DISTRIBUTION



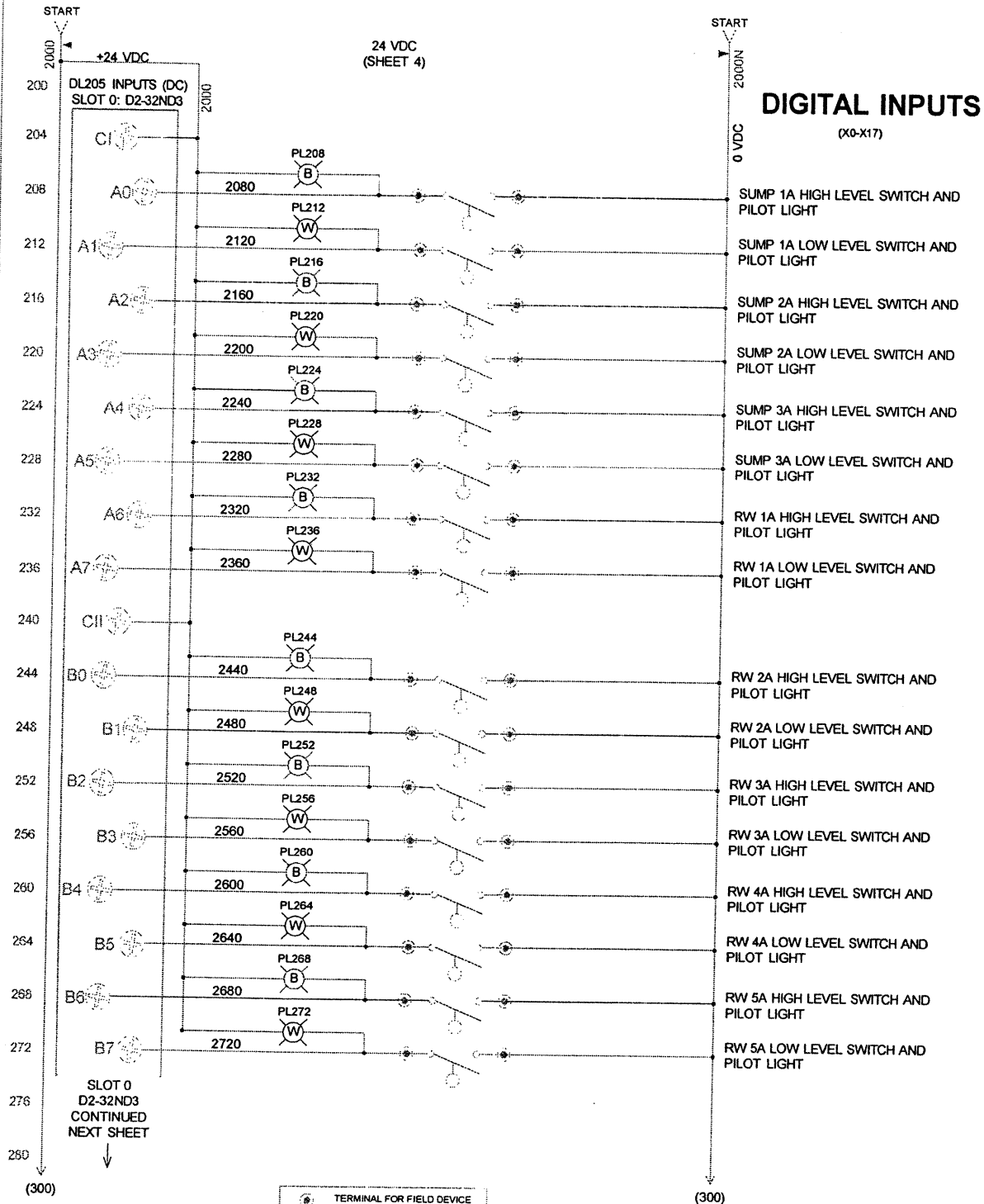
**PRODUCTION
DRAWING**



DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1
5 123 None
FCU 08/01/08
PLC & COMMUNICATION WIRING



DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1

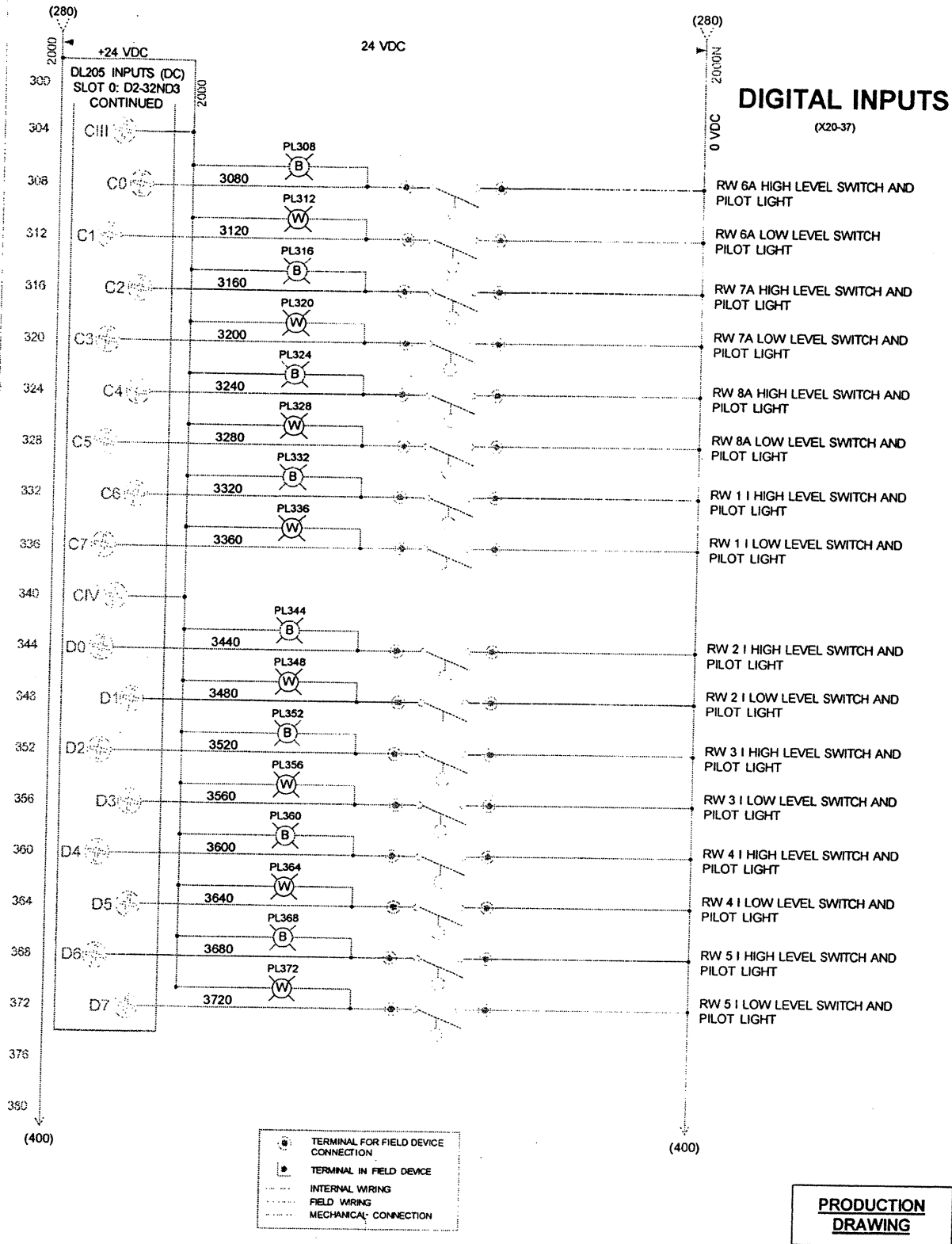
6 23

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FCU

08/01/08

GENERAL 24 VDC INPUTS



DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1

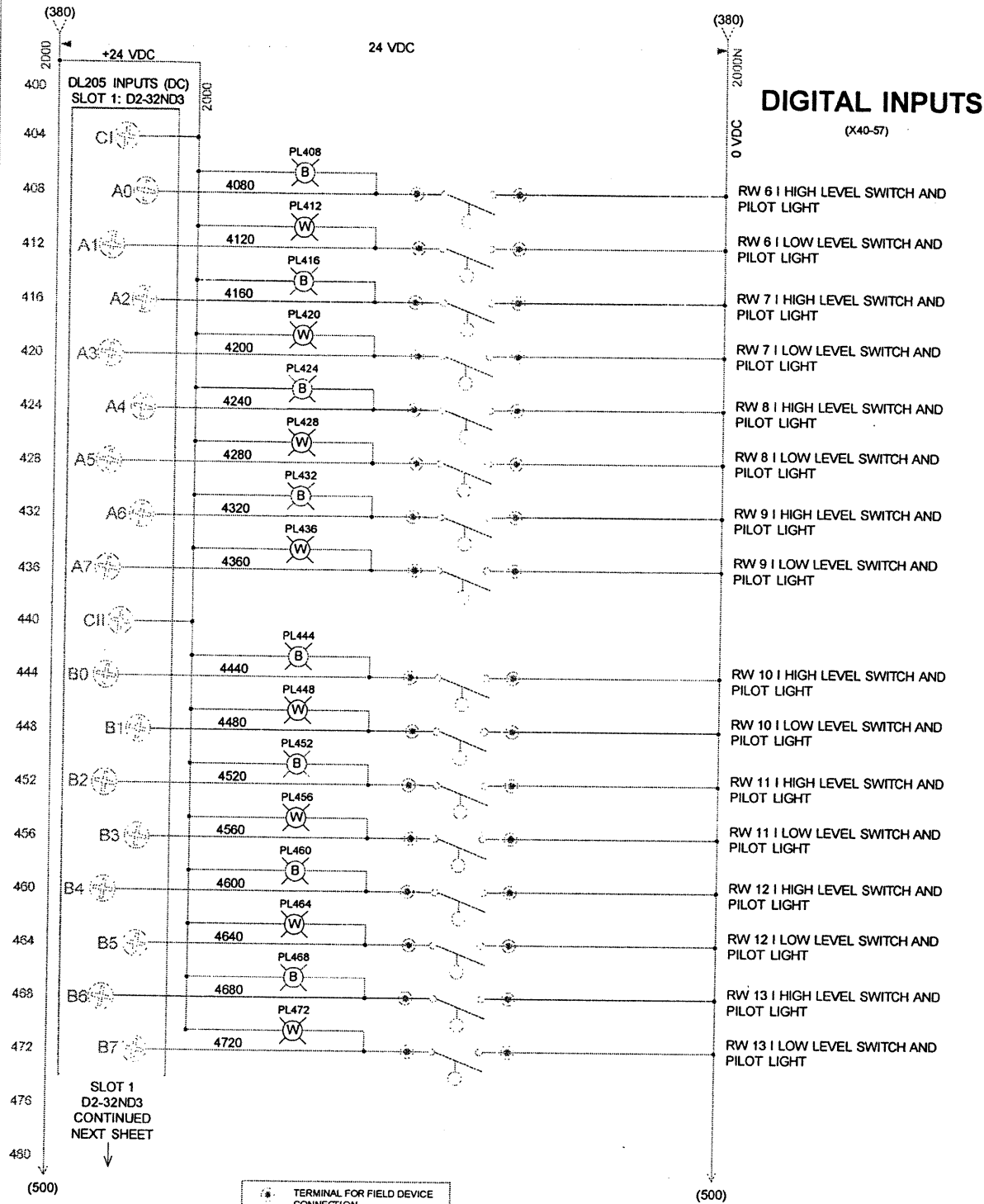
7 23

None

FCU

08/01/08

GENERAL 24 VDC INPUTS



**PRODUCTION
DRAWING**



DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1

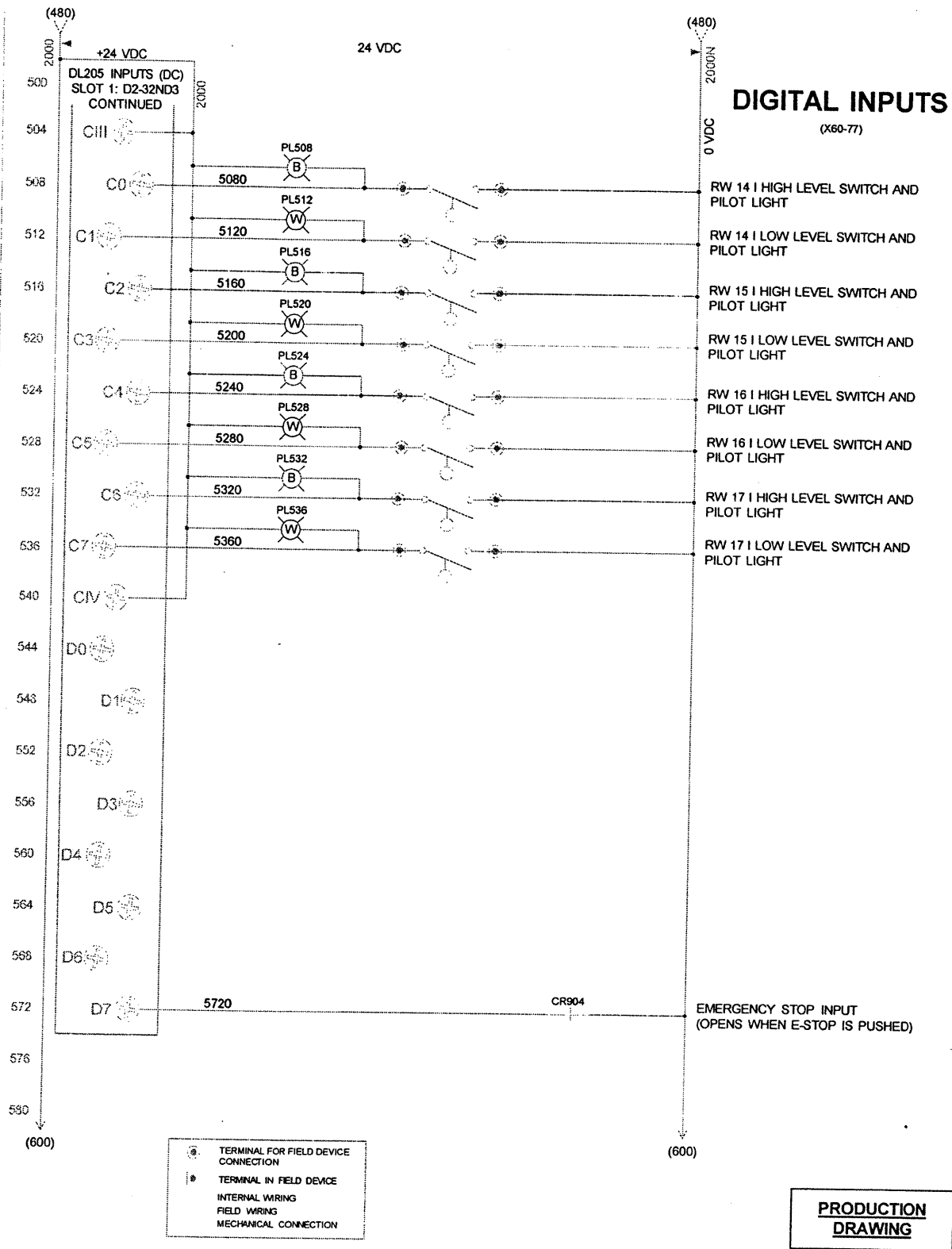
8 23

None

FCU

08/01/08

GENERAL 24 VDC INPUTS



DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1

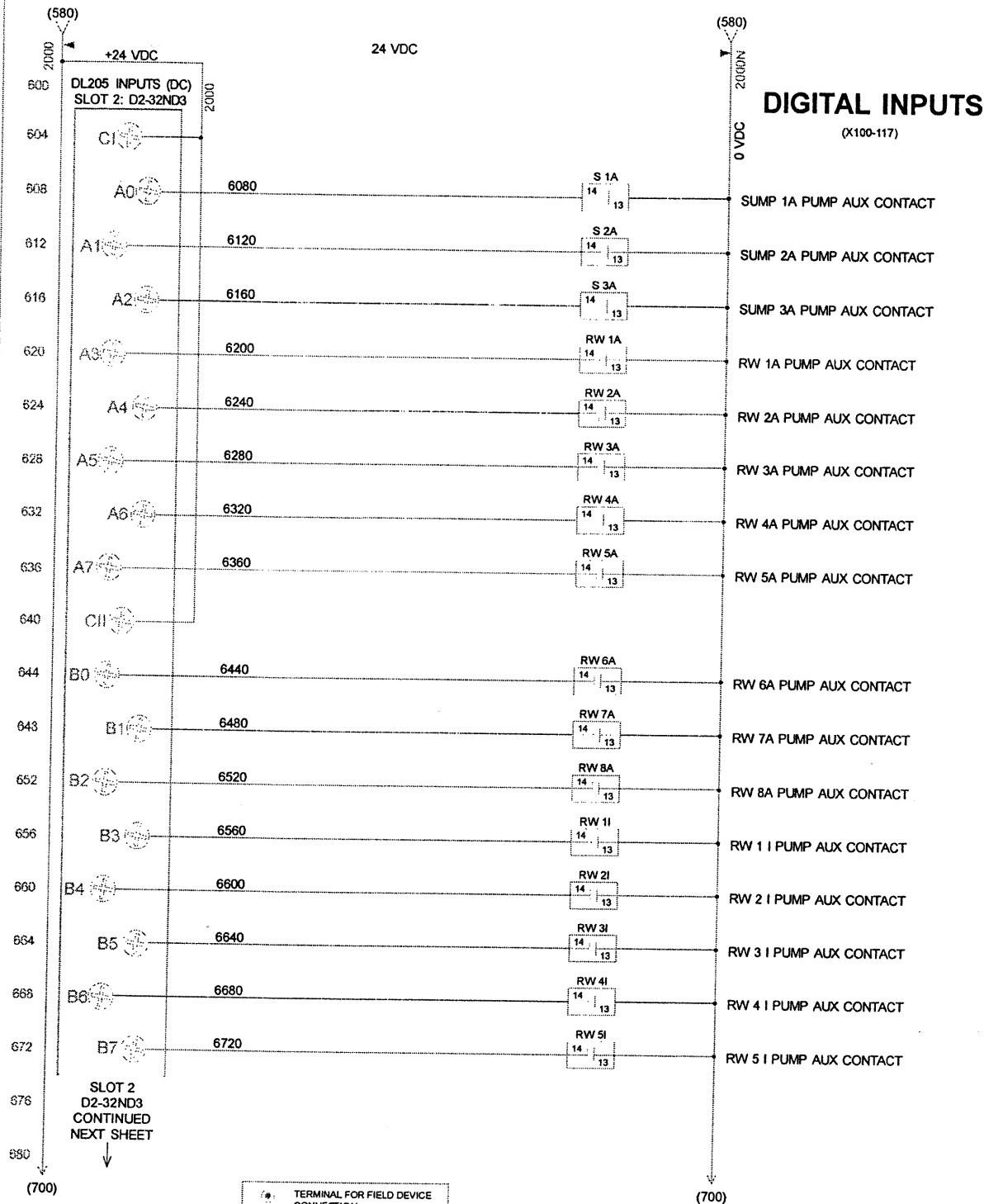
9 23

FCU

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08/01/08

GENERAL 24 VDC INPUTS

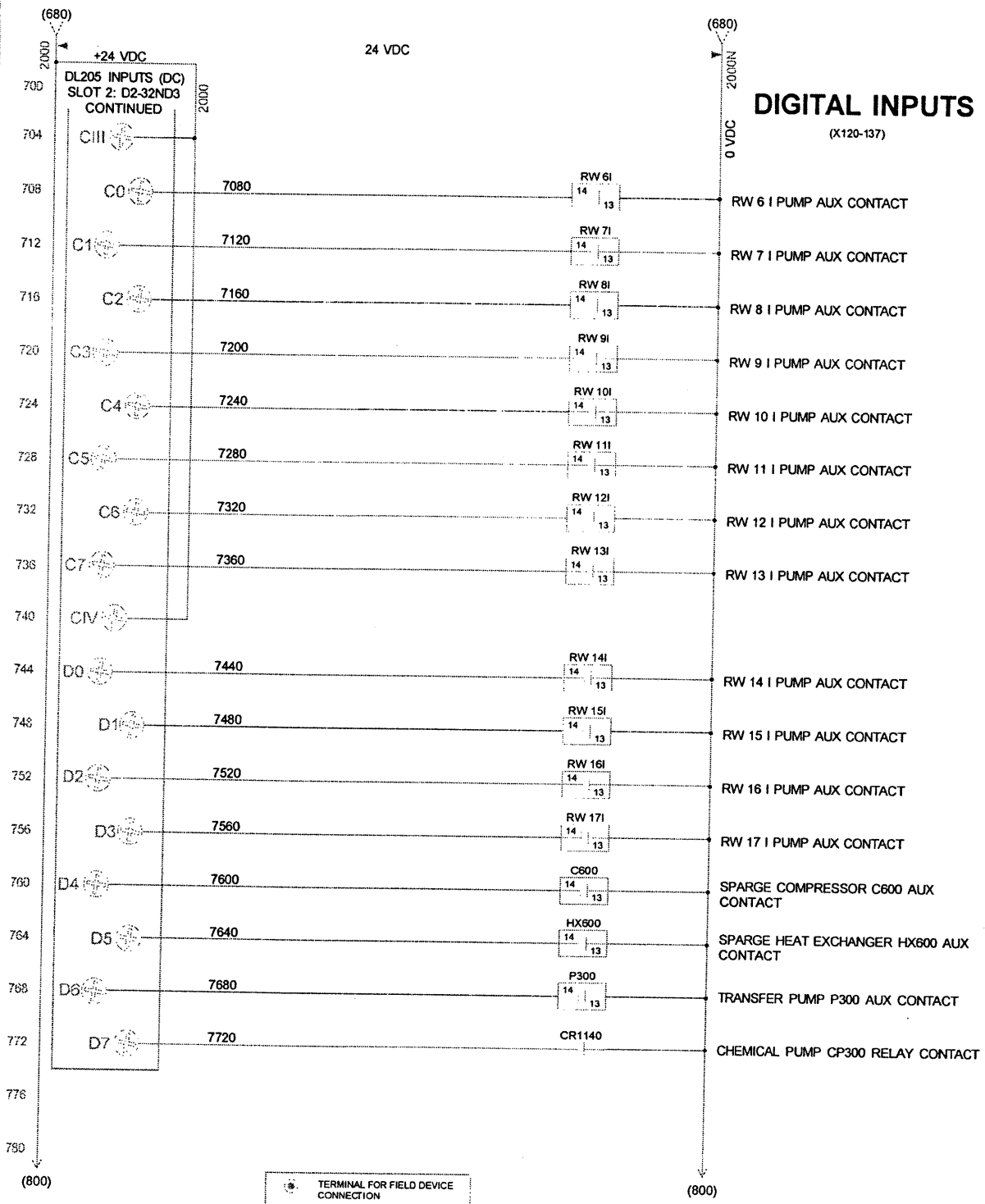


**PRODUCTION
DRAWING**

DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1
10 - 23
None
FCU 08/01/08
GENERAL 24 VDC INPUTS



TERMINAL FOR FIELD DEVICE CONNECTION
 TERMINAL IN FIELD DEVICE
 INTERNAL WIRING
 FIELD WIRING
 MECHANICAL CONNECTION

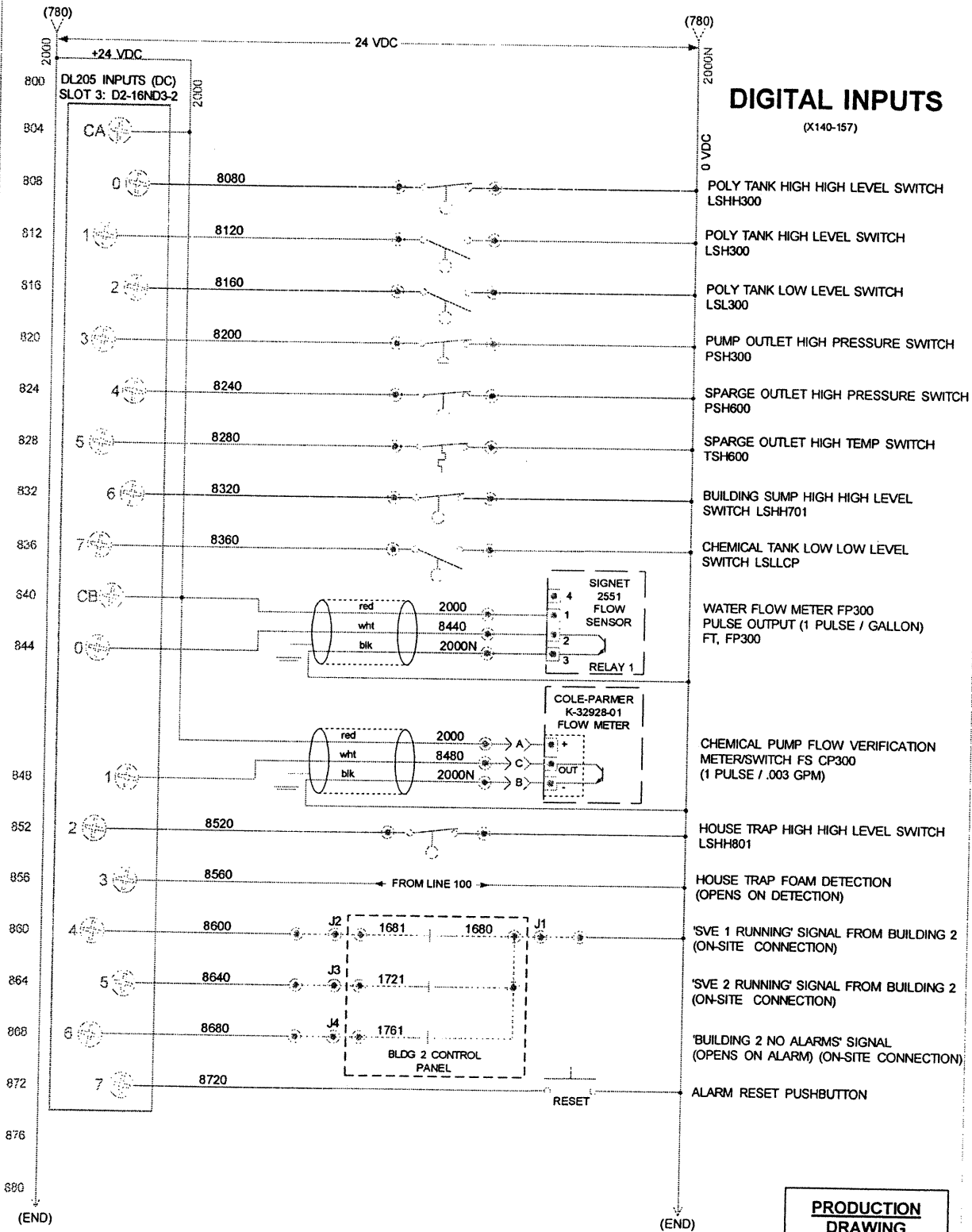
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BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1
11 23 None
FCU 08/01/08
GENERAL 24 VDC INPUTS



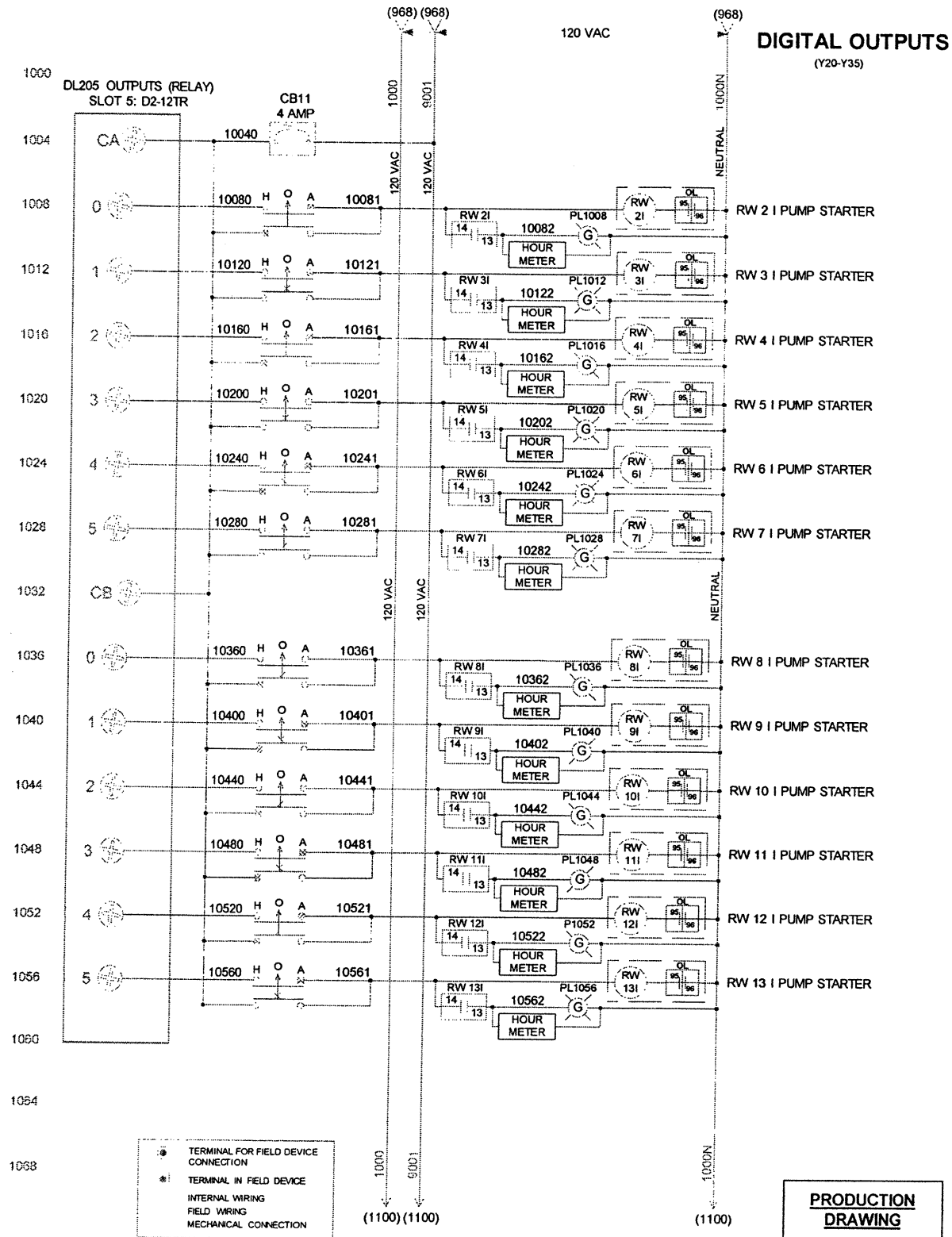
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 • TERMINAL IN FIELD DEVICE
 INTERNAL WIRING
 FIELD WIRING
 MECHANICAL CONNECTION



DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1
 12 of 23 None
 FCU 08/01/08
 GENERAL 24 VDC INPUTS



07-014 BLDG 3 PROD REV1

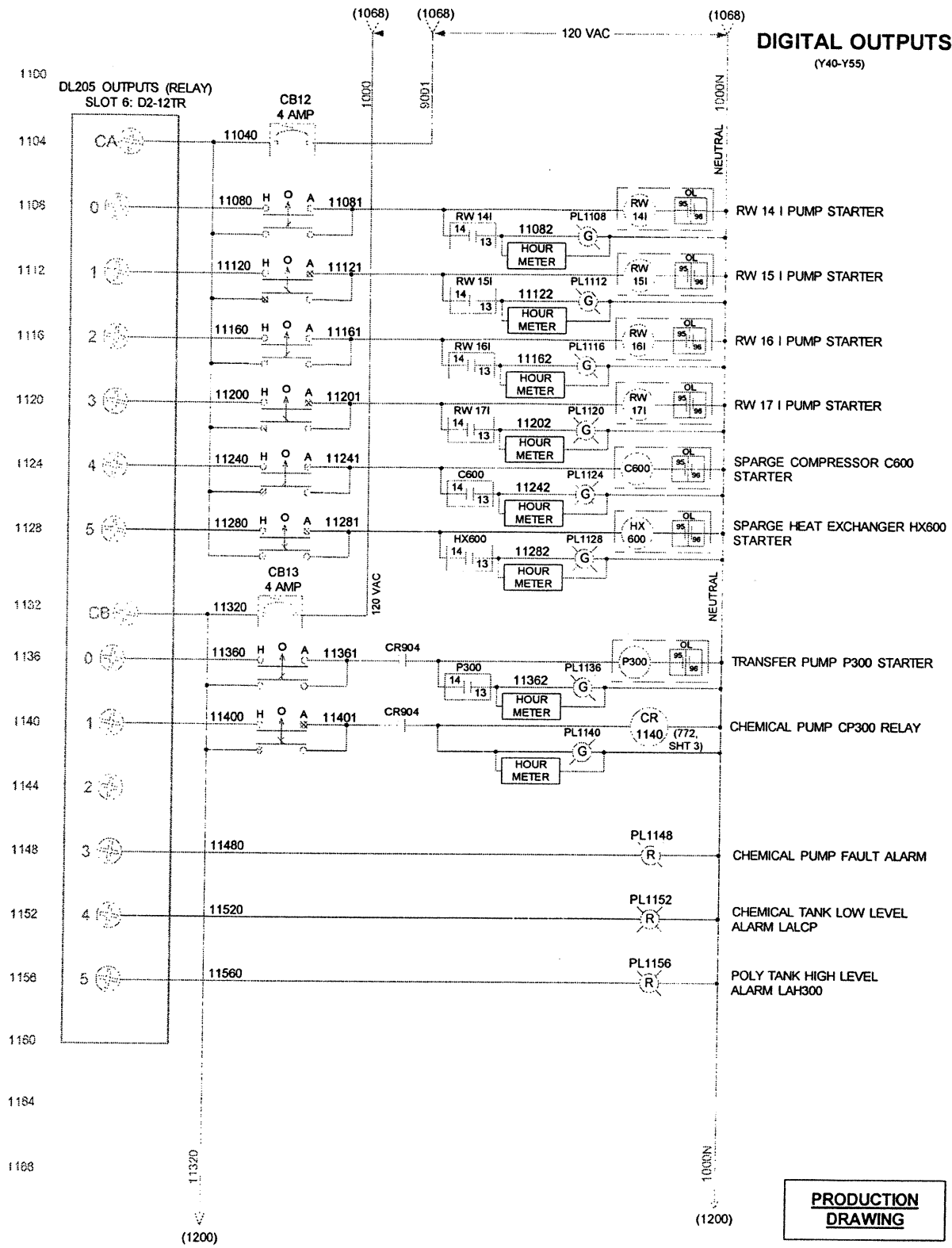
DEXTER CHEMICAL
BRONX, NY

14 23

None

FCU 08/01/08

2007-014 120 VAC DIGITAL OUTPUTS

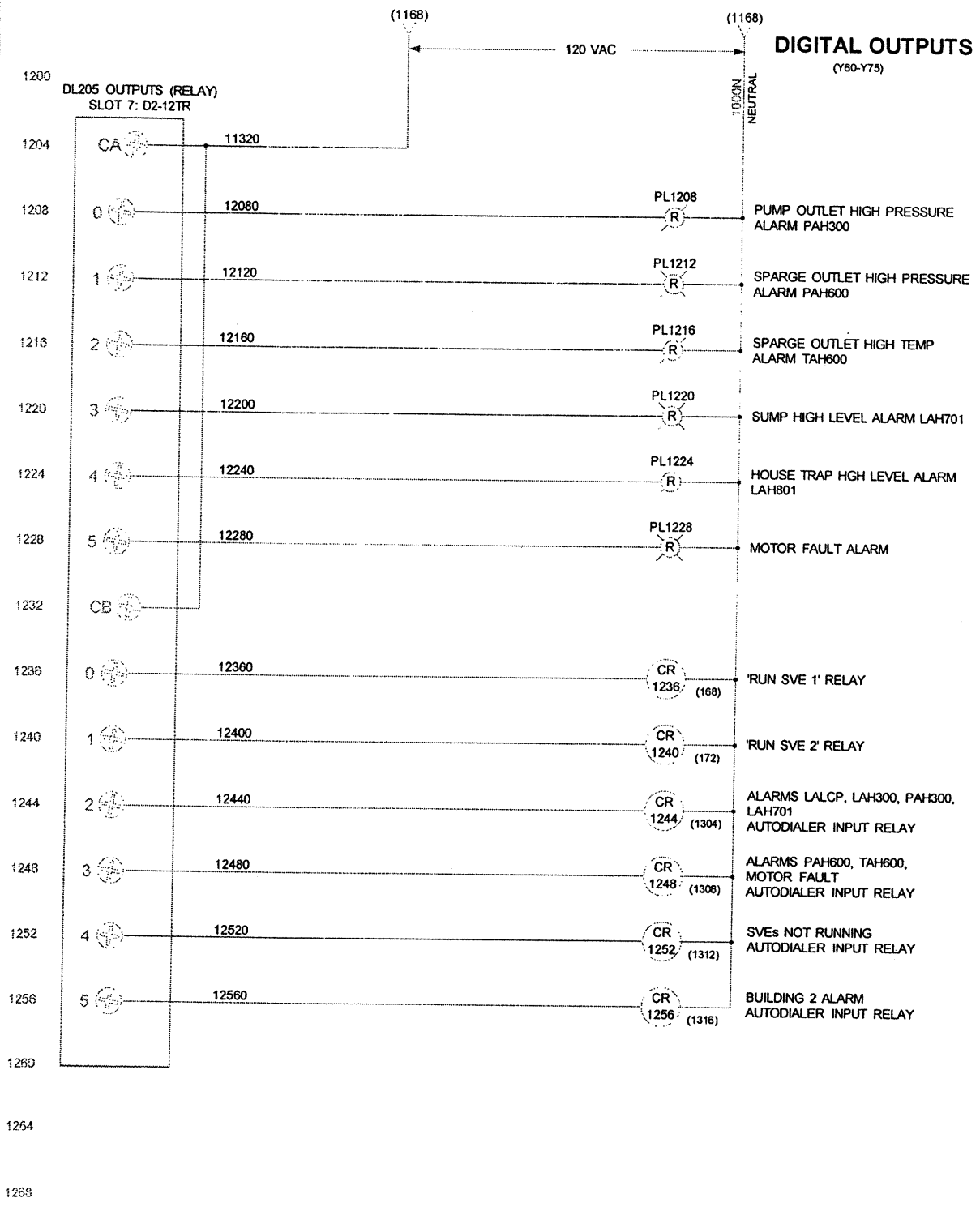


○ TERMINAL FOR FIELD DEVICE CONNECTION
 □ TERMINAL IN FIELD DEVICE
 — INTERNAL WIRING
 - - - FIELD WIRING
 . . . MECHANICAL CONNECTION



DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 3 PROD REV1
 15 23 None
 FCU 08/01/08
 2007-014 120 VAC DIGITAL OUTPUTS



TERMINAL FOR FIELD DEVICE CONNECTION
 INTERNAL WIRING
 FIELD WIRING
 MECHANICAL CONNECTION

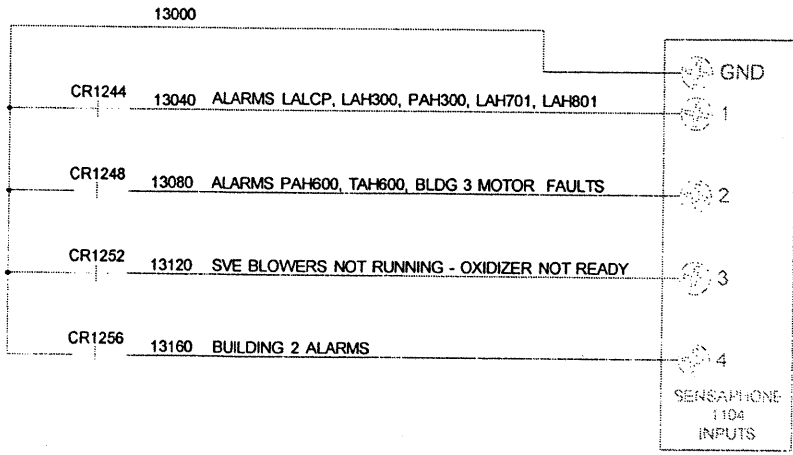


DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 3 PROD REV1
 16 23 None
 FCU 08/01/08
 2007-014 120 VAC DIGITAL OUTPUTS

**PRODUCTION
DRAWING**

1300
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AUTO DIALER INPUTS

TERMINAL FOR FIELD DEVICE
CONNECTION

TERMINAL IN FIELD DEVICE

INTERNAL WIRING

FIELD WIRING

MECHANICAL CONNECTION

**PRODUCTION
DRAWING**



DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1

17 23

None

FCU

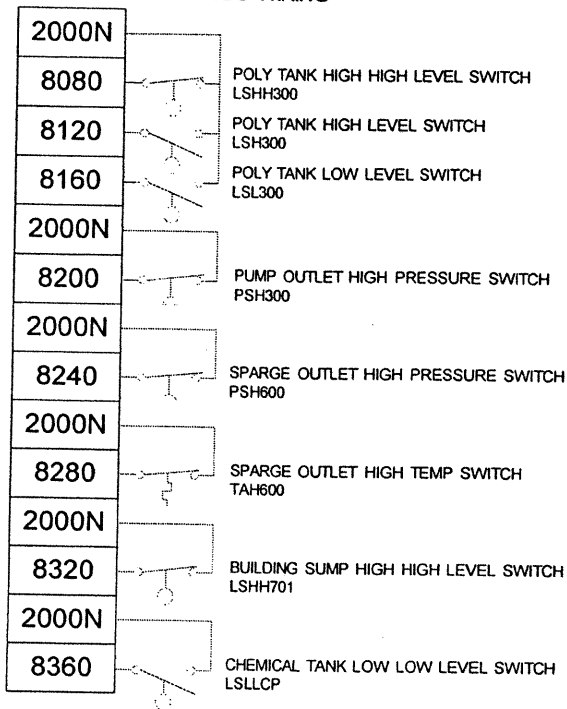
08/01/08

AUTODIALER INPUTS

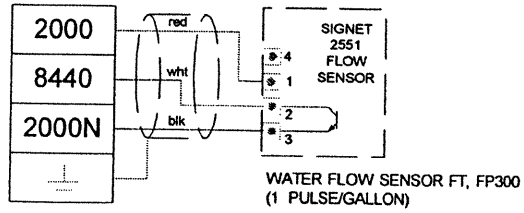
CONNECTION DIAGRAM FOR FIELD DEVICES

BUILDING CONNECTIONS

NON-INTRINSIC 24 VDC WIRING



NON-INTRINSIC 24 VDC WIRING



NON-INTRINSIC 24 VDC WIRING

NON-INTRINSIC 120 VAC WIRING

INTER-PANEL 24 VDC CONTROL WIRING

PRODUCTION
DRAWING

DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1

Ver: 18.23

None

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08/01/08

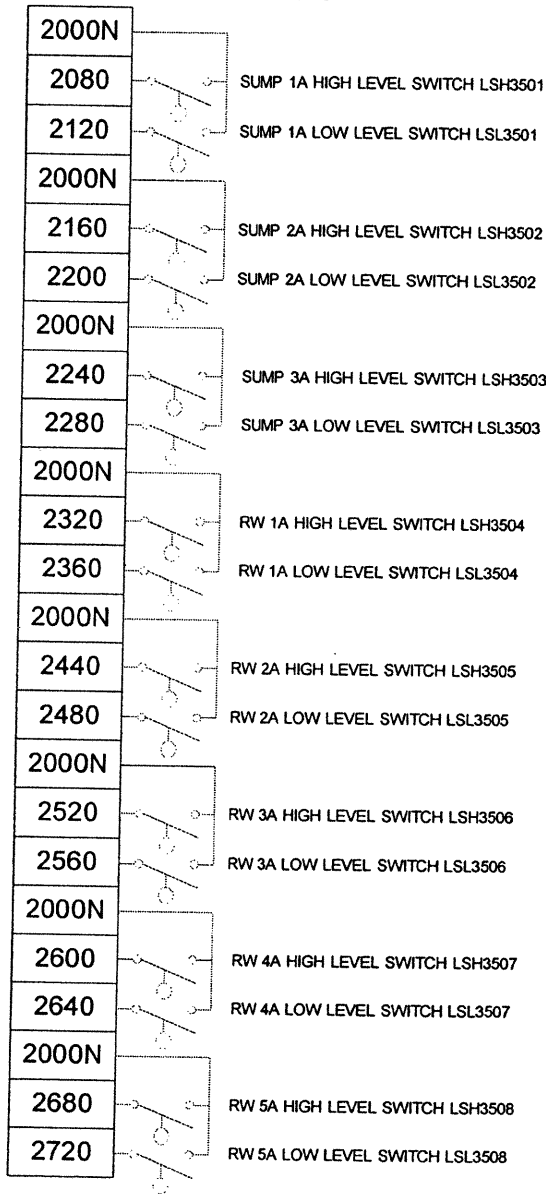
FIELD CONNECTIONS

3:50:10 PM 8/12/2008

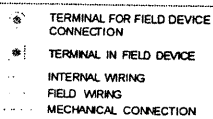
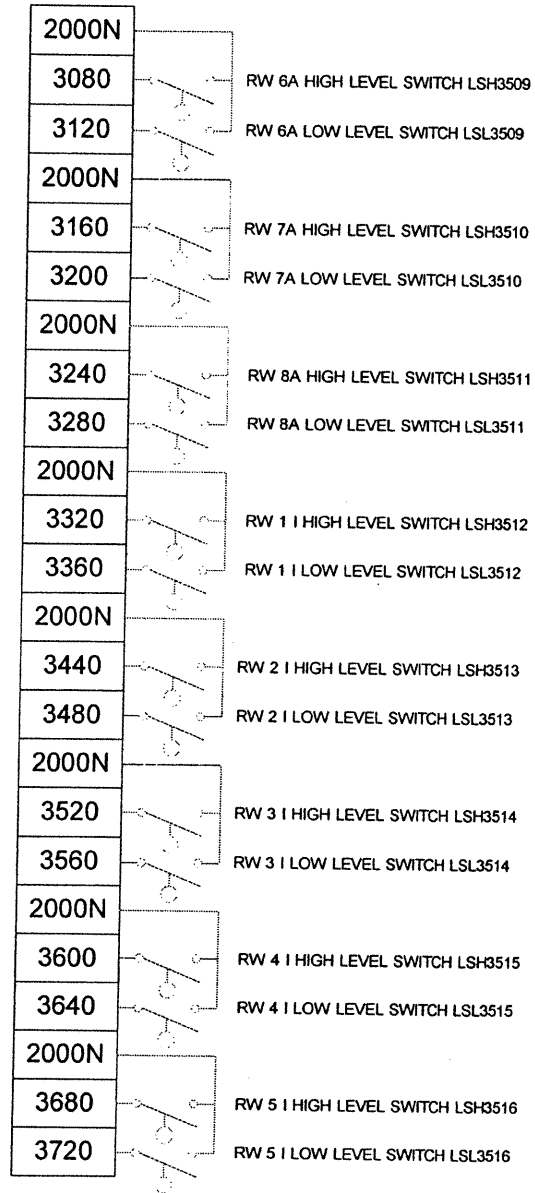
CONNECTION DIAGRAM FOR FIELD DEVICES

ON-SITE CONNECTIONS

NON-INTRINSIC 24 VDC INPUTS



NON-INTRINSIC 24 VDC INPUTS



**PRODUCTION
DRAWING**

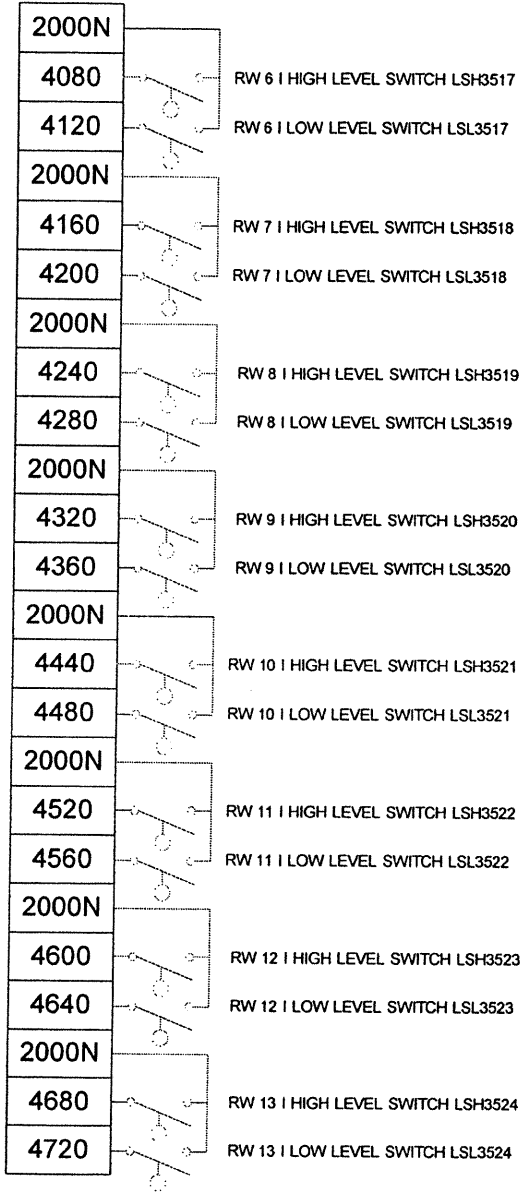
DEXTER CHEMICAL
BRONX, NY

2007-014

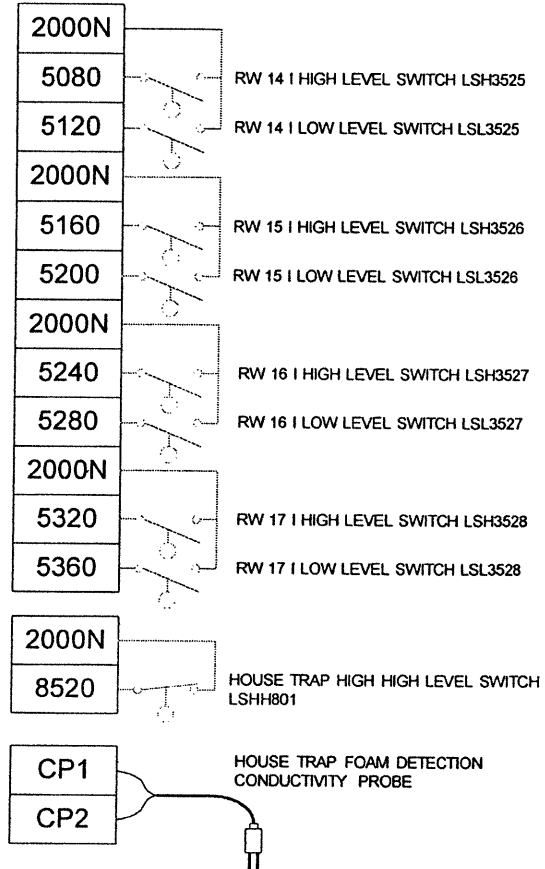
07-014 BLDG 3 PROD REV1
19-123 None
FCU 08/01/08
FIELD CONNECTIONS

CONNECTION DIAGRAM FOR FIELD DEVICES

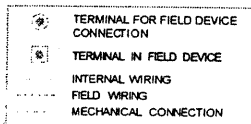
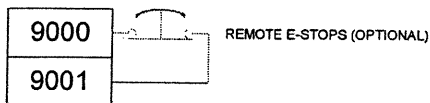
NON-INTRINSIC 24 VDC INPUTS



NON-INTRINSIC 24 VDC INPUTS



NON-INTRINSIC 120 VAC WIRING



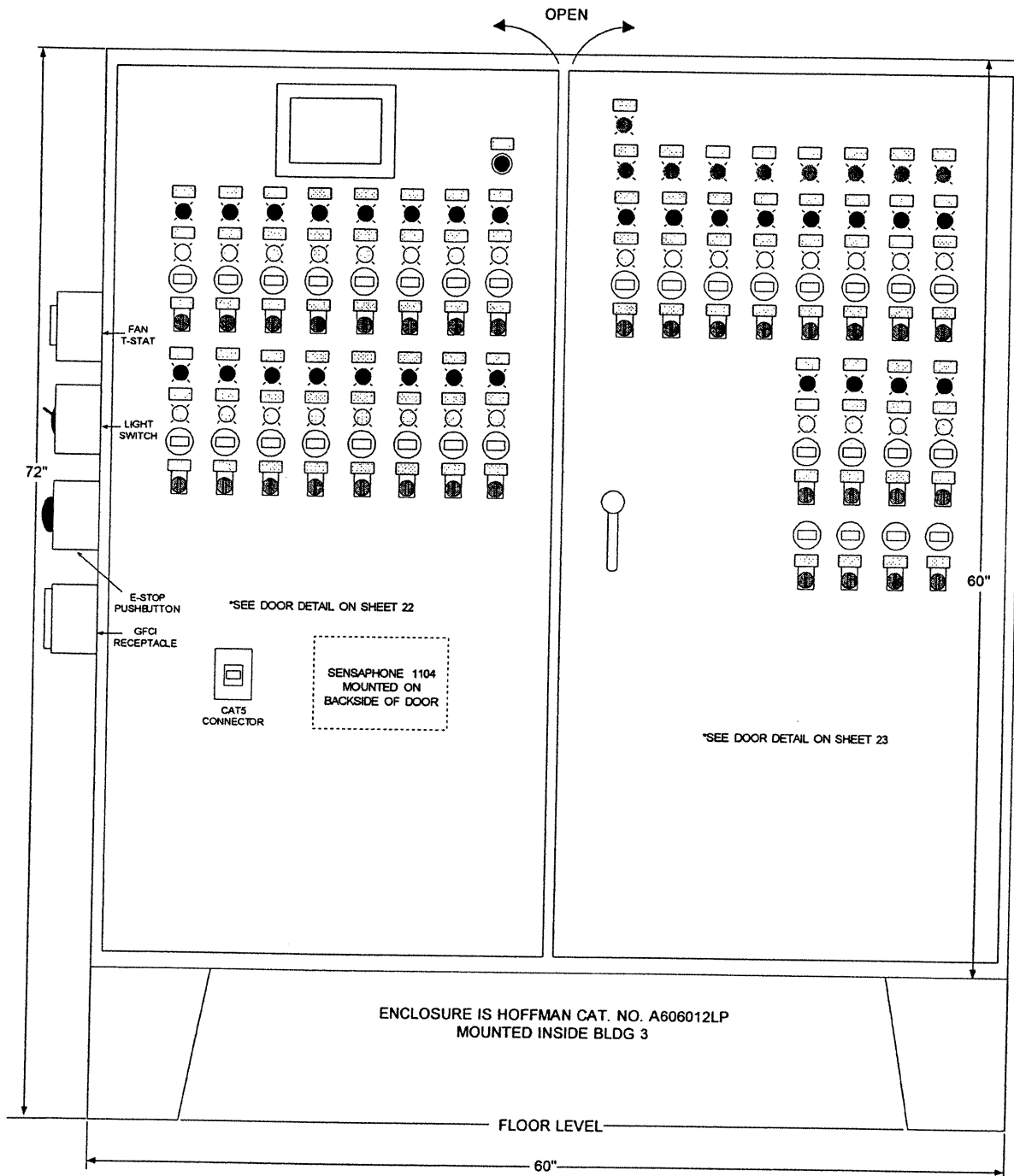
**PRODUCTION
DRAWING**

DEXTER CHEMICAL
BRONX, NY

2007-014

07-014 BLDG 3 PROD REV1
20.23
FCU
None
08/01/08
FIELD CONNECTIONS

BLDG 3 CONTROL PANEL
FRONT VIEW



DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 3 PROD REV1

21 23

FCU

NONE

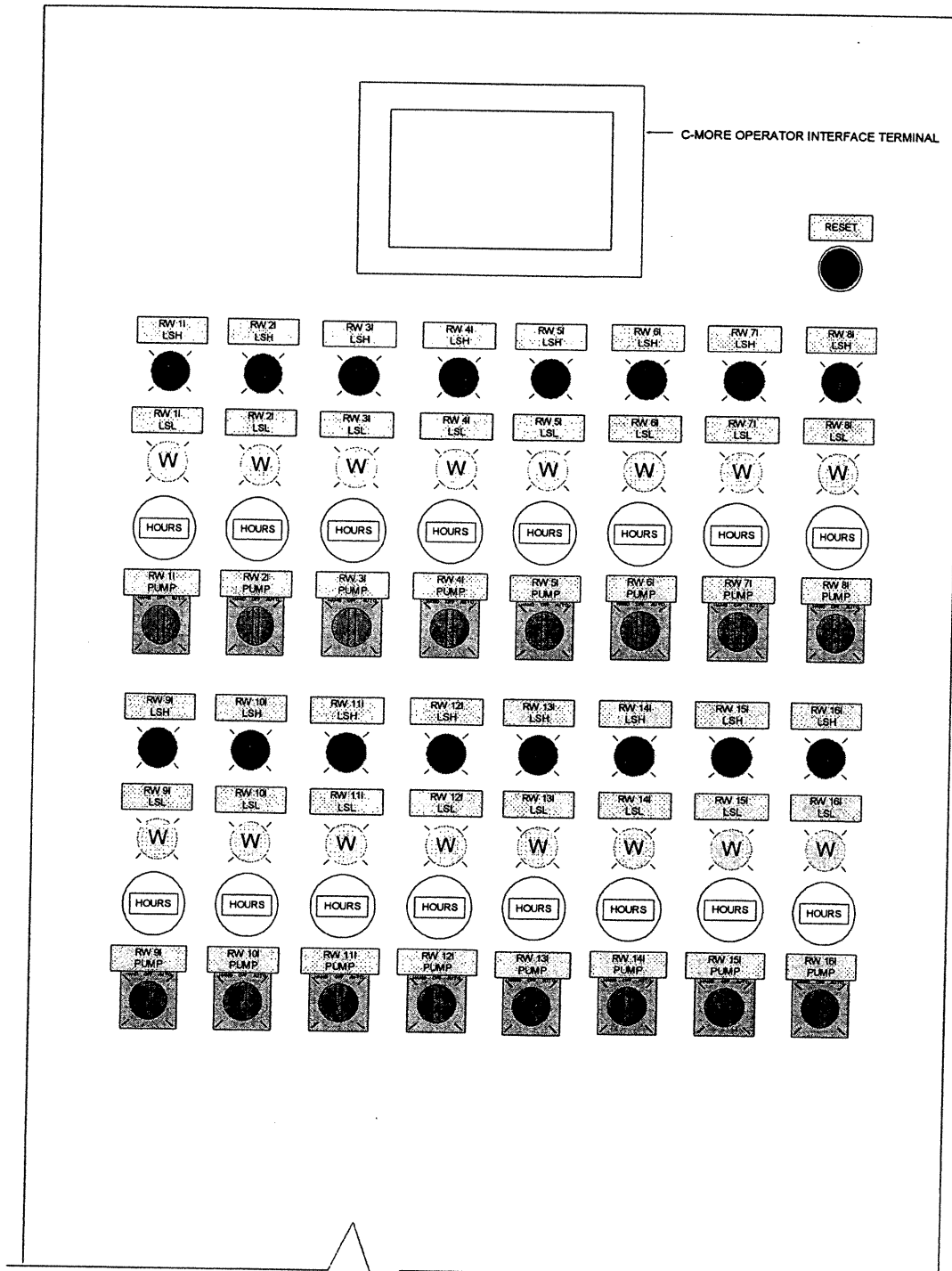
08/01/08

2007-014

DOOR LAYOUT DRAWING

3:50:10 PM 8/12/2008

CONTROLS ON ENCLOSURE LEFT HAND DOOR



DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 3 PROD REV1

22 23

0

NONE

FCU

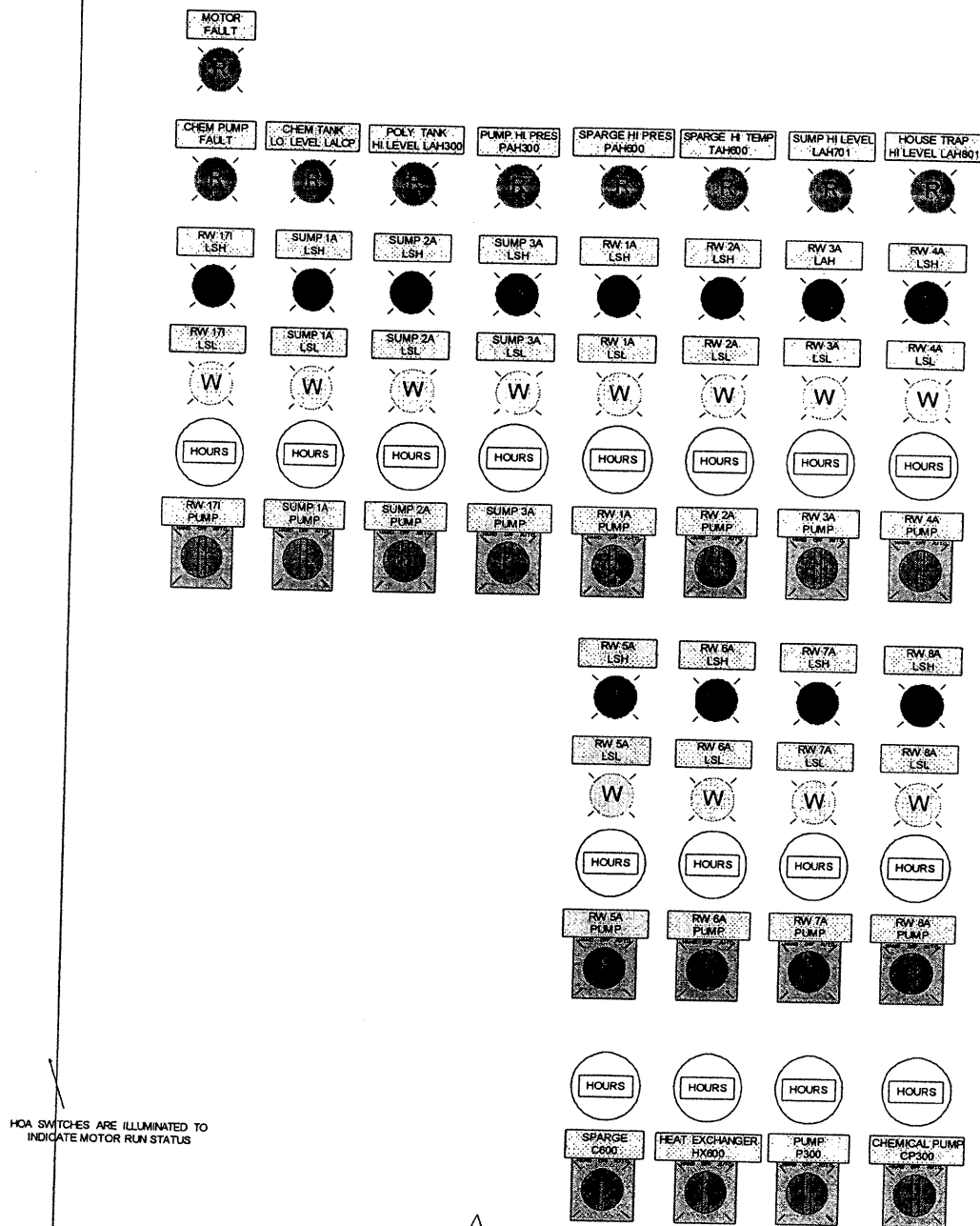
08/01/08

2007-014

DOOR LAYOUT DRAWING

3:50:10 PM 8/12/2008

CONTROLS ON ENCLOSURE RIGHT HAND DOOR



HOA SWITCHES ARE ILLUMINATED TO
INDICATE MOTOR RUN STATUS



DEXTER CHEMICAL
BRONX, NY

07-014 BLDG 3 PROD REV1

0

23 23

NONE

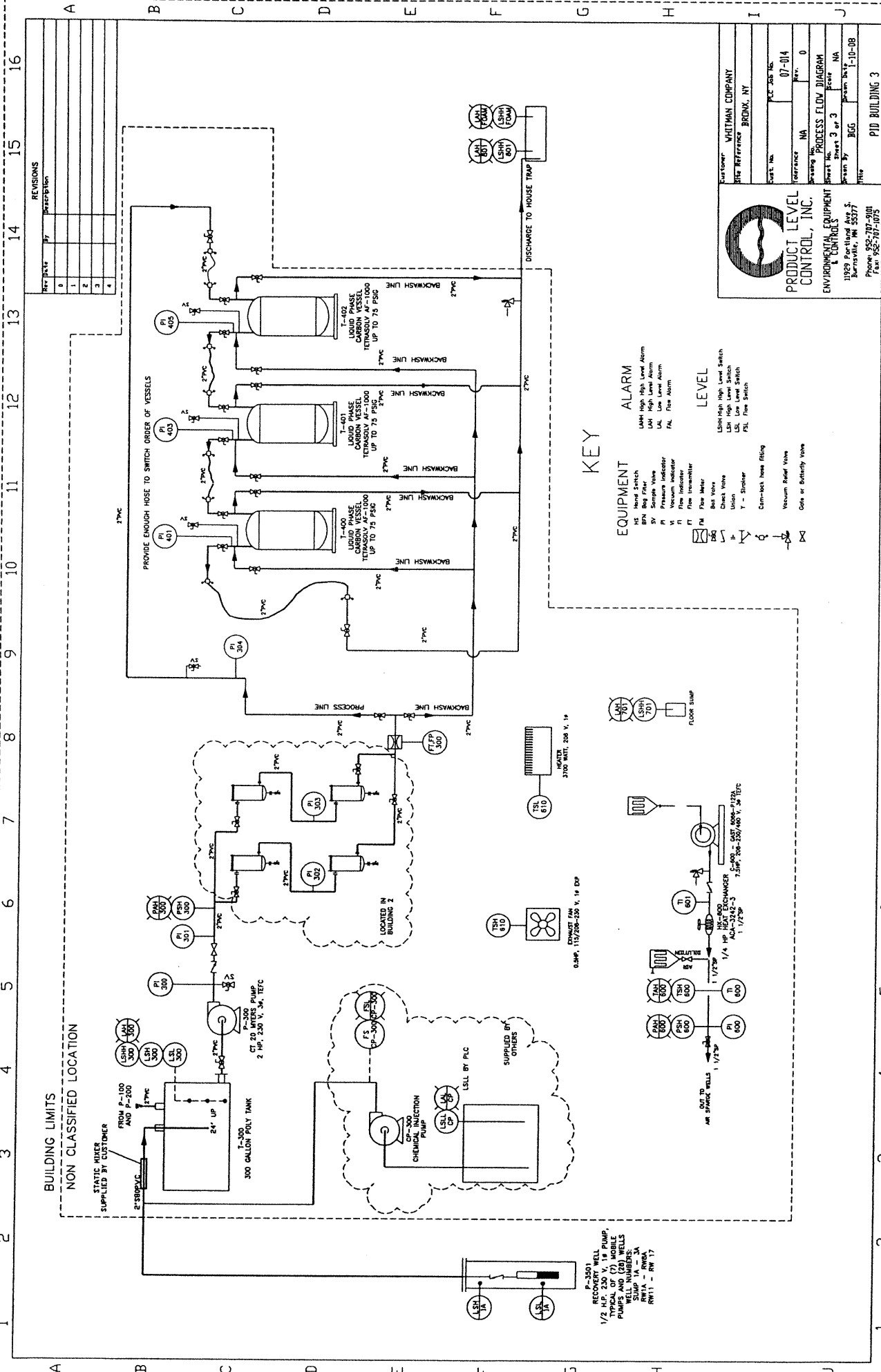
FCU

08/01/08

2007-014

DOOR LAYOUT DRAWING

3:50:10 PM 8/12/2008

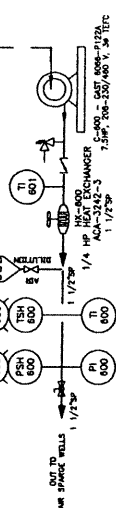


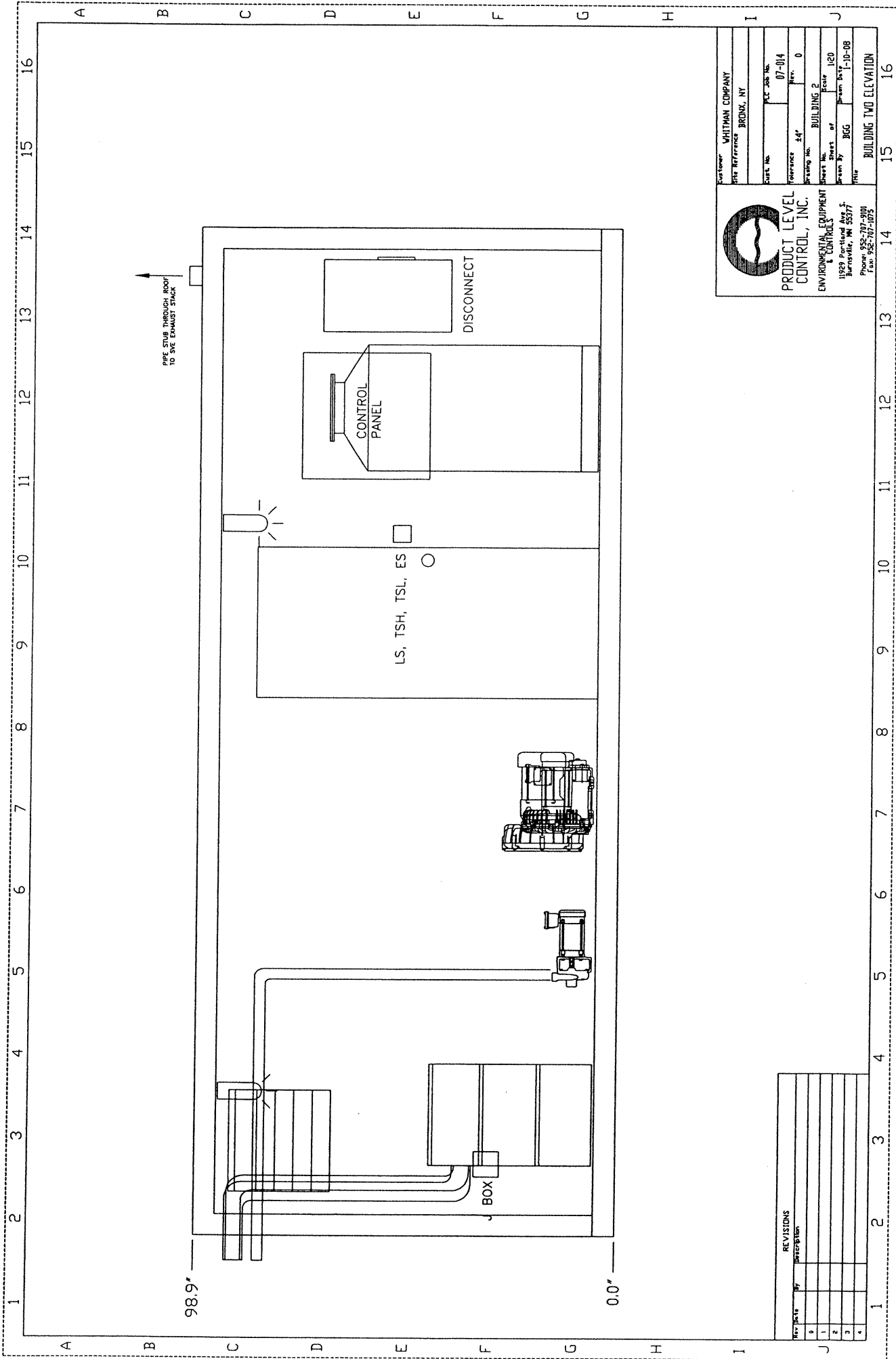
P-3501
RECOVER WELL
1/2 HP, 230 V, 18 DPM
TYPICAL OF (7) MOBILE
PUMPS AND (20) WELLS
SUPPLIED BY OTHERS
RW1A - RW1A
RW11 - RW11

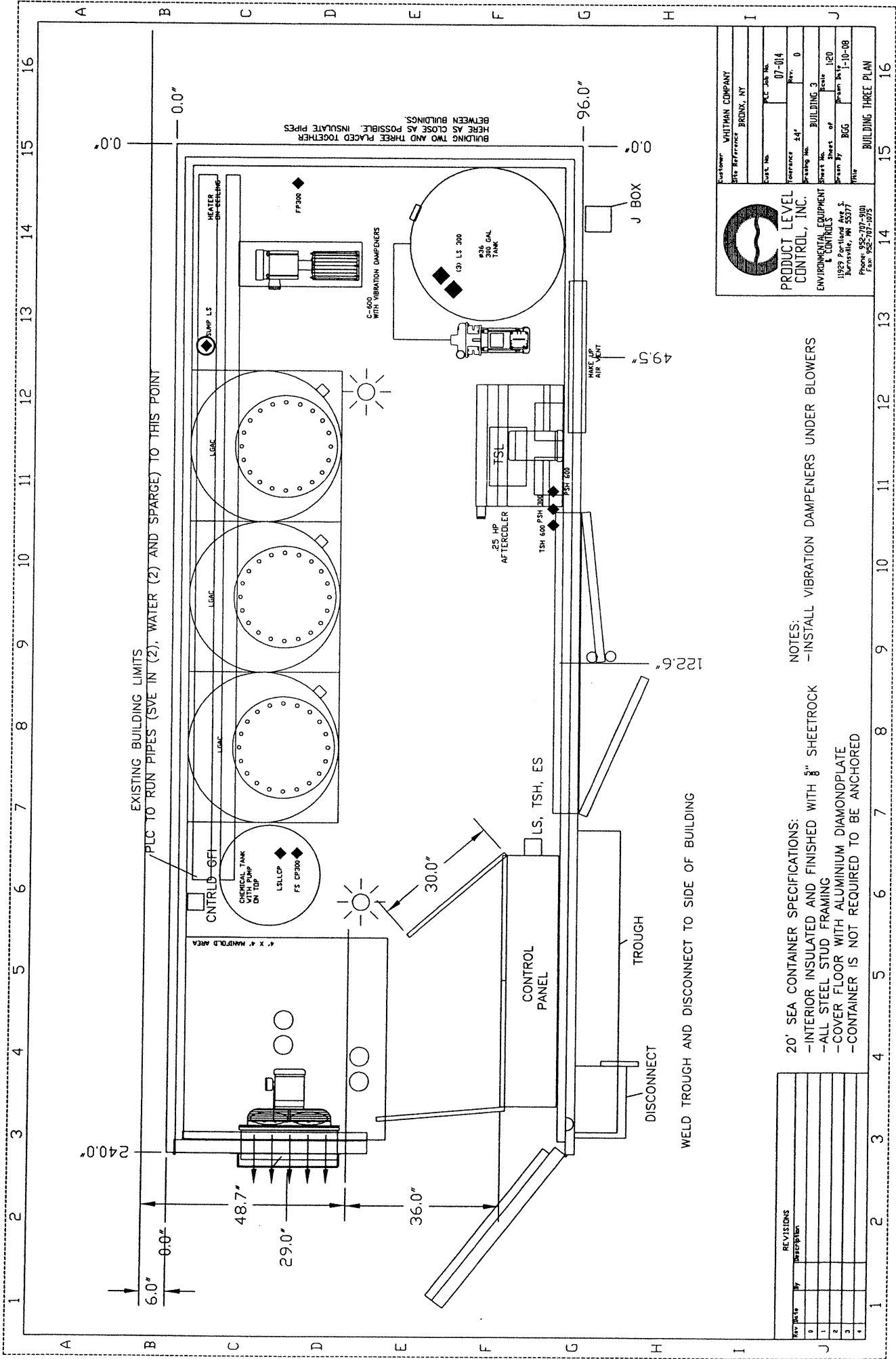
6.8MP, 115/200-230 V, 18 DPM

HEATER
3700 WATT, 208 V, 18

EXHAUST FAN
6.8MP, 115/200-230 V, 18 DPM







20' SEA CONTAINER SPECIFICATIONS:

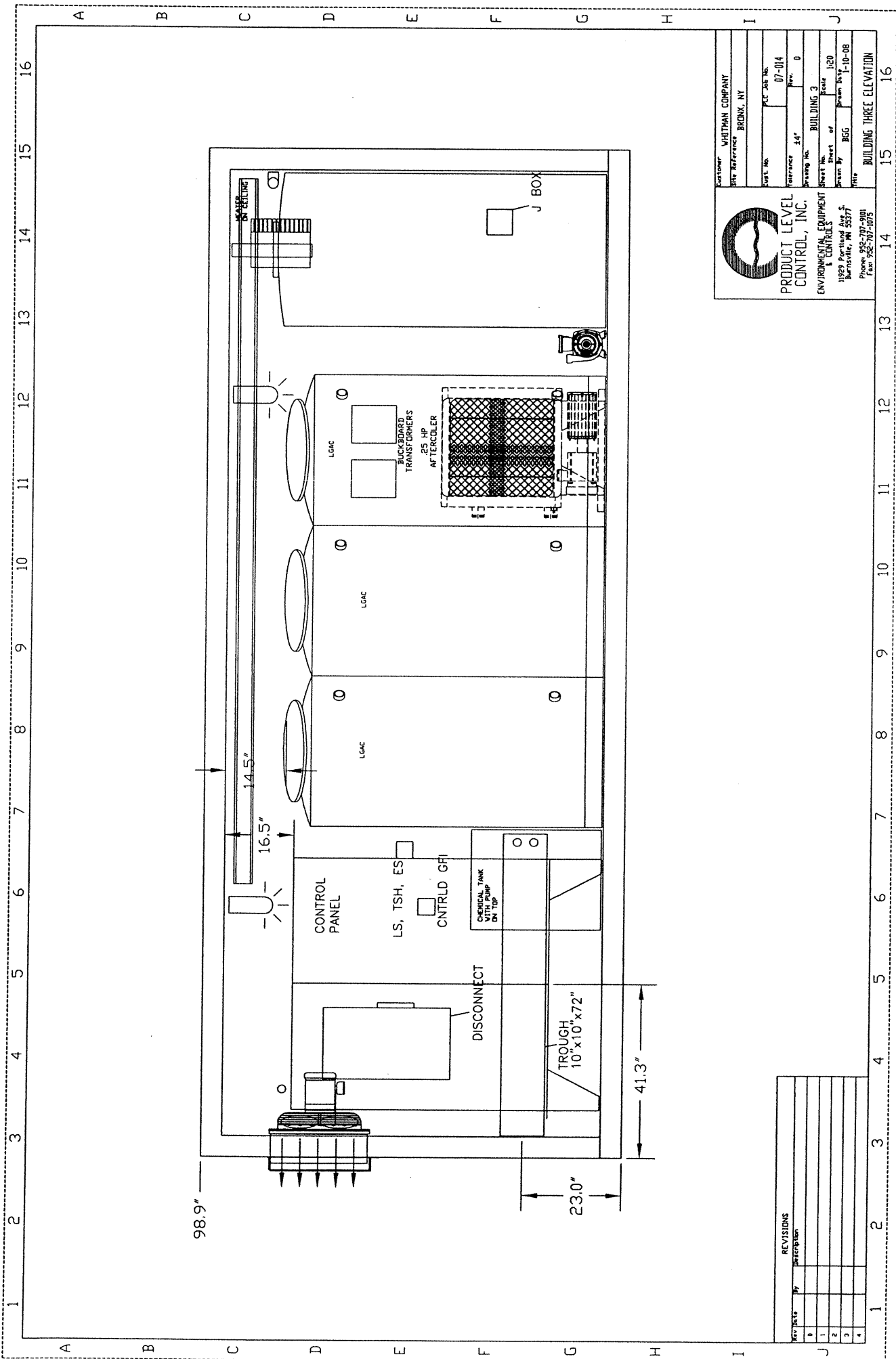
- INTERIOR INSULATED AND FINISHED WITH 5" SHEETROCK
- ALL STEEL STUD FRAMING
- COVER FLOOR WITH ALUMINUM DIAMONDPLATE
- CONTAINER IS NOT REQUIRED TO BE ANCHORED

NOTES:

- INSTALL VIBRATION DAMPENERS UNDER BLOWERS

PRODUCT LEVEL CONTROL, INC.
ENVIRONMENTAL EQUIPMENT & CONTROLS
11929 Portland Ave.
Aurora, IL 60007
Phone: 847-531-1000
Fax: 847-531-1005

Customer: WHITMAN COMPANY
Site Reference: BROOKLYN, NY
Job No.: 07-014
Drawing No.: BUILDING 3
Sheet No.: 120
Drawn by: BCG
Date: 1-10-08
Title: BUILDING THREE PLAN



REVISIONS	
NO.	DESCRIPTION
1	
2	
3	
4	



PRODUCT LEVEL CONTROL, INC.
 ENVIRONMENTAL EQUIPMENT & CONTROLS
 1929 Portland Ave.
 Bensenville, IL 60015
 Phone: 815-377-0700
 Fax: 815-377-0705

Customer: WHITMAN COMPANY
 Site Reference: BROOK, NY

Cost No.: _____
 PLC Job No.: 07-014
 Revision: 0

Drawing No.: BUILDING 3
 Sheet No.: 120
 Sheet of: 120
 Drawn By: BGG
 Date: 1-10-08

File: BUILDING THREE ELEVATION

SYSTEM STARTUP PROCEDURE

SECTION INCLUDES

- 1.1 Overview
- 1.2 Contact person at PLC
- 1.3 Tools required
- 1.4 Phone line hookup
- 1.5 Power hookup
- 1.6 Overload settings
- 1.7 External piping hookup
- 1.8 External switch hookup
- 1.9 Freezing conditions
- 1.10 Valve settings
- 1.11 Turning power on
- 1.12 Motor rotation
- 1.13 Heater and exhaust fan
- 1.14 Switch settings
- 1.15 Control panel logic
- 1.16 System operation
- 1.17 Voltage
- 1.18 Amperage
- 1.19 Switch operation
- 1.20 Conduit seals

1.1 OVERVIEW

- a) Following is a step-by-step procedure, which will help ensure your system begins its operation successfully. Product Level Control has assembled this startup guide to help ensure common mistakes are prevented and to provide knowledge to our customers. This document cannot be expected to cover all possible startup conditions. Follow all standard safety procedures when following these instructions.
- b) Startup Date: ____/____/____.
- c) Startup Location: _____.
- d) Startup Person: _____.

1.2 CONTACT PERSON AT PRODUCT LEVEL CONTROL

- a) If at any time you do not understand this procedure, or you would like additional information, do not hesitate to call Product Level Control. When calling, please ask for Bruce at extension 27 and indicate the phone call is in reference to project 07 - 014.

1.3 TOOLS REQUIRED

- a) Tools listed below are in addition to a typical tool set.
 - i) Voltmeter
 - ii) Clamp on amperage meter
 - iii) Telephone
 - iv) Flashlight

1.4 PHONE LINE HOOKUP

- a) If your system includes an auto dialer, telephone service is required. Typically, the local telephone company or your contractor will run the phone line to the control panel on the system. If your system does not require telephone service, please proceed to the next section.
 - i) Verify the phone service is operating properly by connecting a telephone to the incoming phone line and making a phone call. Note that some customers put long distance blocks on the telephone service.
 - ii) Connect the phone line to the control panel. Labels inside the control panel will guide you to this connection.
 - iii) Auto dialers require setup. Please refer to the auto dialer's operation and maintenance manual for setup instructions. Product Level Control will gladly assist you in this setup if requested.

1.5 POWER HOOKUP

- a) Typically a licensed electrician runs wiring from the power source to the system. Depending on local codes, a disconnect separate from the control panel disconnect may be required.
- b) Disconnect switch inside of system's control panel is to remain off. Do not turn disconnect on until supplied voltage is verified as described below.
- c) If present, open the white swing out panel inside of the control panel. Use caution when this door is open because high voltage wires are present.
- d) Inside of the system's control panel, verify supplied power agrees with the system's electrical prints and labels inside of the panel. If a neutral termination is present in the control panel, be sure the neutral wire has been run from the power source to this termination.
- e) On three phase systems, if a high leg is present, be sure this is in the center or B phase location in the control panel's termination block. A high leg is a power lead that has a noticeably higher voltage to neutral or to ground than the other power legs.
 - i) Record voltage readings across all phases
 - (1) A – B phase voltage = _____
 - (2) A – C phase voltage = _____
 - (3) B – C phase voltage = _____
 - (a) Above voltages should be within 10% of each other and also within 10% of requirement.
 - (b) If (a) is not true, call Product Level Control
 - (4) Neutral – A phase voltage = _____
 - (5) Neutral – B phase voltage = _____
 - (6) Neutral – C phase voltage = _____
 - (a) Above voltages except (5) should be between 110 and 125 volts.
 - (b) If (a) is not true, call Product Level Control

1.6 OVERLOAD SETTINGS

- a) Normally every motor has an overload relay located inside the control panel. Overloads are designed to trip when a motor draws more amps than the motor is designed for.

- b) Verify each overload setting matches each motor's full load amperage as indicated on the motor's nameplate. Note that most motors are rated for more than one voltage so be sure you are reading amperage on the motor nameplate as it relates to the supplied voltage. Now is a good time to record the motor nameplate amperages in Section 1.19 chart.
- c) Product Level Control set these overloads correctly during in house testing. The above steps verify settings have not changed during shipment.

1.7 EXTERNAL PIPING HOOKUP

- a) You soon will be running the system. Now is a good time to make sure all inlet and outlet piping assemblies are connected to the system properly and also make sure all valves external to the system are set properly.

1.8 EXTERNAL SWITCH HOOKUP

- a) Make sure all switches external to the system are connected properly. These may include injection gallery level switches or down well pump control switches.

1.9 FREEZING CONDITIONS

- a) Freezing conditions or conditions where freezing has occurred recently can cause problems. Ice in pipes will restrict flow and may cause extreme pressure or vacuum levels that can cause equipment failure.
- b) Verify assemblies in the system do not have ice present.
- c) Verify piping outside of the system does not have ice present. Ice blockages in exterior piping can cause catastrophic equipment failures.

1.10 VALVE SETTINGS

- a) For systems that include sparge compressors:
 - i) Open all valves in system except for sample ports. Valves to open include: all ball valves and gate valves including the bleed air valve.
- b) For systems that include soil vapor extraction pumps or blowers:
 - i) Open all valves in system except for sample ports and relief valves. Valves to open include: all ball valves and gate valves including the bleed air dilution valve.
 - ii) Do not open manual tank drain valves.
 - iii) If your system has a vapor carbon bypass, arrange valving according to your preference.
 - iv) If your system includes water transfer pumps, open each pump's downstream gate valve 1 full turn from closed. This will allow for a restricted flow, which can be adjusted later according to site conditions. Also, make sure all drain plugs are installed.
- c) For systems that include air strippers:
 - i) Open all valves in system except for sample ports. Valves to open include: all ball valves, gate valves and the air damper on the air stripper blower.
 - ii) Adjust the influent water transfer pump's downstream gate valve 1 full turn from closed. This will allow for a restricted flow, which can be adjusted later according to site conditions. It is common for an air

stripper to not perform according to specifications due to an influent water flow higher than specified.

- iii) Verify all drain plugs are installed. Inspect lower stage of air stripper for a small drain hole.
- iv) Adjust effluent water valving to a capacity slightly higher than the influent.

1.11 TURNING POWER ON

- a) Position all Hand-Off-Auto (HOA) selector switches to Off position. See HOA descriptions below
 - i) Hand, H: motors will run, all operating and safety switches are ignored.
 - ii) Off, O: motors will not run, all operating switches are ignored.
 - iii) Auto, A: motors will run according to operating switches and system logic.
- b) Power up the control panel by switching the disconnect in the panel to the on position.

1.12 MOTOR ROTATION

- a) Correct motor rotation is extremely important.
- b) Your system was completely wet tested at Product Level Control. When it was tested, all motors were rotating the correct direction. On site, power phasing or wiring may cause the motors to rotate the wrong direction.
- c) Read and understand all operating instructions for each piece of equipment. Follow the manufacturer-supplied instructions to verify all pieces of equipment are ready for operation.
- d) If your system includes an Emergency Stop button (E Stop), make sure this red knob is pulled out. System will not operate if Emergency Stop is pushed in.
- e) For three phase power systems:
 - i) Select a three-phase motor for which you would like to check rotation. Make sure this motor will not cause damage to the system or itself if it rotates backwards.
 - ii) Turn HOA switch to hand momentarily (less than 1 second) to check rotation. This step usually works with more success if there is another person watching the motor as it starts up. Remember to follow proper safety procedures.
 - iii) If motor rotation is not correct, your system's phasing is not correct. Turn off power at the source and swap A and C phase incoming power wires. Follow all typical safety procedures when performing this step including locking power off at the source. Record the new voltage values in above Section 1.6.
- f) Verify all motors are rotating in the correct direction by momentarily turning each HOA switch to Hand and watching their rotation.

1.13 HEATER AND EXHAUST FAN

- a) Verify each exhaust fan starts when the exhaust fan thermostat is set at a temperature below ambient. Make sure exhaust fan stops when the thermostat is set at a temperature above ambient.

- b) Verify each heater starts up when the heater thermostat is set at a temperature above ambient. Make sure heater shuts down when the thermostat is set at a temperature below ambient.

1.14 SWITCH SETTINGS

- a) Locate all system switches in system. Typically, these can be pressure, vacuum, level or temperature switches.
- b) Set these switches in positions that you believe to be correct based on anticipated run conditions. These settings can be changed later.
- c) Some level switches include legends at the switch to indicate proper position. Verify these switches are installed according to the legend.

1.15 CONTROL PANEL LOGIC

- a) The control panel tells the system how to operate. It is important to understand the logic.
- b) Read the attached Alarm Interlock Schedule and Sequence of Operations.
- c) It is common for operators to believe the system is malfunctioning while in fact it is operating as designed.

1.16 SYSTEM OPERATION

- a) The system is now ready to be operated.
- b) Water transfer pumps will be damaged if ran dry. Before operating transfer pumps, make sure they are primed properly.
- c) Start system by placing all HOA selector switches in Auto and then press and release the Reset button.
- d) System should now be operating.
- e) Inspect system as it operates and listen for abnormal noises or vibrations.
- f) Adjust bleed air dilution valves on sparge and SVE systems to bring pressure levels to desired operating conditions.

1.17 VOLTAGE

- a) With a majority of the motors operating including the largest motor, record voltage readings across all phases and document in the chart below. Fluctuating or decreased voltages cause system performance issues and damage to motors.

Date/Time	L1-L2	L1-L3	L2-L3	L1-neutral	L2-neutral	L3-neutral

1.18 AMPERAGE

- a) While motors are operating, record amperage values from each motor.
 - i) Typically, amperage readings are taken inside of control panel.
 - ii) Take amperage readings from each leg of each motor and record in chart below.
 - iii) Compare amperage readings to motor nameplates.

Motor	nameplate amps	L1 amps	L2 amps	L3 amps	neutral amps
Exhaust Fan					
P-100					
P-200					
B-100					
B-200					
Heater					
P-300					
C-600					
HX-600					

1.19 SWITCH OPERATION

- a) While system is operating, manually adjust each switch one at a time to cause fault conditions. These switches include pressure, vacuum, temperature and level.
- b) Verify system responds properly according to the system's logic.

1.20 CONDUIT SEALS

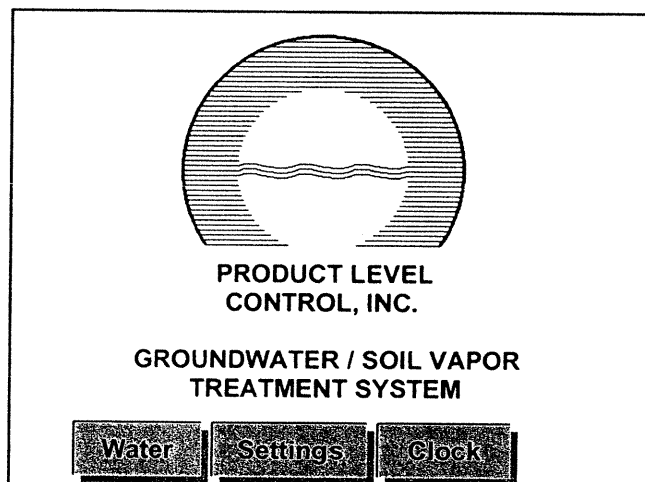
- a) Seals are conduit fittings located adjacent to walls dividing classified locations from non-classified locations and also near light switches, thermostats, emergency stops and motor disconnects.
- b) The purpose of seals is to prevent gasses from entering control panels or electrical spark areas through conduit.
- c) After the system has operated successfully for a length of time, pour the seals. Typically, the seal material is called "Chico." Follow the instructions included with the Chico.

Operator Interface Instructions for Dexter Chemical Groundwater / SVE System

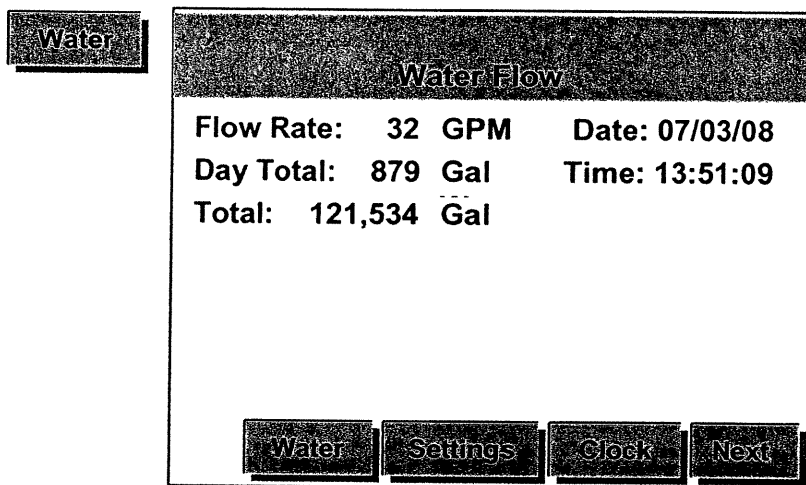
The operator interface touch screen is used for viewing and editing parameters. Actions are performed by touching objects or "buttons" on the screen. Different screens are displayed by pressing the menu buttons at the bottom of the screen. When a read/write data display is touched, a numeric keypad will pop up on the screen and a new value can be entered. Read-only data cannot be edited.

The Menu Buttons:

The 3 buttons at the bottom of this screen (the initial display) are used to navigate through all the functions of the operator interface. These 3 buttons will appear on all screens along with any other buttons needed for a specific operation.



The Water Function:



Flow Rate: Current flow rate through flow transmitter FT300.

Day Total: Total gallons pumped through FT300 during the current day (this number resets to 0 at midnight).

Total: Running total gallons pumped through FT300 (does not reset).

Date: Current date on the real time clock/calendar (can be reset in the Clock function).

Time: Current time on the real time clock/calendar (can be reset in the Clock function).

Operator Interface Instructions for Dexter Chemical Groundwater / SVE System

The Water Function Continued:

Next	07/15/08 3,789	06/29/08 4,568	Capt
	07/14/08 3,879	06/28/08 1,345	
	07/13/08 4,568	06/27/08 2,321	
	07/12/08 1,345	06/26/08 4,675	
	07/11/08 2,321	06/25/08 5,121	
	07/10/08 4,675	06/24/08 1,443	
	07/09/08 5,121	06/23/08 2,657	
	07/08/08 1,443	06/22/08 6,437	
	07/07/08 2,657	06/21/08 5,821	
	07/06/08 6,437	06/20/08 1,987	
	07/05/08 5,821	06/19/08 1,674	
	07/04/08 1,987	06/18/08 4,255	
	07/03/08 1,674	06/17/08 2,677	Back
	07/02/08 4,255	06/16/08 2,533	Next
	07/01/08 2,677	06/15/08 3,754	
	06/30/08 2,533		

This screen displays the gallons pumped on each of the last 31 days that the system was powered up.

Capt Pressing this button (Capture) will save this screen to the compact flash memory card in JPEG format. The file name is 'Water Total Screen 1.jpg'. Instructions on how to access this file is given on page 6.

Next	06/14/08 2,789	05/30/08 3,578	Capt
	06/13/08 3,573	05/29/08 1,345	
	06/12/08 1,379	05/28/08 2,321	
	06/11/08 2,187	05/27/08 4,675	
	06/10/08 2,465	05/26/08 5,121	
	06/09/08 4,789	05/25/08 1,443	
	06/08/08 0	05/24/08 2,657	
	06/07/08 1,342	05/23/08 6,437	
	06/06/08 1,784	05/22/08 5,821	
	06/05/08 2,443	05/21/08 1,987	
	06/04/08 4,534	05/20/08 0	
	06/03/08 2,334	05/19/08 4,255	
	06/02/08 2,088	05/18/08 2,677	
	06/01/08 1,575	05/17/08 2,533	
	05/31/08 2,755	05/16/08 3,754	Back
	05/30/08 3,578		

This screen is the same as the previous screen but shows gallons pumped on each of the last 33 thru 62 days that power was applied to the system. This screen is saved as 'Water Total Screen 2.jpg'

Operator Interface Instructions for Dexter Chemical Groundwater / SVE System

The Settings Function:

The screenshot shows a screen titled "Settings pg 1". On the left, there is a numeric keypad with a "Settings" button above it. The keypad displays the following values: 20.0, 0800, 2030, 0000, and 0000. To the right of the keypad, the settings are listed: "Chemical Pump Fault Delay" (20.0 Sec), "Monday System On Time" (0800 Hr:Min), "Friday System Off Time" (2030 Hr:Min), "Aux 1" (0000), and "Aux 2" (0000). At the bottom of the screen, there are four buttons: "Water", "Settings", "Clock", and "Next".

To edit a setpoint:

- Press the read/write data display you want to edit and the numeric keypad will be displayed.
- Press digit keys of new value.
If you enter the wrong digits press [Clear] to clear the data and start again.
- Press [ENT]. The keypad will disappear if the new data is valid. If the keypad does not disappear; the data you entered is out of range.
- Press [Cancel] to remove the keypad from the screen.

Setpoint Descriptions

Chemical Pump Fault Delay: Length of time that Chemical Pump can run with no flow sensed by the controller before the 'Chemical Pump Fault Alarm' turns on.

Monday System On Time: Time of day in 24 hour format that the system will start running on Monday if a 'Friday System Off Time' is entered. Example; 0730 = 7:30 AM. Enter 0000 to disable the weekend shutdown function.

Friday System Off Time: Time of day in 24 hour format that the system will stop running on Friday. Example; 1930 = 7:30 PM. Enter 0000 to disable the weekend shutdown function.

Aux 1: Unused function (future).

Aux 2: Unused function (future)

Operator Interface Instructions for Dexter Chemical Groundwater / SVE System

The Settings Function Continued:

Next

	On Hr:Mn	Off Hr:Mn	Disable Enter 1	
*	0800	2030	0	SVE 1
*	0900	2030	0	SVE 2
*			0	Sparge
*			0	Chemical Pump

Settings pg 2

Back

Water

Settings

Clock

Next

On Hr:Mn: Time of day in 24 hour format that the device (SVE 1, SVE 2) should start running.

Off Hr:Mn: Time of day in 24 hour format that the device (SVE 1, SVE 2) should stop running.

NOTE: Enter 0000 for On time and Off time to run a device continuously.

Disable Enter 1: Enter 1 to disable a device, 0 to enable a device. When a device is disabled it will not run in the 'Auto' mode, but will run in the 'Hand' mode.

Next

	On Hr:Mn	Off Hr:Mn	Disable Enter 1	
*	0800	2100	0	Sump 1A
*	0900	2200	0	Sump 2A
*	1000	2300	0	Sump 3A
*	0900	2200	0	RW 1A
*	0800	2100	0	RW 2A
*	1000	2300	0	RW 3A
*	0900	2200	0	RW 4A

Settings pg 3

Back

Water

Settings

Clock

Next

This screen and the next 3 screens are the same as the previous screen, but for the 28 well pump stations.

Operator Interface Instructions for Dexter Chemical Groundwater / SVE System

The Clock Function:

Clock

Real Time Clock Settings
Enter 1 at left to stop clock,
Enter new time settings below,
Enter 2 at left to restart clock.

* 0	Second (0-59)	* 0	Month (1-12)
* 0	Minute (0-59)	* 0	Year (0-99)
* 0	Hour (0-23)		
* 0	Day Of Week (0-6)		
* 0	Day Of Month (1-31)		

Water **Settings** **Clock**

This screen allows adjustment of the controller's real time clock. To adjust time settings:

1. Enter 1 in the yellow field to stop the clock
2. While clock is stopped enter the new time and calendar settings.
3. Enter 2 in yellow field to restart the clock.

Operator Interface Instructions for Dexter Chemical Groundwater / SVE System

Instructions For Retrieving Screen Captures:

1. Follow the instructions on page 2 for capturing one or both of the data logging screens.
2. Connect a CAT-5e cable (non crossover) to the PC and the CAT-5 connector on the control panel.
3. Open Internet Explorer (any web browser should work) and type the link:
ftp://169.254.79.51/Compact_Flash_1/Log into the address box and press 'Enter' or click 'Go'.
4. Something similar to the following should appear:

FTP directory /Compact_Flash_1/Log at 169.254.79.51

07/14/08 11:40 AM 21,808 Water Total Screen 1.jpg
07/14/08 11:40 AM 21,915 Water Total Screen 2.jpg

The 2 .jpg files are the screen captures. They can be viewed now by clicking on them.

HINT: You can now add this link to a Favorites folder to save time the next time you access these files.

5. To copy and paste the files to another location:
On the Internet Explorer toolbar click 'Page' then 'Open FTP site in Internet Explorer',
Now click on the file you want to copy, press 'Ctrl' and 'C' or select 'Copy' from the Edit menu.
Browse to the location you want to move the file to, press 'Ctrl' and 'V' to paste the file or select 'Paste' from the Edit menu.
The files can now be inserted in MS Word documents or attached to an e-mail.

HINT: if the .jpg files you access are not up to date you may need to change a setting in Internet Explorer:

On the Internet Explorer toolbar click 'Tools', click 'Internet Options'.
Under 'Temporary Internet Files' or 'Browsing History' click 'Settings'
Under 'Check for newer versions of stored pages' select 'Every visit to page' then click 'OK'

CONTROLS WET TEST CHECKLIST

07-014 Whitman

Bronx, NY

7/28/2008

ALARM INTERLOCKS SCHEDULE: X = DEVICE SHUTDOWN CONDITION

ALARM INTERLOCKS	PUMP SECTION										CHECKBOX COLUMN
	SVE Blower B100 (Bldg 2)	SVE Blower B200 (Bldg 2)	Transfer Pump P100 (Bldg 2)	Transfer Pump P200 (Bldg 2)	Sparge Compressor C600 (Bldg 3)	Heat Exchanger HX600 (Bldg 3)	Chemical Pump P300 (Bldg 3)	Well Pumps P3501-P3528 (Bldg 3)	ALARM DELAY	ACTION	
BUILDING 2 INPUTS											
Oxidizer Not Ready (opens)	X	X			X	X			10 sec	Alarm 'Oxidizer Not Ready', auto reset	
VGAC Inlet Hi Pressure PSH200	X	X			X	X			3 sec	Alarm PAH200, manual reset	
VGAC Inlet Hi Temp TSH200	X	X			X	X			3 sec	Alarm TAH200, manual reset	
Sump Hi Hi Level LSHH701	X	X	X	X	X	X			3 sec	Alarm LAH701, manual reset	
Transfer Pump P100 Overload			X						3 sec	Motor Fault Alarm, manual reset	
Transfer Pump P200 Overload				X					3 sec	Motor Fault Alarm, manual reset	
B100 Enabled, B200 Disabled											
MS1 Hi Hi Level LSHH100	X				X	X			3 sec	Alarm LAH100, manual reset	
SVE Blower B100 Overload	X				X	X			3 sec	Motor Fault Alarm, manual reset	
B100 Disabled, B200 Enabled											
MS2 Hi Hi Level LSHH200		X			X	X			3 sec	Alarm LAH200, manual reset	
SVE Blower B200 Overload		X			X	X			3 sec	Motor Fault Alarm, manual reset	
B100 Enabled, B200 Enabled											
MS1 Hi Hi Level LSHH100	X				X	X			3 sec	Alarm LAH100, manual reset	
MS2 Hi Hi Level LSHH200		X			X	X			3 sec	Alarm LAH200, manual reset	
SVE Blower B100 Overload	X				X	X			3 sec	Motor Fault Alarm, manual reset	
SVE Blower B200 Overload		X			X	X			3 sec	Motor Fault Alarm, manual reset	
BUILDING 3 INPUTS											
Poly Tank Hi Hi Level LSHH300	X	X	X	X	X	X		X	3 sec	Alarm LAH300, manual reset	
Pump Outlet Hi Pressure PSH300	X	X	X	X	X	X	X	X	3 sec	Alarm PAH300, manual reset	
Sparge Outlet Hi Pressure PSH600					X	X			3 sec	Alarm PAH600, manual reset	
Sparge Outlet Hi Temp TSH600					X	X			3 sec	Alarm TAH600, manual reset	
Sump Hi Hi Level LSHH701	X	X	X	X	X	X	X	X	3 sec	Alarm LAH701, manual reset	
Chemical Tank Lo Lo Level LLSLCP	X	X	X	X	X	X	X	X	3 sec	Alarm LALCP, manual reset	
House Trap Hi Hi Level LSHH801	X	X	X	X	X	X	X	X	3 sec	Alarm LAH801, manual reset	
Foam Detection	X	X	X	X	X	X	X	X	12 sec	Chemical Pump Fault Alarm' manual reset	
No Chemical Flow FS CP300	X	X	X	X	X	X	X	X	Adjust	Chemical Pump Fault Alarm' manual reset	
Sparge Compressor C600 Overload					X	X			3 sec	Motor Fault Alarm, manual reset	
Chemical Pump CP300 Fault	X	X	X	X	X	X	X	X	3 sec	Motor Fault Alarm, manual reset	
Heat Exchanger HX600 Overload					X	X			3 sec	Motor Fault Alarm, manual reset	
Transfer Pump P300 Overload	X	X	X	X	X	X	X	X	3 sec	Motor Fault Alarm, manual reset	
Well Pumps P3501-P3528 Overload							X	X	3 sec	Motor Fault Alarm, manual reset	

[illegible]



CARBON PARTS LIST

File Name:

Parts List

Customer:

WHITMAN

Site Reference:

BRONX

Date:

8/18/2008

Reference	Qty	Units	Description	Material	Part Number
LIQUID CARBON	3	each	TETASOL AF-1000 CARBON VESSEL, LIQUID PHASE, MEDIUM PRESSURE SERIES, 1000 LB GAC, 3 PSIG PRESSURE DROP AT DESIGN FLOW OF 50 GPM, 75 PSI MAX, 2" FPT	STEEL / PVC	TETRASOLV-AF-1000 WITH LIFTING EYES MODIFIED TO HANDLE 75 PSIG
VAPOR CARBON	2	each	CARBON VESSEL, VAPOR PHASE, TETRASOLV-VFV-500 HIGH PRESSURE & VACUUM, 500 LB GAC, 18 INCHES OF WATER COLUMN PRESSURE DROP AT DESIGN FLOW OF 350 CFM, FULL VACUUM / 12 PSI MAX, 140°F MAX, 2" FPT	STEEL / PVC	TETRASOLV-VFV-500 WITH LIFTING EYES



Liquid & Vapor Filtration
Remedial • Industrial • Municipal

Operation & Maintenance Manual

AFD • AF • HPP • HPAF SERIES

Tetrasolv Filtration Liquid Filters

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1.0 GENERAL DESCRIPTION

The liquid series filters utilize fixed bed filtration to treat water. The filters employ a variety of medias to remove or catalyze contaminants. Flow through the filter may be either up flow or down flow depending upon the media supplied and the operation parameters. Generally inlet and outlet locations are indicated on the filter and or the filter drawings.

Product data sheets, drawings, MSDS, etc are available from www.tetrasolv.com or call the number below or email your request to support@tetrasolv.com.

2.0 SAFETY CONSIDERATIONS

It is important that the entire O&M manual be read prior to set up and operation of the carbon system.

- ♦ **WARNING: We strongly recommend the use of a relief device in all installations. Exceeding the maximum pressure of the filter could result in catastrophic failure of the vessel.**
- Always adhere to "lockout/tagout" procedures when servicing the system.
- Wear appropriate safety equipment when operating system.
- Review the MSDS sheet for the installed media prior to working with the installed carbon.
- ♦ **WARNING: Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.**
- Understand the potential hazards of the stream

being treated by the system. The media may contain higher concentrations of the contaminants being adsorbed than is in the influent stream. In addition the media may be considered hazardous material and therefore may require specific handling precautions unknown to Tetrasolv Filtration.

3.0 INSTALLATION

3.1 Shipment

Typically filters are shipped with media installed. However, in certain instances media is shipped to the site to be installed after installation. In very large systems it may be advisable to not install the media until adsorbers have been placed into final position and secured.

3.2 Unloading

Refer to the product data sheet for weight information for appropriate sizing information for the equipment to be used.

All components should be lifted either by crane or forklift as designated by the model.

- ♦ **WARNING:** Failure to follow the procedures outlined below can result in catastrophic damage to the system.

Crane Lift - If a crane lift is to be used we recommend the following method. A "spreader" equaling 75% of the distance between the opposing lifting eyes on each adsorber should be used to insure proper lifting force direction. Attach an appropriately sized spreader beam and lifting cables to each lift eye of the component. The use of an experienced crane operator and quality equipment is highly recommended.

Fork-Lift - When using a forklift we recommend that the fork tubes on the filter be used or a pallet if the unit was shipped on a pallet.

- ♦ **WARNING:** Never attempt to pick up an adsorber which has wet carbon installed. The lifting eyes are designed only to lift the adsorber with dry carbon installed.

3.3 Inspection

Perform the following inspections after un-loading the filter. Note any discrepancies and contact Tetrasolv

Filtration immediately.

- Check the vessel exterior for damage which may have occurred during shipment. Inspect the support structures and piping support for damage.
- Inspect the piping system for damage. Insure the valves operate properly. Check installed instruments and instrument installation points for damage.
- Visually inspect the interior (if possible) of the vessel for loose laterals and or internal damage.
- Inspect the carbon discharge, drain and vent valves for damage.

3.4 Set Up

The filter should be placed on a level concrete pad of appropriate thickness to support the system at it's maximum operational weight. The filter should be secured to the pad using appropriately sized anchor bolts.

Connect the site piping to the filter inlet and outlet connection points. It is important that all piping connected to the filter should be self supported. We also recommend in hard pipe installation that a flexible joint be used to further insulate the filter from vibration and stress.

Connect any gauges and instrumentation shipped loose with the system.

The outlet piping should be designed to allow flooded operation of the Adsorber at all times to assure effective operation. If the outlet line does not provide for back pressure on the Adsorber unit, then the discharge piping should include an elevated piping loop to assure flooded operation.

Siphoning can occur when the discharge line allows suction to be placed on the process discharge. Siphoning can cause air pockets to occur in the adsorbers. If channeling is likely to occur we recommend the installation of an appropriately sized vacuum breaker.

If the supply pump is capable of producing pressure greater than the design limitation of the filter it is recommended that a rupture disk or pressure relief valve be installed prior to the influent connection.

If water conditions such as high suspended solids exist a filter should be installed prior to the Adsorber. A simple cartridge or screen filter helps prevent pressure buildup in the media bed. Many other water issues may effect Adsorber operation and we therefore recommend you discuss your specific installation with a representative.

Connect the process inlet and outlet to the site influent and effluent process lines.

3.5 Wetting and Deaeration

Dry carbon and other medias must be wetted and deaerated prior to use. This procedure displaces air from the internal structure of the carbon granule, thus assuring that the liquid to be treated is in contact with the carbon surface.

Prior to operation, the filter must be filled with clean, uncontaminated liquid. The recommended method for filling the vessel is through the outlet line. Open the inlet line to purge air from the system. Feed water into the outlet line until water flows from the inlet line. The wet carbon or media should be allowed to set for a minimum of 1 hours.

This is also a good time to inspect the system for leaks which may have been caused in transit and unloading the system. If leaks are spotted, tighten the fitting or flange bolts carefully until the leak stops. Do not overtighten the bolt or fitting. If the leak persists contact Tetrasolv Filtration for assistance.

After wetting, the carbon bed can be deaerated by draining the adsorber, and again filling the adsorber upflow with uncontaminated water. This procedure will eliminate any air pockets which may have formed between the carbon granules.

After completing the wetting and Dearation it is recommended that a backwash be performed. The backwash will remove media fines which can cause excess pressure drop in the system if not removed. In addition backwashing helps equalize the bed. Follow the directions outlined in Backwashing (refer to section 4.2).

After backwashing close the system valves and wait 1 hour.

The system is now ready for operation.

4.0 OPERATION

Flowrates to the filter should be determined based upon the required contact time between the liquid and the filtration media. The required contact time normally is determined prior to installation and operation of the filter.

It is important that the filters remain flooded at all times. If it is necessary to drain adsorbers while off-line it is recommend the procedures in section 3.5 "Wetting and Dearation" be repeated.

4.1 Modes of Operation

With certain applications (2) filters in series flow are utilized. Listed below are typical operational modes.

- Shutdown - Both filters completely off-line and isolated.
- Series Flow - Influent enters primary filter and exits through secondary adsorber (this is the preferred method of operation)
- Isolation Flow - Only one filter is receiving influent. This mode is typically used when the operator is maintaining the off-line filter.
- Parallel Flow - Both filters are receiving the influent as the primary. Flow is split equally between the filters. This mode is used when higher flow rates need to be achieved and contact times are not critical.
- Backwash Mode - Used when back-washing either filter.

4.2 Backwashing

IMPORTANT: Backwashing is not advisable with AFD or AF Series Filters. If a backwash is required please contact the number below or support@tetrasolv.com for assistance.

Usually backwashing is only performed in carbon adsorbers after new carbon has been installed or prior to removing the carbon from the adsorber. However, sometimes water conditions necessitate backwashing to remove suspended solids from the top of the carbon bed. Keep in mind that backwashing a carbon bed during normal service runs may cause the transfer zone to be disturbed leading to pre-mature breakthrough of the carbon bed. Backwashing helps to reduce and equalize pressure drop across the media bed as well as removes

collected particulate from the top of the bed. Backwash rates for filters typically fall in the 5 to 20 gpm/ft². Backwash rates are dependent upon temperature of the backwash water, filter design and the media conditions. Refer to the data sheet for the supplied filter to obtain the cross sectional bed area. Refer to the data sheet for the supplied media to obtain the recommended backwash rate. Backwashing should begin at a low rate and proceed upwards.

Clean, uncontaminated, sediment free water is introduced to the filter through the outlet connection. This liquid flows upwards through the filter and exits through the inlet line - directed to a back-wash water collection point or drain. The flow rate should not be high enough to cause a significant quantity of media to exit.

IMPORTANT: Use only clean un-contaminated water free of sediments. If there is any question that sediments may be present the water should be filtered through a 100 micron filter or smaller. Sediments introduced into the lateral system during backwash can cause excessive pressure build-up in the underdrain leading to underdrain failure.

If possible position an observer at the backwash discharge point. The adsorber should note excessive media loss and general appearance of the backwash effluent. If conditions warrant the observer should also instruct that the backwash be stopped.

Monitor the differential pressure for the filter being backwashed during the operation. If the differential pressure exceeds 30 PSIG discontinue the backwash and contact Tetrasolv Filtration.

IMPORTANT: Differential Pressure exceeding 30 PSIG during backwash may damage the vessel underdrain.

4.3 Monitoring

Filter units only require periodic monitoring if properly installed. The following items may be monitored:

- Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate build-up of filtered solids. Never exceed maximum design pressure of filter. If the differential pressure exceeds 20 PSIG it may become necessary to perform a backwash (see Backwashing Section 4.2)
- Samples: Inlet and outlet sample points if provided for liquid analysis to determine system performance. Before pulling a sample

the sample valve should be opened and allowed to flow freely for a few minutes to insure a fresh sample is obtained.

- Air: Check for trapped air by opening upper vent valve and allowing small amount of liquid to flow out. If your system was provided with automatic vent systems it is still necessary to periodically verify their operation.
- Inspect the discharge stream periodically for filtration media. If filter media is present in the exit stream shut down the system and contact Tetrasolv Filtration immediately.

Note: When the system is first started up small amounts of fines may be present. This is normal and should discontinue within a short period of time.

5.0 FILTRATION MEDIA REPLACEMENT

Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the filtration media is complete, it is recommended that the inside of the filter be washed to remove all contamination and any trace of spent media. After the filter has been washed, the filter should also be checked thoroughly and any minor maintenance conducted.

5.1 Media Loading - Dry Method

Fill the adsorber 1/4 full of clean water to protect the lower manifold and limit the amount of dust generated.

- ♦ **WARNING** - Dry activated carbon generates considerable dust. While activated carbon poses no health risk the dust can cause respiratory irritation and occasional skin rash. Therefore we recommend the use of proper clothing and dust mask during filling operation.

Super Sacks - Hoist the bag over the manway and untie the outer bag exposing the inner chute. Untie the inner chute while clasp it shut. Remain holding the chute and carefully lower the chute into the manway. Un-clasp the chute and allow the carbon to discharge from the sack. The carbon should flow out very quickly and completely. When finished shake the bag and invert the chute into the bag.

If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

5.2 Media Loading - Slurry Method

In this method dry-activated carbon will be delivered to the site in a slurry truck or slurry capable hoppers. To add the carbon to the filters use the following method:

♦ **WARNING:** Carbon slurry operation is a potentially hazardous operation which should only be performed by experienced operators with prior slurry experience. If you are un-trained do not attempt to perform a slurry without assistance.

1. Use an appropriate sized hose connected to the carbon supply line for the adsorber. Be sure the slurry line is adequately secured and the cam-lock mechanism is completely engaged. If the slurry line disconnects or fails large amounts of carbon will be expelled.
2. Fill the adsorber 1/4 full of water to cushion the vessel internals from the entering carbon.
3. Completely cover the fresh carbon with clean water. Connect air source to the slurry container capable of producing 10 PSIG of air at 175 cfm.
4. Open the adsorber process outlet valve to allow excess water to escape the system (note: depending upon your discharge piping configuration this may not allow sufficient water drainage under non-pressure operation, consult Tetrasolv Filtration). Open the slurry in valve. Fresh carbon should begin flowing quickly into the filter. During this process it may become necessary to stop the slurry and allow excess water to drain from the adsorber.
5. When transfer is complete the transfer hose will begin blowing air only. It may be necessary to inspect the transfer hopper for carbon which did not transfer. If a sufficient quantity is present wash the carbon to the center using clean water and add enough water to re-cover the carbon and repeat the above procedures.
6. Close the valves and proceed to Section 3.5 "Wetting and Deaeration" then perform a backwash.

5.3 Media Removal - Slurry Method

This method can only be used with slurry equipped HPAF Series!

In this method spent activated carbon will be removed from the spent adsorber into a slurry truck or slurry capable hoppers. To remove the carbon from the filter use the following method:

♦ **WARNING:** Carbon slurry operation is a potentially hazardous operation which should only be performed by experienced operators with prior slurry experience. If you are un-trained do not attempt to perform a slurry without assistance.

Backwashing the adsorber to be serviced for a few minutes prior to servicing will make the slurry occur more easily. It is important the the adsorber to be backwashed be full of water prior to attempting the slurry.

1. Connect the carbon discharge line to the carbon discharge connection on the adsorber to be emptied.
2. Connect an air source to the carbon fill line capable of producing 50 PSIG of air at 175 cfm.

♦ **WARNING -** The inlet air should be closely monitored to insure the pressure does not exceed the design pressure leading to rupture disc activation. If this can not be done the use of a pressure limiting device which still allows adequate air flow should be used.

3. Open the air vent valve and pressurize the adsorber to 15 PSIG.

IMPORTANT: The initial pressure required for slurry transfer will be between 10 and 20 PSIG. Because of the compressibility of air the pressure should be reduced as the adsorber empties. If the operator supplying compressed air into the adsorber cannot see the pressure gauge there must be another operator who can call out the pressure reading during the transfer.

4. Open the slurry out valve. Spent carbon should begin flowing quickly out of the carbon vessel.
5. When transfer is complete the transfer hose will begin blowing air only. Bleed all air from the adsorber, remove the manway and inspect the adsorber for carbon which did not transfer. If a sufficient quantity is present wash the carbon to the center using clean water and add enough water to re-cover the carbon and repeat the above procedures.

6. Inspect the internals prior to refilling the adsorber.

Inspect the interior lining. Do not place the adsorber back into operation if any defects are noted.

6.0 MAINTENANCE

6.1 Extended Shut Down

If the filter will be shutdown for extended periods certain procedures should be taken to protect the filter.

If possible backflush the filter. Drain all water from the adsorber utilizing the effluent connection and the drain port if available. When draining allow air to enter the system by venting the influent line. Store the drained filter with system vented.

Caution should be taken during system startup following exposure to freezing conditions as the media may still be in a frozen state days or weeks after.

Prior to placing the adsorber back into service it is recommended the procedures outlined in section 3.5 "Wetting and Dewateration" be followed.

Monitor the filter closely after extended shutdown for signs of potential problems such as interior manifold failure or leaking valves and gaskets.

6.2 Manway Opening & Closing

When it becomes necessary to open a manway the following methods should be closely followed:

- ♦ **WARNING: Opening a manway while a vessel is pressurized can cause serious injury or death. Always verify pressure is relieved before attempting to remove a cover.**
- ♦ **WARNING: Opening the lower manway on an filter which contains media can result in large quantities of media being discharged. Worse still the manway may not be able to be successfully sealed without removal of the media.**

Verify vessel is isolated and relieve pressure using filter vent valve.

Round T-Bolt Closures

1. Carefully loosen retaining nuts around manway ring. If while loosening the bolts you hear a hissing or any other indication of pressure immediately re-tighten the bolts and verify pressure has been relieved.

3. Swing all T-Bolts away from manway cover and slowly open cover. If gasket sticks to manway cover gently pry away to avoid tearing the gasket.

4. Clean O-Ring surface. Lubricate gasket with petroleum jelly.

5. Close manway and tighten bolts. It may be necessary to further tighten bolts after pressure has been applied to filter to prevent leaking.

Elliptical Closures

1. Slip a bent bar between the manway handle and the flange frame. ***This is to insure the manway does not fall into the vessel when the yokes are removed.***

2. Carefully loosen both large nuts holding the yokes to the manway. Remove the yokes.

3. Slide the bar out of the handle while holding it. Push the manway in and tilt to allow the manway to be pulled out of the filter.

Closing the manways:

1. Clean the gasket surface and replace if necessary. Apply tape to the gasket and the cover to hold the gasket in place while it is placed into position.

2. Slip a bent bar between the manway handle and the flange frame. ***This is to insure the manway does not fall into the vessel when the yokes are removed.***

3. Place the yoke into the manway cover slot and hand tighten. Carefully inspect the gasket to be sure it can be seen around the inside surface of the manway opening.

4. Wrench tighten nuts.

7.0 Troubleshooting

The following situations are typical problems which may arise during the operation of filters. If these problems cannot be resolved by using this guide or problems occur which are not addressed in this guide please contact TetraSolv Filtration at the number listed below or e-mail support@tetrasolv.com

Situation:

High pressure drop or inadequate flow through filters at expected pressure drop levels.

Probable Cause:

- a) Verify effluent and influent lines to and from adsorber are not restricted.
- b) Sediments or solids may have clogged the surface of the media. Remove the top manway cover and inspect the surface of the media. Backwashing the media should resolve this issue. Explore the possibility of pre-filtration ahead of the media filter to limit future problems.
- c) Air is trapped in the top of the filter or the system piping. Relieve air using vent valves.
- d) Underdrain collection baskets clogged. Contact Tetrasolv Filtration for recommendations.

Situation:

Manways failing to seal. Water leaking from.

Probable Cause:

- a) Manway not installed properly.
- b) Missing or damaged gasket
- c) Debris trapped between gasket and ring

Solution:

Tighten the bolts on the manway first. If this does not solve the problem remove and reinstall manway as outlined in 6.4 if possible. If problem persists contact TetraSolv Filtration for further assistance.

Situation:

Premature filter exhaustion.

Probable Cause:

- a) Inadequate contact time between the media and the liquid stream.
- b) Contaminants in stream not originally accounted for in initial design or higher levels of contaminants than originally accounted for.

- c) Trapped air or solids on bed causing channeling.

Solution:

Sample and analyze the influent water stream. Verify proper conditions exist. Also look closely at suspended and dissolved solids.

Verify contact time sufficient for contaminate being adsorbed. Decrease flow rate or install additional media.

Inspect surface of filter for fouling.

Release excess air from top of filter through filter vent line.

Situation:

Activated Carbon bed discharge stream has higher level of contaminants than influent stream.

Probable Cause:

Carbon bed has reached saturation. Carbon beds will often release larger amounts of contaminants than they are adsorbing as the mechanical bonds are broken when the carbon has reached it's saturation point.

Also, activated carbon will preferentially exchange more easily adsorbed compounds for ones already trapped in the carbon surface releasing the compounds trapped in unpredictable levels.



Liquid & Vapor Filtration
Remedial • Industrial • Municipal

Operation & Maintenance Manual

VFD • VFV • VF • VR SERIES

Tetrasolv Filtration Vapor Filters

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1.0 GENERAL DESCRIPTION

The liquid series filters utilize fixed bed filtration to treat vapor. The filters employ a variety of medias to remove or catalyze contaminants. Flow through the filter may be either up flow or down flow depending upon the media supplied and the operation parameters. Generally inlet and outlet locations are indicated on the filter and or the filter drawings.

The most common application utilizes activated carbon as the adsorption media. Typically vapor which contains low levels of organic contaminants flows upward through the column of activated carbon where the larger organic molecules adhere to the porous structure of the activated carbon granules. This adsorption begins at the bottom of the "bed" and continues upward as the original adsorptive area becomes saturated.

Complete saturation of the carbon is dependent upon many factors such as contaminant levels, temperature, compounds being adsorbed, humidity, etc. Typically a carbon isotherm has been run on the influent stream to determine the expected rate of consumption of the activated carbon media. When monitoring has determined discharge air no longer meets discharge requirements the carbon will have to be removed and replaced (*refer to section 5.0*).

2.0 SAFETY CONSIDERATIONS

It is important that the entire O&M manual be read prior to set up and operation of the carbon system. If you have any questions please contact Tetrasolv Filtration at the number listed below or support@tetrasolv.com.

- ♦ **WARNING:** Where system pressure may exceed design pressure we strongly recommend the use of a relief device. Exceeding the maximum pressure of the filter could result in catastrophic failure

of the vessel.

- Always adhere to "lockout/tagout" procedures when servicing the system.
- Wear appropriate safety equipment when operating system.
- ♦ **WARNING:** *Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depletion may reach hazardous levels. If workers must enter a container containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces - including all applicable federal and state requirements.*
- ♦ **WARNING:** *High concentrations of certain compounds such as BETX and low concentrations such as ketones, aldehydes, organic acids and sulphur may cause severe temperature rises.*
- Understand the potential hazards of the stream being treated by the system. The activated carbon may contain higher concentrations of the contaminants being adsorbed than is in the influent stream. In addition the carbon may be considered hazardous material and therefore may require specific handling precautions unknown to Tetrasolv Filtration.

3.0 INSTALLATION

3.1 Shipment

Typically filters are shipped with media installed. However, in certain instances media is shipped to the site to be installed after installation. In very large systems it may be advisable to not install the media until adsorbers have been placed into final position and secured.

3.2 Unloading

Refer to the product data sheet for weight information for appropriate sizing information for the equipment to be used.

All components should be lifted either by crane or forklift as designated by the model.

- ♦ **WARNING:** *Failure to follow the procedures outlined below can result in catastrophic damage to the system.*

Crane Lift - If a crane lift is to be used we recommend the following method. A "spreader" equaling 75% of the distance between the opposing lifting eyes on each adsorber should be used to insure proper lifting force direction. Attach an appropriately sized spreader beam and lifting cables to each lift eye of the component. The use of an experienced crane operator and quality equipment is highly recommended.

Fork-Lift - When using a forklift we recommend that the fork tubes on the filter be used or a pallet if the unit was shipped on a pallet.

3.3 Inspection

Perform the following inspections after un-loading the system. Note any discrepancies and contact TetraSolv immediately.

- Check the vessel exterior for damage which may have occurred during shipment. Inspect the support structures and piping support for damage.
- Inspect the piping system for damage. Insure the valves operate properly. Check installed instruments and instrument installation points for damage.
- If the filters are shipped without carbon visually inspect the interior of the vessel for damaged internals.
- Inspect the carbon discharge, drain and vent valves for damage

3.4 Set Up

The filter should be placed on a level concrete pad of appropriate thickness to support the system at it's maximum operational weight. The filter should be secured to the pad using appropriately sized anchor bolts.

Connect the site piping to the filter inlet and outlet connection points. It is important that all piping connected to the filter should be self supported. We also recommend in hard pipe installation that a flexible joint be used to further insulate the filter from vibration and stress.

Connect any gauges and instrumentation shipped

loose with the system.

The outlet piping if connected to a stack or vent should be designed to prevent the introduction of water or debris into the adsorber piping. Discharge piping should be sized equal to or greater than the diameter of the system piping or back pressure could occur creating excess pressure drop on the system.

Flowrates greater than 60 cfm / sq ft can produce bed fluidization in vapor phase filters. When this occurs carbon granules can be lifted and propelled out of the carbon bed in up-flow applications. In extreme cases large amounts of carbon can be expelled. If the system will be operating near or greater than the amount stated above please contact Tetrasolv for recommendations.

Carbon filters can be manifold in parallel operation for higher flowrates. Series operation is the preferred method of operation as it provides for the greatest degree of bed utilization.

Vapor conditions such as high humidity and high temperature (> 125° F) can cause inefficient adsorption to occur. If these conditions exist contact Tetrasolv for support. Also, any free water or product and debris should be eliminated with a knockout filter prior to the vapor stream entering the system. Many other vapor issues may effect Adsorber operation and we therefore recommend you discuss your specific installation with a representative.

4.0 OPERATION

4.1 Modes of Operation

With certain applications (2) filters in series flow are utilized. Listed below are typical operational modes.

- Shutdown - Both filters completely off-line and isolated.
- Series Flow - Influent enters primary filter and exits through secondary adsorber (this is the preferred method of operation)
- Isolation Flow - Only one filter is receiving influent. This mode is typically used when the operator is maintaining the off-line filter.
- Parallel Flow - Both filters are receiving the influent as the primary. Flow is split equally

between the filters. This mode is used when higher flow rates need to be achieved and contact times are not critical.

4.3 Monitoring

Adsorber units only require periodic monitoring if properly installed. The following items may be monitored:

Pressure: Check inlet and outlet pressure. Increase in pressure differential may indicate media breakdown or presence of high moisture. Rapid increase in pressure drop could indicate adsorber failure.

Samples: Inlet and outlet sample points if provided for vapor analysis to determine system performance.

5.0 ADSORBER SERVICING

The Adsorber may be serviced on-site using a vacuum removal method. Prior to servicing the unit should be closed off from influent and effluent lines and any electrical devices or connections should be tagged off.

After removal of the spent carbon is complete, it is recommended that the inside of the Adsorber be checked thoroughly and any minor maintenance conducted.

5.1 Carbon Loading - Bulk Bag

- ♦ **WARNING** - Dry activated carbon generates considerable dust. While activated carbon poses no health risk the dust can cause respiratory irritation and occasional skin rash. Therefore we recommended the use of proper clothing and dust mask during filling operation.

Hoist the bag over the manway and untie the outer bag exposing the inner chute. Untie the inner chute while clasp it shut. Remain holding the chute and carefully lower the chute into the manway. Un-clasp the chute and allow the carbon to discharge from the sack. The carbon should flow out very quickly and completely. When finished shake the bag and invert the chute into the bag.

If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

5.2 Carbon Loading - Vacuum Method

manifold failure or leaking valves and gaskets.

In this method dry-activated carbon will be loaded into the adsorbers using a vacuum rig. To add the carbon to the filters use the following method:

WARNING: Due to the low vacuum rating of the VF series adsorbers (< 60" H₂O) only experienced change-out personnel should attempt this method of re-filling. Exceeding the recommend vacuum rating could lead to failure of the superstructure of the vessel.

1. Connect a 3" vacuum source to the auxiliary connection of the adsorber to be filled.
2. Install a 16" bolted transfer lid onto the manway opening of the adsorber to be filled.
3. Turn on the vacuum and check for good flow of air through the adsorber. Connect the fill line to the transfer lid and lead enough hose to reach the fresh carbon source (Note: This should be as short of a distance as possible).
4. Begin vacuuming carbon into the adsorber. It is important to note that the loading method is actually conveying and not true vacuum. The hose should contain 1/3 air with the carbon. Closely view the adsorber being filled. If the adsorber is collapsing in excessively take less carbon and more air. This is something from experience and cannot be adequately explained here.
5. When transfer is complete the transfer lid should be removed and the carbon in the adsorber should be leveled out to insure even pressure drop across the bed.
6. Close the manway and turn the adsorber back on.

Note: When the system is first started up small amounts of fines may be present in the discharge stream. This is normal and should discontinue within a short period of time.

6.0 MAINTENANCE

6.1 Extended Shutdown

If the system is to be shutdown for extended period of time it is recommended that the valve be placed in shutdown mode and the system water drain valve be left open.

Monitor the system closely after extended shutdown for signs of potential problems such as interior



BLOWERS PARTS LIST

File Name:

Parts List

Customer:

WHITMAN

Site Reference:

BRONX

Date:

8/18/2008

Reference	Qty	Units	Description	Material	Part Number
B 100	1	each	BLOWER, REGENERATIVE, ENVIRONMENTAL, EN833, 7.5 HP 3 PHASE, EXP, 208/230/460 V, 3 PHASE (EN833 REPLACES EN823), 3" I/O		ROTRON-EN833BA72L
B-101	1	each	BLOWER, REGENERATIVE, ENVIRONMENTAL, EN523, 3 HP 3 PHASE, EXP, 208/230/460 V, 3 PHASE, 1 1/2" I/O		ROTRON-EN523M72L
C-600	1	each	GAST 6066P122A WITH COUPLING		
C-600	1	each	WEG 7 1/2HP 1750 RPM(T213 FRAME) TEFC 2 PHASE 208-230/460		
HX-600	1	each	AMERICAN IND, ACA 3242-3 .25 HP TEFC 208/3 PHASE, 1 1/2" MNPT I/O		
VRV B-100	1	each	VACUUM RELIEF VALVE, 2" FNPT, 2/229, 5/338, 10/415, 15/426, 20/426 ("HG/SCFM RATING) RATED FOR SERVICE UP TO 29"HG	BRONZE, SS, CAST	KUNKLE-215V-H01AQE0010 (SET VACUUM, 10 INCH Hg)
VRV B-200	1	each	VACUUM RELIEF VALVE, 2" FNPT, 2/229, 5/338, 10/415, 15/426, 20/426 ("HG/SCFM RATING) RATED FOR SERVICE UP TO 29"HG	BRONZE, SS, CAST	KUNKLE-215V-H01AQE0009 (SET VACUUM, 9 INCH Hg)

EN633 & EN833 Regenerative Blower

AMETEK®
Rotron® Industrial Products

FEATURES

- Manufactured in the USA – ISO 9001 compliant
- CE Compliant – Declaration of conformity on file
- Maximum flow: 120/184 SCFM
- Maximum pressure: 216/192 IWG
- Maximum Vacuum 149IWG/168 IWG
- Standard Motor: 7.5 HP, TEFC
- Cast Aluminum blower housing, impeller & Cover
- Cast Iron flanges (threaded)
- UL & CSA approved motor with permanently sealed ball bearings
- Inlet & outlet internal muffling
- Quiet operation within OSHA Standards

MOTOR OPTIONS

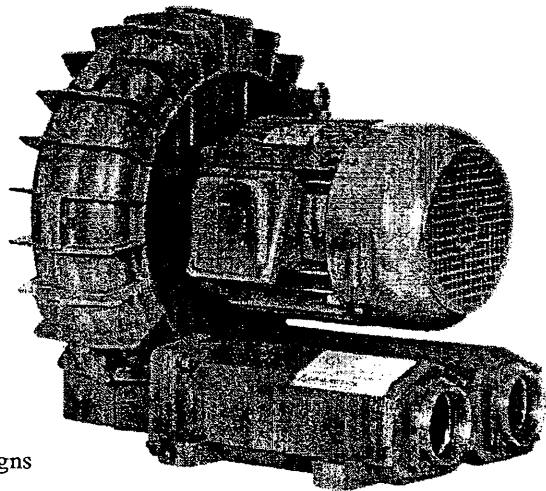
- International Voltage and Frequency (HZ)
- Chemical duty, High Efficiency, Inverter duty or industry Specific designs
- Various horsepower for application –specific needs

BLOWER OPTIONS

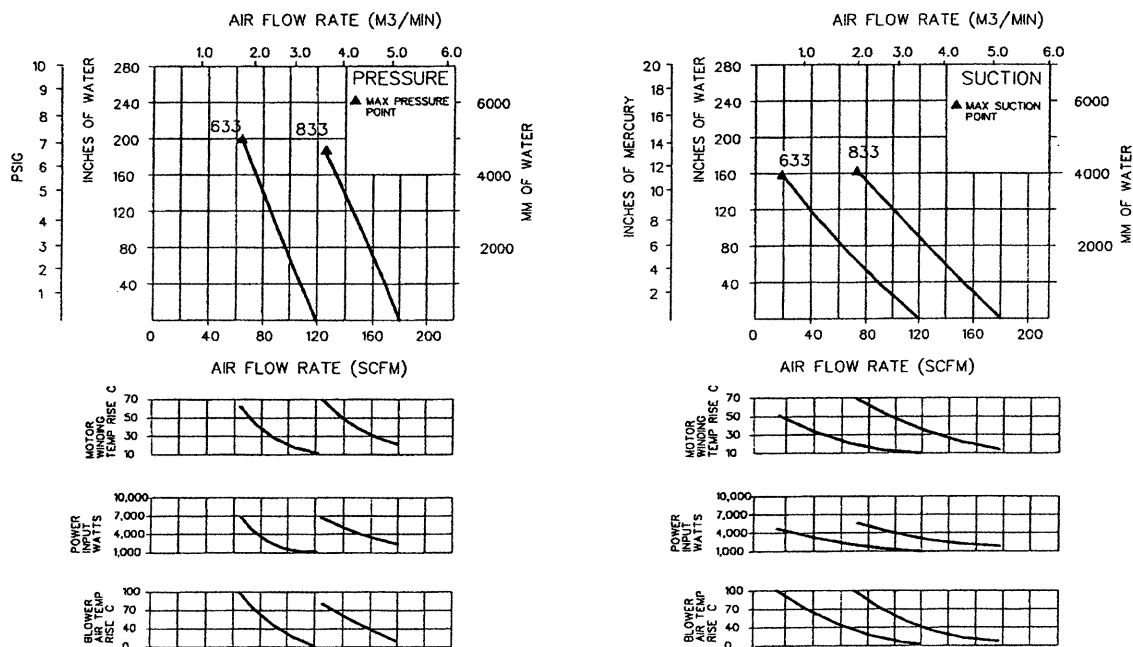
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES (See catalog accessory section)

- Flowmeters reading in SCFM
- Filters and moisture separators
- Pressure gages, Vacuum gages and relief valves
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

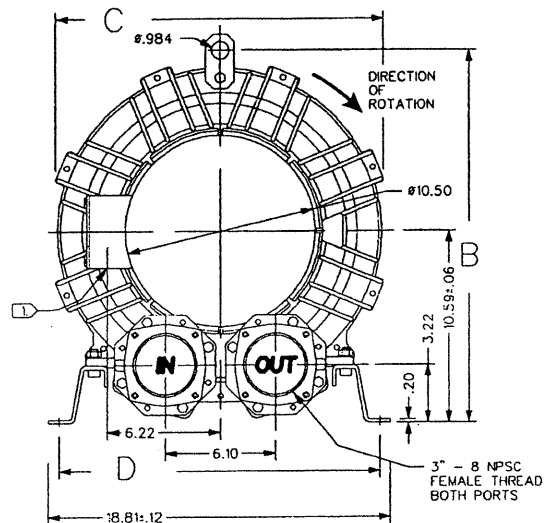
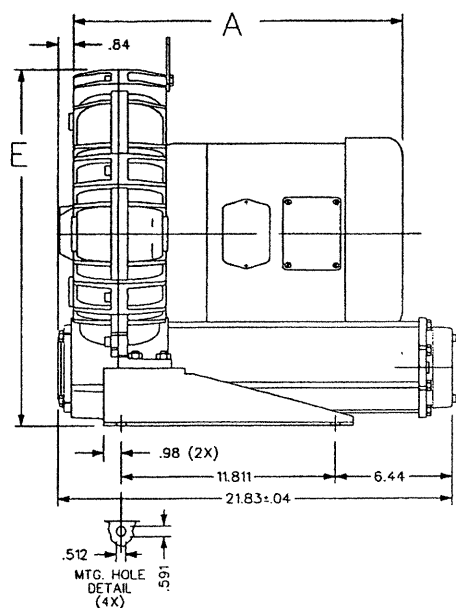


BLOWER PERFORMANCE AT STANDARD CONDITIONS



EN633 & EN833 Regenerative Blower

AMETEK®
Rotron® Industrial Products



	A	B	C	D	E
633	18.04	19.72	16.68	17.24	18.94
833	18.22	20.47	18.01	17.64	19.59

Filter 515255 included

Model	EN633BA72L	EN833BA72L	CP633FY72LR	CP833FY72LR
Part #	081275	081291	081274	081287
Motor Enclosure- Shaft Material	XP-CS	XP-CS	CHEM XP-SS	CHEM XP-SS
Horsepower	7.5	7.5	Same as EN633BA72LR- 081275 Except add Chemical Processing (CP) Features from catalog inside front cover	Same as EN833BA72LR - 081291 Except add Chemical Processing (CP) Features from catalog inside front cover
Voltage	208-230/460	208-230/ 460		
Phase-Frequency	Three - 60 Hz	Three - 60 Hz		
Insulation Class	B	B		
NEMA Rated Motor amps	20-18/9.3	20-18/9.3		
Service Factor	1.0	1.0		
Locked Rotor amps	88.7	88.7		
Max blower amps	15/7.5	19/9.5		
Recommended NEMA Starter Size	1/1	1/1		
Shipping Weight	180 lb (82 kg)	280 lb (127 kg)		

SERVICE AND PARTS MANUAL FOR BLOWER MODEL

EN633 and EN833

DIRECT DRIVE REGENERATIVE BLOWER



Technical & Industrial Products
627 Lake Street, Kent, Ohio 44240 U.S.A.
Telephone: 330-673-3452 Fax: 330-677-3306
e-mail: rotronindustrial@ametek.com
internet: www.ametektip.com

AMETEK

Your Choice. Our Commitment.™

WARRANTY, INSTALLATION, MAINTENANCE AND TROUBLESHOOTING INSTRUCTIONS

**AMETEK**

TECHNICAL AND INDUSTRIAL PRODUCTS

627 Lake Street, Kent, Ohio 44240 USA

Telephone: 330-673-3452 Fax: 330-677-3306

e-mail: rottronindustrial@ametek.com web site: www.ametektip.com

1. AMETEK Rotron DR, EN and HiE regenerative direct drive blowers are guaranteed for one full year from the date of installation (limited to 18 months from the date of shipment) to the original purchaser only. Should the blower fail we will evaluate the failure. If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.
2. AMETEK Rotron Minispiral, Revaflow, Multiflow, Nautilair, remote drive blowers, moisture separators, packaged units, CP blowers, Nasty Gas™ models and special built (EO) products are guaranteed for one full year from date of shipment for workmanship and material defect to the original purchaser only. Should the blower fail, If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.
3. **Parts Policy** - AMETEK Rotron spare parts and accessories are guaranteed for three months from date of shipment for workmanship and material defect to the original purchaser only. If failure is determined to be workmanship or material defect related we will at our option repair or replace the part.

Corrective Action - A written report will be provided indicating reason(s) for failure, with suggestions for corrective action. Subsequent customer failures due to abuse, misuse, misapplication or repeat offense will not be covered. AMETEK Rotron will then notify you of your options. Any failed unit that is tampered with by attempting repair or diagnosis will void the warranty, unless authorized by the factory.

Terms and Conditions - Our warranty covers repairs or replacement of regenerative blowers only, and will not cover labor for installation, outbound and inbound shipping costs, accessories or other items not considered integral blower parts. Charges may be incurred on products returned for reasons other than failures covered by their appropriate warranty. Out-of-warranty product and in warranty product returned for failures determined to be caused by abuse, misuse, or repeat offense will be subject to an evaluation charge. Maximum liability will in no case exceed the value of the product purchased. Damage resulting from mishandling during shipment is not covered by this warranty. It is the responsibility of the purchaser to file claims with the carrier. Other terms and conditions of sale are stated on the back of the order acknowledgement.

Installation Instructions for SL, DR, EN, CP, and HiE Series Blowers

1. **Bolt It Down** - Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.
2. **Filtration** - All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller

imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

3. **Support the Piping** - The blower flanges and nozzles are designed as connection points only and are not designed to be support members.

Caution: Plastic piping should not be used on blowers larger than 1 HP that are operating near their maximum pressure or suction point. Blower housing and nearby piping temperatures can exceed 200°F. Access by personnel to the blower or nearby piping should be limited, guarded, or marked, to prevent danger of burns.

4. **Wiring** - Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.
5. **Pressure/Suction Maximums** - The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Field representative will need to know the operating pressure/suction to properly diagnose the problem.
6. **Excess Air** - Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

Note: Remote Drive (Motorless) Blowers - Properly designed and installed guards should be used on all belts, pulleys, couplings, etc. Observe maximum remote drive speed allowable. Due to the range of uses, drive guards are the responsibility of the customer or user. Belts should be tensioned using belt gauge.

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all standard models in the DR, EN, CP, and HiE series have sealed bearings that require no maintenance. Bearing should be changed after 15,000 to 20,000 hours, on average. Replacement bearing information is specified on the chart below.

Bearing Part Number	Size	Seal Material	Grease	Heat Stabilized
510217 510218 510219	205 206 207	Polyacrylic	Nye Rheotemp 500 30% +/- 5% Fill	Yes - 325 F
510449 516440 516648	203 202 307	Buna N	Exxon Polyrex Grease	NO
516840 516841 516842 516843 516844 516845 516846 516847	206 207 208 210 309 310 311 313	Buna N	Exxon Polyrex Grease	NO

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOES NOT TURN	Humming Sound	* One phase of power line not connected * One phase of stator winding open - Bearings defective - Impeller jammed by foreign material - Impeller jammed against housing or cover ** Capacitor open	- Connect - Rewind or buy new motor - Change bearings - Clean and add filter - Adjust - Change capacitor
	No Sound	* Two phases of power line not connected * Two phases of stator winding open	- Connect - Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	- Insufficient fuse capacity - Short circuit	- Use time delay fuse of proper rating - Repair
	Motor Overheated Or Protector Trips	- High or low voltage * Operating in single phase condition - Bearings defective - Impeller rubbing against housing or cover - Impeller or air passage clogged by foreign material - Unit operating beyond performance range - Capacitor shorted * One phase of stator winding short circuited	- Check input voltage - Check connections - Check bearings - Adjust - Clean and add filter - Reduce system pressure/vacuum - Change capacitor - Rewind or buy new motor
	Abnormal Sound	- Impeller rubbing against housing or cover - Impeller or air passages clogged by foreign material - Bearings defective	- Adjust - Clean and add filter - Change bearings
	Performance Below Standard	- Leak in piping - Piping and air passages clogged - Impeller rotation reversed - Leak in blower - Low voltage	- Tighten - Clean - Check wiring - Tighten cover, flange - Check input voltage
* 3 phase units ** 1 phase units *** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.			

Blower Disassembly:

WARNING: Attempting to repair or diagnose a blower may void Rotron's warranty. It may also be difficult to successfully disassemble and reassemble the unit.

- 1) Disconnect the power leads. **CAUTION:** Be sure the power is disconnected before doing any work whatsoever on the unit.
- 2) Remove or separate piping and/or mufflers and filters from the unit.
- 3) Remove the cover bolts and then the cover. **NOTE:** Some units are equipped with seals. It is mandatory that these seals be replaced once the unit has been opened.
- 4) Remove the impeller bolt and washers and then remove the impeller. **NOTE:** Never pry on the edges of the impeller. Use a puller as necessary.
- 5) Carefully note the number and location of the shims. Remove and set them aside. **NOTE:** If the disassembly was for inspection and cleaning the unit may now be reassembled by reversing the above steps. If motor servicing or replacement and/or impeller replacement is required the same shims may not be used. It will be necessary to re-shim the impeller according to the procedure explained under assembly.

- 6) Remove the housing bolts and remove the motor assembly (arbor/housing on remote drive models).
- 7) Arbor disassembly (Applicable on remote drive models only):
 - a) Slide the bearing retraining sleeve off the shaft at the blower end.
 - b) Remove the four (4) screws and the bearing retaining plate from the blower end.
 - c) Lift the shaft assembly far enough out of the arbor to allow removal of the blower end snap ring.
 - d) Remove the shaft assembly from the arbor.
 - e) If necessary, remove the shaft dust seal from the pulley end of the arbor.

Muffler Material Replacement:

- 1) Remove the manifold cover bolts and then manifold cover.
- 2) The muffler material can now be removed and replaced if necessary. On blowers with fiberglass acoustical wrap the tubular retaining screens with the fiberglass matting before sliding the muffler pads over the screens.
- 3) Reassemble by reversing the procedure.

NOTE: On DR068 models with tubular mufflers it is necessary to remove the cover and impeller accessing the muffler material from the housing cavity.

Blower Reassembly:

- 1) Place the assembled motor (assembled arbor assembly for remote drive models) against the rear of the housing and fasten with the bolts and washer.
- 2) To ensure the impeller is centered within the housing cavity re-shim the impeller according to the procedure outlined below.
- 3) If blower had a seal replace the seal with a new one.
- 4) Place the impeller onto the shaft making sure the shaft key is in place and fasten with the bolt, washer and spacer as applicable. Torque the impeller bolt per the table below. Once fastened carefully rotate the impeller to be sure it turns freely.
- 5) Replace the cover and fasten with bolts.
- 6) Reconnect the power leads to the motor per the motor nameplate.

Bolt Size	Torque Pound-Force-Foot
1/4-20	6.25 +/- 0.25
5/16-18	11.5 +/- 0.25
3/8-16	20.0 +/- 0.5
1/2-13	49.0 +/- 1
5/8 -11	90.0 +/- 2

Impeller Shimming Procedure:

WARNING: This unit may be difficult to shim. Extreme care may be exercised.

Tools Needed: Machinist's Parallel Bar
Vernier Caliper with depth measuring capability
Feeler gauges or depth gauge

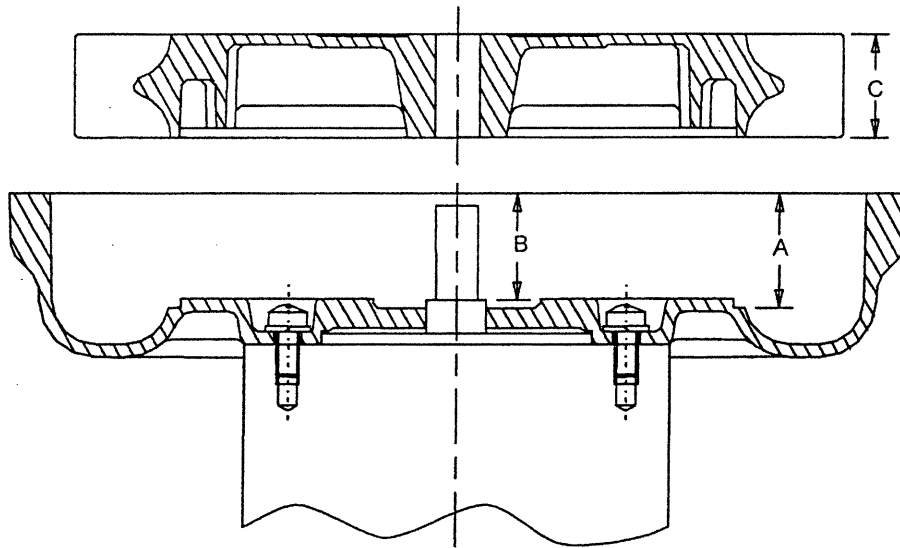
Measure the Following:

Distance from the flange face to the housing (A)
Distance from the flange face to the motor shaft shoulder (B)
Impeller Thickness (C)

Measurements (A) and (B) are made by laying the parallel bar across the housing flange face and measuring to the proper points. Each measurement should be made at three points, and the average of the readings should be used.

$$\text{Shim Thickness} = B - (A+C)/2$$

After the impeller installation (step #4 above) the impeller/cover clearance can be checked with feeler gauges, laying the parallel bar across the housing flange face. This clearance should nominally be (A-C)/2.





ROTRON TECHNICAL MOTOR DIVISION
REGENERATIVE BLOWER GROUP

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Saugerties, New York 12477
Phone: (845) 246-3401
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EXPLOSION-PROOF BLOWERS



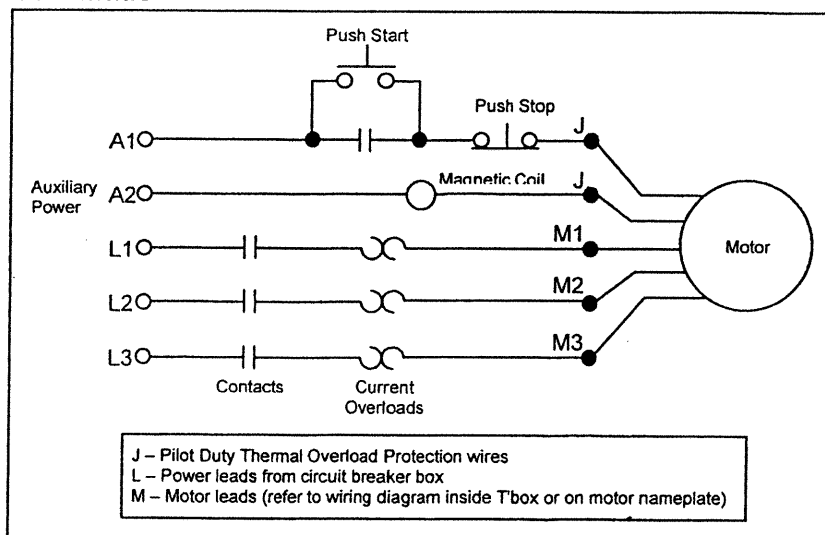
IMPORTANT: Read before wiring this Explosion-proof Blower

This AMETEK Rotron Explosion-proof Regenerative Blower may be equipped with Pilot Duty Thermal Overload (PDTO) or Automatic Thermal Overload (ATO) protection. When properly wired to a motor starter, this protection limits the motor winding temperature rise per the National Electric Code (NEC) article 500. Failure to properly wire this blower is an NEC violation and could cause an explosion. AMETEK Rotron assumes no responsibilities for damages incurred by negligent use of this product, and will not warranty a blower on which the PDTO is not properly connected. Some blowers 1 HP and under do not require PDTO and have built in ATO. Consult the factory if verification of wiring connections is required.

In all cases, follow the motor controller manufacturer's instructions. The following schematic is for conceptual understanding only, and may not apply to all motor/controller combinations.

The manufacturer's wiring diagram found on the motor takes precedent over reference diagrams supplied by AMETEK Rotron Technical Motor Division.

Schematic



The schematic is shown for a three phase motor. For a single phase motor disregard L3 and M3. Pushing the START button completes the auxiliary control circuit, allowing current to flow through the magnetic coil. The contacts are magnetically closed, starting the motor and latching the auxiliary circuit. The motor will continue to run until the STOP push button is depressed, the motor reaches the overload temperature, or the current sensing overloads trip out.

If you have any questions, contact AMETEK Rotron at 914-246-3401 for the location of your area representative.

POLICY REGARDING INSTALLATION OF AMETEK ROTRON REGENERATIVE BLOWERS IN HAZARDOUS LOCATIONS

AMETEK Rotron will not knowingly specify, design or build any regenerative blower for installation in a hazardous, explosive location without the proper NEMA motor enclosure. AMETEK Rotron does not recognize sealed blowers as a substitute for explosion-proof motors. Sealed units with standard TEFC motors should never be utilized where local, state, and/or federal codes specify the use of explosion-proof equipment.

AMETEK Rotron has a complete line of regenerative blowers with explosion-proof motors. Division 1 & 2, Class I, Group D; Class II, Groups F & G requirements are met with these standard explosion-proof blowers.

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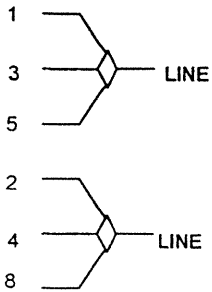
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FS2 Rev B 3/10/98

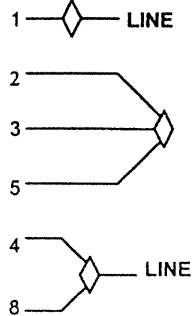
WIRING DIAGRAMS, XP MOTORS

H. 1Ø, 6 WIRE

115 VAC



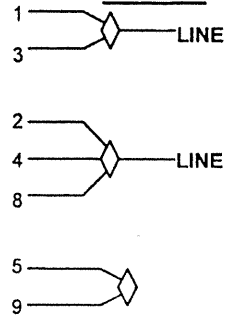
230 VAC



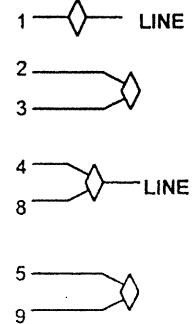
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

I. 1Ø, 7 WIRE

115 VAC



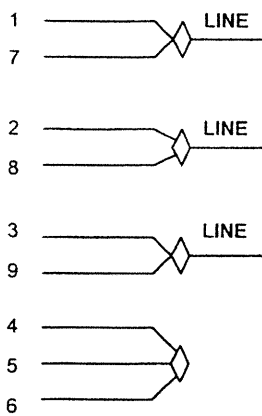
230 VAC



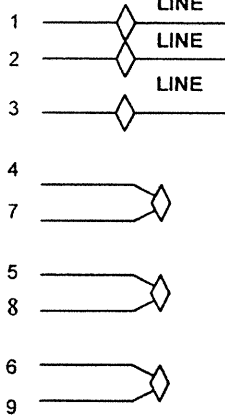
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

K. 3Ø, 9 WIRE

230 VAC

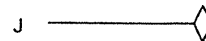


460 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

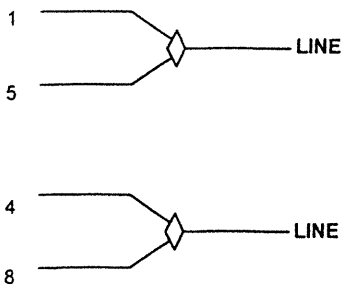
L. PILOT DUTY THERMAL OVERLOADS



HOOK J LEADS TO CONTROL CIRCUITRY

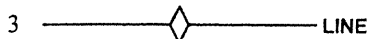
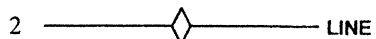
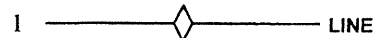
M. 1Ø 230 VAC

SINGLE VOLTAGE

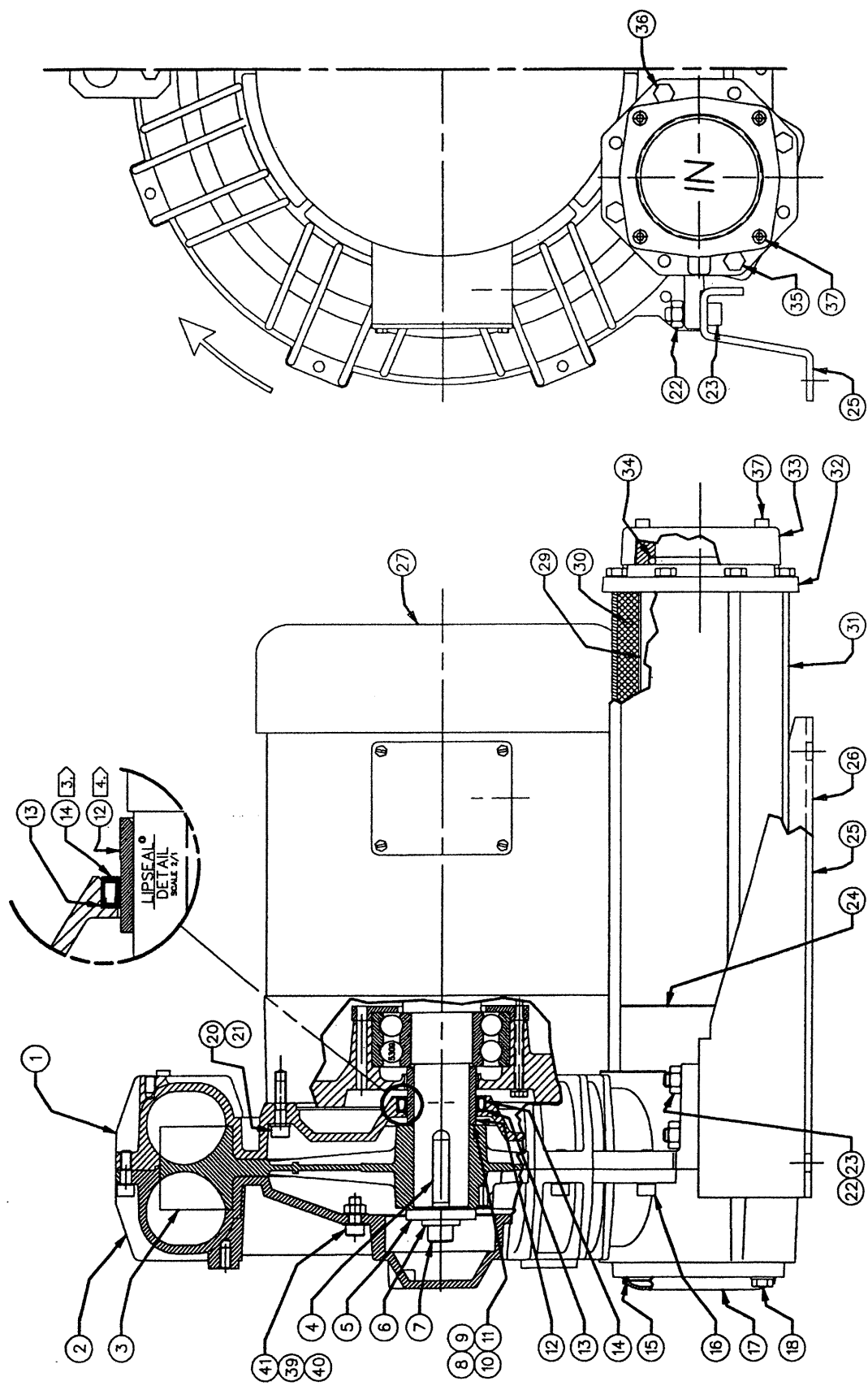


INTERCHANGE LEADWIRES 5 & 8 TO REVERSE ROTATION

N. 3Ø 575 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION



EN633 AND EN833 ASSEMBLY DRAWING

en 633/833

Service and Parts Manual

Model:

Part No.:

Parts Breakdown

EN633 EN833
081275 081291

Item No.	Qty.	Req'd	Description		
1	1		Housing	552132	552133
2	1		Cover	552135	552136
3	1		Impeller	552126	552127
4	1		Key	552138	552138
5	1		Washer- Imp	15567	155367
6	1		Lockwasher - Imp	155384	155384
7	1		Screw - Imp	155359	155359
8	A/R		Shim	155571	155571
9	A/R		Shim	155572	155572
10	A/R		Shim	155573	155573
11	A/R		Shim	155574	155574
12	1		Sleeve - Imp	Not used	Not used
13	1		Felt washer -Imp	155575	155575
14	1		Lipseal	552140	55214
15	2		O-ring	552141	552141
16	9		Screw housing to cover	155356	155356
17	2		Blind flange	552143	552143
18	8		Screw Blind flange	155356	155356
19			Not used	Not used	Not used
20	4		Lockwasher housing to motor	155537	155537
21	4		Screw housing to motor	155576	155576
22	4		But -foot	155577	155577
23	4		Bolt - foot	155362	155362
24	1		Manifold	552145	552145
25	1		Foot (left)	552147	552147
26	1		Foot (right)	552148	552148
27	1		Motor	SEE BELOW	SEE BELOW
28			Not used	Not used	Not used

*As needed **Viewed looking at inlet/outlet ports

11-17-06 REV A

en 633/833

Service and Parts Manual

Model:

Part No.:

Parts Breakdown

EN633 EN833
081275 081291

Item No.	Qty. Req'd	Description		
29	2	Retainer (muffler)	552149	552149
30	2	Muffler foam	552150	552150
31	2	Muffler tower	552152	552152
32	2	Closing plate	552154	552154
33	2	Flange	529834	529834
34	2	O-ring	155376	155376
35	7	Screw muffler long	155579	155579
36	1	Screw Muffler - Short	155581	155581
37	8	Screw- Flange	155419	155419
38		Not used	Not used	Not used
39	3	Bolt - Cover hole	155354	155354
40	3	Nut - Cover hole	155380	155380
41	6	Washer - Cover hole	155537	155537
42	0	Rails	Not used	Not used
43	0	Screw -rails	Not used	Not used
44	0	washer - rails	Not used	Not used
45	0	Lockwasher rails	Not used	Not used
46	0	Nut- rail	Not used	Not used
47	0	Lockwasher - Cover hole	Not used	Not used

Model	Part #	Motor	Wiring Diagram	Inline Filter (included)
EN633BA72L	081275	552205	K + L	515255
EN833BA72L	081291	552205	K + L	515255

*As needed **Viewed looking at inlet/outlet ports

11-17-06 REV A

SERVICE AND PARTS MANUAL FOR BLOWER MODEL

EN454 – EN656



ROTRON Industrial Products
627 lake Street, Kent, ohio 44240 U.S.A.
Telephone: 330-673-3452 Fax: 330-677-3306
e-mail: rotronindustrial@ametek.com
internet: www.ametektip.com

AMETEK

Your Choice. Our Commitment.™

WARRANTY, INSTALLATION, MAINTENANCE AND TROUBLESHOOTING INSTRUCTIONS

**AMETEK**

TECHNICAL AND INDUSTRIAL PRODUCTS

627 Lake Street, Kent, Ohio 44240 USA

Telephone: 330-673-3452 Fax: 330-677-3306

e-mail: rottronindustrial@ametek.com web site: www.ametektip.com

1. AMETEK Rotron DR, EN and HiE regenerative direct drive blowers are guaranteed for one full year from the date of installation (limited to 18 months from the date of shipment) to the original purchaser only. Should the blower fail we will evaluate the failure. If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.
2. AMETEK Rotron Minispiral, Revaflo, Multiflow, Nautilair, remote drive blowers, moisture separators, packaged units, CP blowers, Nasty Gas™ models and special built (EO) products are guaranteed for one full year from date of shipment for workmanship and material defect to the original purchaser only. Should the blower fail, If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.
3. **Parts Policy** - AMETEK Rotron spare parts and accessories are guaranteed for three months from date of shipment for workmanship and material defect to the original purchaser only. If failure is determined to be workmanship or material defect related we will at our option repair or replace the part.

Corrective Action - A written report will be provided indicating reason(s) for failure, with suggestions for corrective action. Subsequent customer failures due to abuse, misuse, misapplication or repeat offense will not be covered. AMETEK Rotron will then notify you of your options. Any failed unit that is tampered with by attempting repair or diagnosis will void the warranty, unless authorized by the factory.

Terms and Conditions - Our warranty covers repairs or replacement of regenerative blowers only, and will not cover labor for installation, outbound and inbound shipping costs, accessories or other items not considered integral blower parts. Charges may be incurred on products returned for reasons other than failures covered by their appropriate warranty. Out-of-warranty product and in warranty product returned for failures determined to be caused by abuse, misuse, or repeat offense will be subject to an evaluation charge. Maximum liability will in no case exceed the value of the product purchased. Damage resulting from mishandling during shipment is not covered by this warranty. It is the responsibility of the purchaser to file claims with the carrier. Other terms and conditions of sale are stated on the back of the order acknowledgement.

Installation Instructions for SL, DR, EN, CP, and HiE Series Blowers

1. **Bolt It Down** - Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.
2. **Filtration** - All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

Should excessive amounts of material pass through the blower, it is suggested that the cover(s) and impeller(s) be removed periodically and cleaned to avoid impeller imbalance. Impeller

imbalance greatly speeds bearing wear, thus reducing blower life. Disassembling the blower will void warranty, so contact the factory for cleaning authorization.

3. **Support the Piping** - The blower flanges and nozzles are designed as connection points only and are not designed to be support members.

Caution: Plastic piping should not be used on blowers larger than 1 HP that are operating near their maximum pressure or suction point. Blower housing and nearby piping temperatures can exceed 200°F. Access by personnel to the blower or nearby piping should be limited, guarded, or marked, to prevent danger of burns.

4. **Wiring** - Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.
5. **Pressure/Suction Maximums** - The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Field representative will need to know the operating pressure/suction to properly diagnose the problem.
6. **Excess Air** - Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

Note: Remote Drive (Motorless) Blowers - Properly designed and installed guards should be used on all belts, pulleys, couplings, etc. Observe maximum remote drive speed allowable. Due to the range of uses, drive guards are the responsibility of the customer or user. Belts should be tensioned using belt gauge.

Maintenance Procedure

When properly piped, filtered, and applied, little or no routine maintenance is required. Keep the filter clean. Also, all standard models in the DR, EN, CP, and HiE series have sealed bearings that require no maintenance. Bearing should be changed after 15,000 to 20,000 hours, on average. Replacement bearing information is specified on the chart below.

Bearing Part Number	Size	Seal Material	Grease	Heat Stabilized
510217 510218 510219	205 206 207	Polyacrylic	Nye Rheotemp 500 30% +/- 5% Fill	Yes - 325 F
510449 516440 516648	203 202 307	Buna N	Exxon Polyrex Grease	NO
516840 516841 516842 516843 516844 516845 516846 516847	206 207 208 210 309 310 311 313	Buna N	Exxon Polyrex Grease	NO

Troubleshooting

		POSSIBLE CAUSE	OUT OF WARRANTY REMEDY ***
IMPELLER DOES NOT TURN	Humming Sound	1. * One phase of power line not connected 2. * One phase of stator winding open 3. Bearings defective 4. Impeller jammed by foreign material 5. Impeller jammed against housing or cover 6. ** Capacitor open	1. Connect 2. Rewind or buy new motor 3. Change bearings 4. Clean and add filter 5. Adjust 6. Change capacitor
	No Sound	1. * Two phases of power line not connected 2. * Two phases of stator winding open	1. Connect 2. Rewind or buy new motor
IMPELLER TURNS	Blown Fuse	1. Insufficient fuse capacity 2. Short circuit	1. Use time delay fuse of proper rating 2. Repair
	Motor Overheated Or Protector Trips	1. High or low voltage 2. * Operating in single phase condition 3. Bearings defective 4. Impeller rubbing against housing or cover 5. Impeller or air passage clogged by foreign material 6. Unit operating beyond performance range 7. Capacitor shorted 8. * One phase of stator winding short circuited	1. Check input voltage 2. Check connections 3. Check bearings 4. Adjust 5. Clean and add filter 6. Reduce system pressure/vacuum 7. Change capacitor 8. Rewind or buy new motor
	Abnormal Sound	1. Impeller rubbing against housing or cover 2. Impeller or air passages clogged by foreign material 3. Bearings defective	1. Adjust 2. Clean and add filter 3. Change bearings
	Performance Below Standard	1. Leak in piping 2. Piping and air passages clogged 3. Impeller rotation reversed 4. Leak in blower 5. Low voltage	1. Tighten 2. Clean 3. Check wiring 4. Tighten cover, flange 5. Check input voltage
* 3 phase units ** 1 phase units *** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.			

Blower Disassembly:

WARNING: Attempting to repair or diagnose a blower may void Rotron's warranty. It may also be difficult to successfully disassemble and reassemble the unit.

- 1) Disconnect the power leads. **CAUTION:** Be sure the power is disconnected before doing any work whatsoever on the unit.
- 2) Remove or separate piping and/or mufflers and filters from the unit.
- 3) Remove the cover bolts and then the cover. **NOTE:** Some units are equipped with seals. It is mandatory that these seals be replaced once the unit has been opened.
- 4) Remove the impeller bolt and washers and then remove the impeller. **NOTE:** Never pry on the edges of the impeller. Use a puller as necessary.
- 5) Carefully note the number and location of the shims. Remove and set them aside. **NOTE:** If the disassembly was for inspection and cleaning the unit may now be reassembled by reversing the above steps. If motor servicing or replacement and/or impeller replacement is required the same shims may not be used. It will be necessary to re-shim the impeller according to the procedure explained under assembly.

- 6) Remove the housing bolts and remove the motor assembly (arbor/housing on remote drive models).
- 7) Arbor disassembly (Applicable on remote drive models only):
 - a) Slide the bearing retraining sleeve off the shaft at the blower end.
 - b) Remove the four (4) screws and the bearing retaining plate from the blower end.
 - c) Lift the shaft assembly far enough out of the arbor to allow removal of the blower end snap ring.
 - d) Remove the shaft assembly from the arbor.
 - e) If necessary, remove the shaft dust seal from the pulley end of the arbor.

Muffler Material Replacement:

- 1) Remove the manifold cover bolts and them manifold cover.
- 2) The muffler material can now be removed and replaced if necessary. On blowers with fiberglass acoustical wrap the tubular retaining screens with the fiberglass matting before sliding the muffler pads over the screens.
- 3) Reassemble by reversing the procedure.

NOTE: On DR068 models with tubular mufflers it is necessary to remove the cover and impeller accessing the muffler material from the housing cavity.

Blower Reassembly:

- 1) Place the assembled motor (assembled arbor assembly for remote drive models) against the rear of the housing and fasten with the bolts and washer.
- 2) To ensure the impeller is centered within the housing cavity re-shim the impeller according to the procedure outlined below.
- 3) If blower had a seal replace the seal with a new one.
- 4) Place the impeller onto the shaft making sure the shaft key is in place and fasten with the bolt, washer and spacer as applicable. Torque the impeller bolt per the table below. Once fastened carefully rotate the impeller to be sure it turns freely.
- 5) Replace the cover and fasten with bolts.
- 6) Reconnect the power leads to the motor per the motor nameplate.

Bolt Size	Torque Pound-Force-Foot
1/4-20	6.25 +/- 0.25
5/16-18	11.5 +/- 0.25
3/8-16	20.0 +/- 0.5
1/2-13	49.0 +/- 1
5/8 -11	90.0 +/- 2

Impeller Shimming Procedure:

WARNING: This unit may be difficult to shim. Extreme care may be exercised.

Tools Needed: Machinist's Parallel Bar

Vernier Caliper with depth measuring capability

Feeler gauges or depth gauge

Measure the Following:

Distance from the flange face to the housing (A)

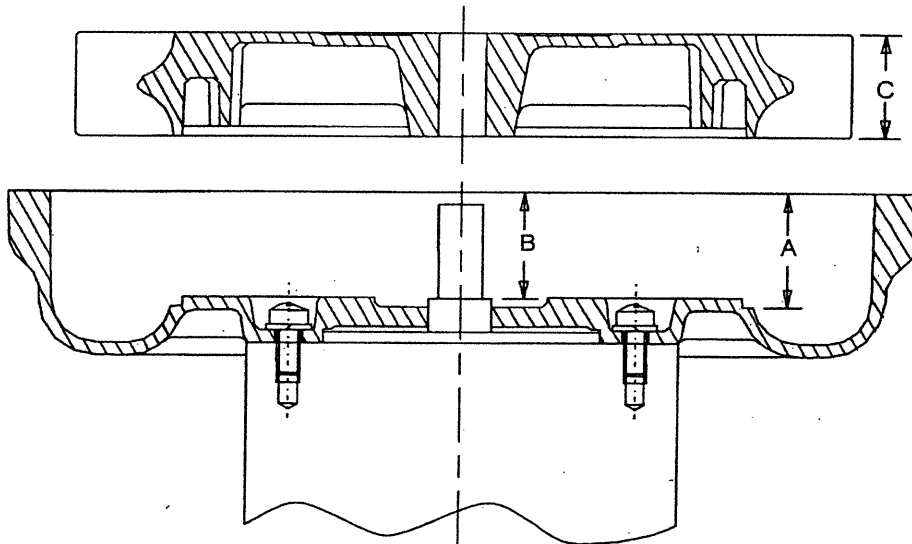
Distance from the flange face to the motor shaft shoulder (B)

Impeller Thickness (C)

Measurements (A) and (B) are made by laying the parallel bar across the housing flange face and measuring to the proper points. Each measurement should be made at three points, and the average of the readings should be used.

$$\text{Shim Thickness} = B - (A+C)/2$$

After the impeller installation (step #4 above) the impeller/cover clearance can be checked with feeler gauges, laying the parallel bar across the housing flange face. This clearance should nominally be $(A-C)/2$.





ROTRON TECHNICAL MOTOR DIVISION
REGENERATIVE BLOWER GROUP

75 North Street
Saugerties, New York 12477
Phone: (845) 246-3401
Fax: (845) 246-3802

EXPLOSION-PROOF BLOWERS



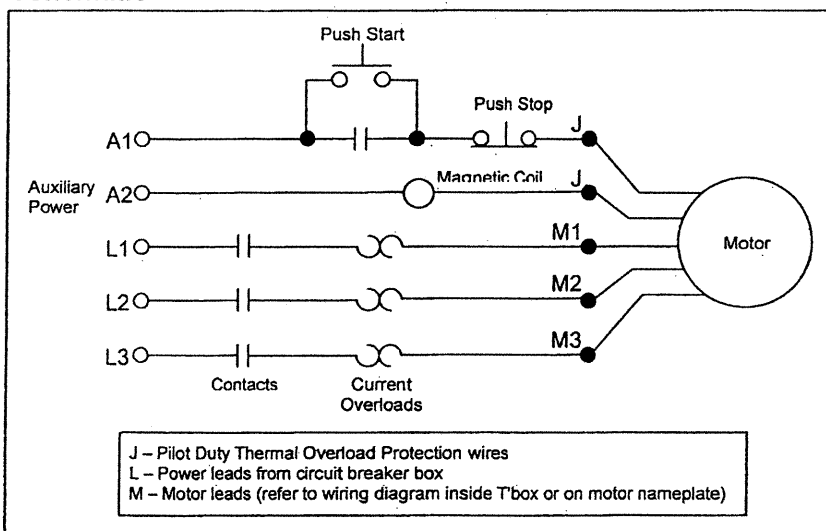
IMPORTANT: Read before wiring this Explosion-proof Blower

This AMETEK Rotron Explosion-proof Regenerative Blower may be equipped with Pilot Duty Thermal Overload (PDTO) or Automatic Thermal Overload (ATO) protection. When properly wired to a motor starter, this protection limits the motor winding temperature rise per the National Electric Code (NEC) article 500. Failure to properly wire this blower is an NEC violation and could cause an explosion. AMETEK Rotron assumes no responsibilities for damages incurred by negligent use of this product, and will not warranty a blower on which the PDTO is not properly connected. Some blowers 1 HP and under do not require PDTO and have built in ATO. Consult the factory if verification of wiring connections is required.

In all cases, follow the motor controller manufacturer's instructions. The following schematic is for conceptual understanding only, and may not apply to all motor/controller combinations.

The manufacturer's wiring diagram found on the motor takes precedent over reference diagrams supplied by AMETEK Rotron Technical Motor Division.

Schematic



The schematic is shown for a three phase motor. For a single phase motor disregard L3 and M3. Pushing the START button completes the auxiliary control circuit, allowing current to flow through the magnetic coil. The contacts are magnetically closed, starting the motor and latching the auxiliary circuit. The motor will continue to run until the STOP push button is depressed, the motor reaches the overload temperature, or the current sensing overloads trip out.

If you have any questions, contact AMETEK Rotron at 914-246-3401 for the location of your area representative.

POLICY REGARDING INSTALLATION OF AMETEK ROTRON REGENERATIVE BLOWERS IN HAZARDOUS LOCATIONS

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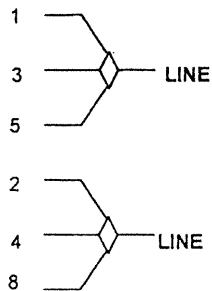
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FS2 Rev R 3/10/98

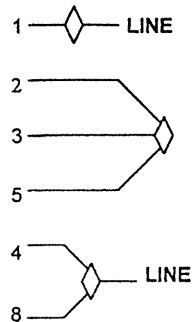
WIRING DIAGRAMS, XP MOTORS

H. 1Ø, 6 WIRE

115 VAC



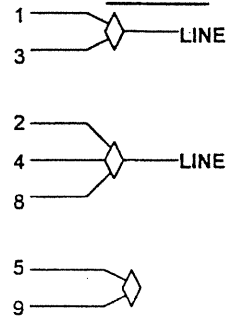
230 VAC



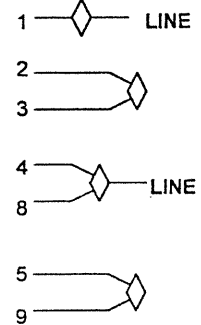
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

I. 1Ø, 7 WIRE

115 VAC



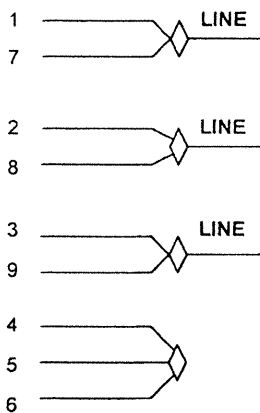
230 VAC



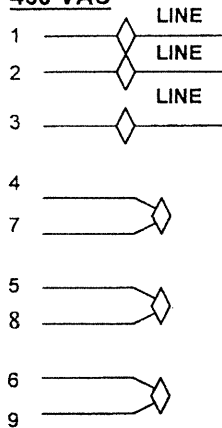
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

K. 3Ø, 9 WIRE

230 VAC

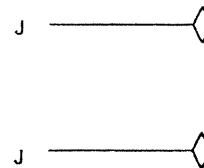


460 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

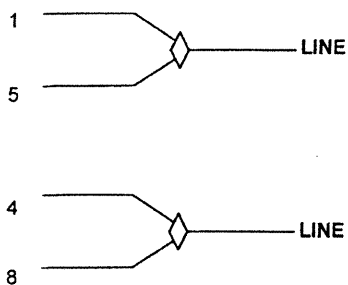
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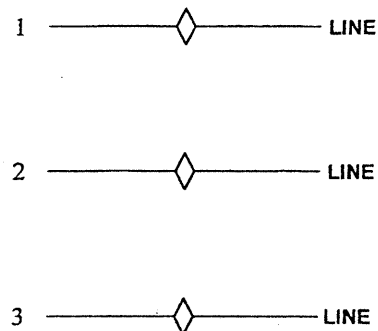
M. 1Ø 230 VAC

SINGLE VOLTAGE



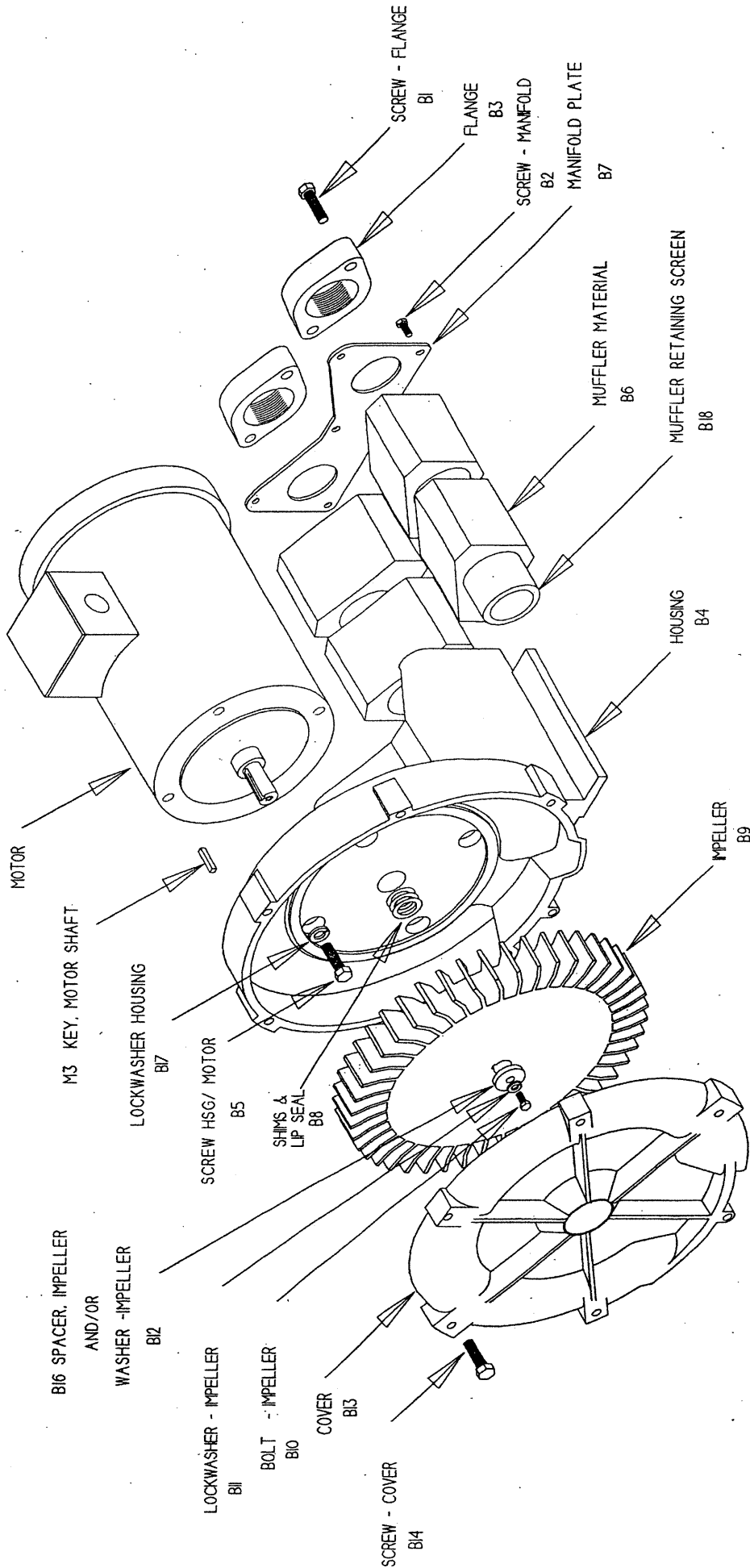
INTERCHANGE LEADWIRES 5 & 8 TO REVERSE ROTATION

N. 3Ø 575 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

ASSEMBLY DIAGRAM DR/EN/CP/HIE XOX



EN 454/513/523/505/555/606/656
Service and Parts Manual

Model:
Part No.:

Parts Breakdown

EN454	EN454	EN513	EN505	EN555	EN606	EN656
038175	080487	038183	038177	038045	038179	080058
038176	080488	038037	038178		038222	080059
			038445		038437	080060
					038536	
					038538	

Item No.	Qty.	Description	Req'd	EN454	EN454	EN513	EN505	EN555	EN606	EN656
M3	1	Key Motor Shaft		510629	510629	510629	510629	510629	510629	510629
B1	4	Screw, Flange		120162	120162	120162	120162	120162	155095	120255
B2	6	Screw, Manifold		155496	155170 (10 pcs)	120214	155170	155496	155176	155170
B3	2	Flange		510354	510354	510354	510354	510354	511480	511480
B4	1	Housing		515737	551001	523419	See Next Page	516721	See Next Page	550195
B5	4	Screw, Hsg/Motor		251791	155128	251791	155128	251791	251791	251791
B6	4	Muffler Material		515743	515743	516560	(6 pcs) 515743	515743	See Next Page	551585
	2	Muffler Insert		Not Used	551006	Not Used	Not Used	Not Used	Not Used	Not Used
B7	1	Manifold Plate		516410	516410	529868	517460	516392	See Next Page	510356
B8	*	Shim .002"		510356	510356	510356	510356	510356	510356	510356
	*	Shim .005"		510357	510357	510357	510357	510357	510357	510357
	*	Shim .010"		510358	510358	510358	510358	510358	510358	510358
	*	Shim .020"		510359	510359	510359	510359	510359	510359	510359
	*	Shim .030"		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B9	1	Impeller		515675	551067	516557	(2 pcs) 516562	517433	511272	550305
B10	1	Bolt, Impeller		120214	120214	120325	120214	120262	120325	120325
B11	1	Lockwasher, Impeller		120203	120203	120203	120203	120203	120203	120203
B12		Washer, Impeller		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B13	1	Cover		517807	551065	516559	517808	516675	511274	550249
B14	6	Screw, Cover		155236	155129	(8 pcs) 120255	(8 pcs) 155098	155236	(8 pcs) 155236	155236
B16	1	Spacer, Impeller Bolt		510355	510355	510355	510355	510355	510355	510355
B17		Lockwasher, Housing		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B18	1	Screen, Muffler Retaining, Right (**)		510362	551087	511718	See Next Page	510362	See Next Page	517436
	1	Screen, Muffler Retaining, Left (**)		510362	551087	511718	See Next Page	510362	See Next Page	517436
B19		Bolt, Muffler Hsg/Hsg		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B20		Muffler Housing		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Bolt, Motor/Muffler		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Lockwasher, Motor/Muffler		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Washer, Motor/Muffler		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
		Spacer, Motor/Muffler		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B23		Bolt, Mounting Rail		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B24		Lockwasher, Rail		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B25		Nut, Rail		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B26		Rail Mounting		Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
	1	Lip Seal		516587	516587	516587	516587	516587	516587	516587

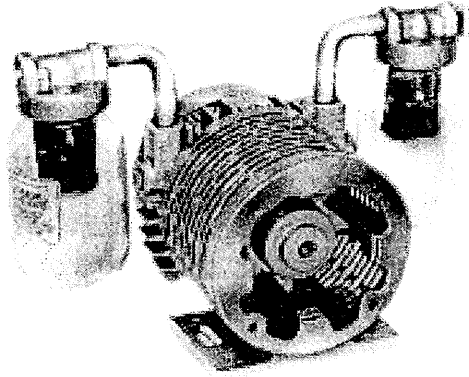
*As needed **Viewed looking at inlet/outlet ports ***Not currently in production; superseded by model listed below

Model	Part No.	Motor	Wiring Diagram	Specific Parts	Bearing, Rear (M1)	Bearing, Impeller End (M2)
EN454W58L	038175	515747	H + L			
EN454W72L	038176	515746	K + L			
EN454W58ML	080487	515747	H + L		510449	510217
EN454W72ML	080488	515746				
EN513W58L	038183	515747	H + L			
EN513W72L	038037	515746	K + L			
EN523M72L	038184	517675	K + L			
EN523M5L	038223	551373	M + L	B13 516555 1 pc Center Annulus	510217	510218
EN505AX58ML	038177	510326	H + L			
EN505AX72ML	038178	510325	K + L	B4 517419	510449	510217
EN505CJ5ML	038445		M + L	B18 517435 2 pcs		
EN555M72L	038045	529622		B4 529654		
		516687	K + L	B18 517436 2 pcs		
EN606M72L	038179				510449	510217
EN606M5L	038222 **	516687	K + L	B4 511276 1 pc		
EN606M86L	038437	551366	M + L	B6 511285 4 pcs	510217	510218
EN606M72ML	038536	529630	N + L	B4 529790 1 pc	510449	510217
EN606M5ML	038538	516687	K + L	B6 529781 4 pcs		
EN656M86XL	080058	551366	M + L	B18 529782 2 pcs	510217	510218
EN656M72XL	080059	529630	N + L		510449	510217
EN656M5XL	080060	516687	K + L			
		551366	M + L	B7 Muffler extension 550253 1 pc	510217	510218

*As needed **Viewed looking at inlet/outlet ports ***Not currently in production; superseded by model listed below

67 SERIES OIL-LESS ROTARY VANE VACUUM PUMPS & COMPRESSORS

OPERATION & MAINTENANCE MANUAL



Model 2067-V103 Shown

Thank you for purchasing this Gast product. It is manufactured to the highest standards using quality materials. Please follow all recommended maintenance, operational and safety instructions and you will receive years of trouble free service.

IMPORTANT: PLEASE READ THIS MANUAL AND SAVE FOR FUTURE REFERENCE.

General information

• Clearances in inches:

MODEL	1067	1567	2067/2567
TOP	.0015	.003	.003
DRIVE END	.001	.002	.002
DEAD END	.0025	.0029	.005
	.003	.0035	.0055

- **Vane Life:** 8,000 – 23,000 hours depending upon application

Product Use Criteria:

- Pump only clean, dry air.
- Operate at 32°F - 104°F (0°C - 40°C).
- Protect unit from dirt & moisture.
- Do not pump flammable or explosive gases or use in an atmosphere that contains such gases.
- Protect all surrounding items from exhaust air. This exhaust air can become very hot.
- Corrosive gases and particulate material will damage unit. Water vapor, oil-based contaminants or other liquids must be filtered out.
- Consult your Gast Distributor/Representative before using at high altitudes.
- Oil-Less rotary-vanes require NO lubrication.
- Sealed bearings are grease packed.
- Use of petroleum or hydrocarbon products will reduce carbon vane service life.



A Unit of **IPEX** Corporation

ISO 9001 & 14001 CERTIFIED

www.gastmfg.com

**Your safety and the safety of others
is extremely important.**

We have provided many important safety messages in this manual and on your product. Always read and obey all safety messages.



This is the safety alert symbol. This symbol alerts you to hazards that can kill or hurt you and others. The safety alert symbol and the words "DANGER" and "WARNING" will precede all safety messages. These words mean:



DANGER

You **will** be killed or seriously injured if you don't follow instructions.



WARNING

You **can** be killed or seriously injured if you don't follow instructions.

All safety messages will identify the hazard, tell you how to reduce the chance of injury, and tell you what can happen if the safety instructions are not followed.

INSTALLATION



WARNING



Electrical Shock Hazard

Disconnect electrical power at the circuit breaker or fuse box before installing this product.

Install this product where it will not come into contact with water or other liquids.

Install this product where it will be weather protected.

Electrically ground this product.

Failure to follow these instructions can result in death, fire or electrical shock.

Correct installation is your responsibility. Make sure you have the proper installation conditions and that installation clearances do not block air flow. Proper guards should be installed to prevent contact with moveable parts of this pump. Do Not lift the unit by the fan shroud.

Blocking air flow over the product in any way can cause the product to overheat.

Mounting

This product can be installed in any orientation. Mounting the product to a stable, rigid operating surface and using shock mounts will reduce noise and vibration.

Plumbing

Remove plugs from the IN and OUT ports. Connect with pipe and fittings that are the same size or larger than the product's threaded ports.

Accessories

The product's internal intake and exhaust filters will provide adequate filtration in most applications. Check filters periodically and replace when necessary. All units should have an intake and exhaust filter to prevent contaminants from entering the pump or the pneumatic system. Please consult your Gast Distributor/Representative for additional filter recommendations.

Install relief valves and gauges at inlet or outlet, or both, to monitor performance. Check valves may be required to prevent back streaming through the pump.

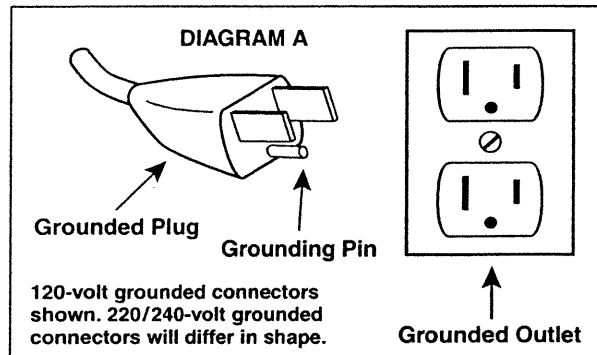
Motor Control

It is your responsibility to contact a qualified electrician to assure that the electrical installation is adequate and in conformance with all national and local codes and ordinances.

Determine the correct overload setting required to protect the motor (see motor starter manufacturer's recommendations). Select fuses, motor protective switches or thermal protective switches to provide protection. Fuses act as short circuit protection for the motor, not as protection against overload. Incoming line fuses help to withstand the motor's starting current. Motor starters with thermal magnetic overload or circuit breakers protect motor from overload or reduced voltage conditions.

The wiring diagram supplied with the product provides required electrical information. Check that power source is correct to properly operate the dual-voltage motors.

Electrical Connection



Model with a power supply cord:

This product must be grounded. For either 120-volt or 220/240-volt circuits connect power supply cord grounding plug to a matching grounded outlet. Do not use an adapter. (See DIAGRAM A)

In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This product may be equipped with a power supply cord having a grounding wire with an appropriate grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if you are not sure whether the product is properly grounded. Do not modify the plug provided. If it will not fit the outlet, have the proper outlet installed by a qualified electrician.

Model that is permanently wired:

This product must be connected to a grounded, metallic, permanent wiring system, or an equipment grounding terminal or lead on the product.

Power supply wiring must conform to all required safety codes and be installed by a qualified person. Check that supply voltage agrees with that listed on product nameplate.

Extension cords:

Use only a 3-wire extension cord that has a 3-blade grounding plug. Connect extension cord plug to a matching 3-slot receptacle. Do not use an adapter. Make sure your extension cord is in good condition. Check that the gage wire of the extension cord is the correct size wire to carry the current this product will draw.

Minimum gage for extension cords										
Amps	Volts	Length of cord in feet								
	120v	25	50	100	150	200	250	300	400	500
	240v	50	100	200	300	400	500	600	800	1000
0-2		18	18	18	16	16	14	14	12	12
2-3		18	18	16	14	14	12	12	10	10
3-4		18	18	16	14	12	12	10	10	8
4-5		18	18	14	12	12	10	10	8	8
5-6		18	16	14	12	10	10	8	8	8
6-8		18	16	12	10	10	8	6	6	6
8-10		18	14	12	10	8	8	6	6	4
10-12		16	14	10	8	8	6	6	4	4
12-14		16	12	10	8	6	6	6	4	2
14-16		16	12	10	8	6	6	4	4	2
16-18		14	12	8	8	6	4	4	2	2
18-20		14	12	8	6	6	4	4	2	2

OPERATION

WARNING

Injury Hazard

Install proper safety guards as needed. Pumps with glass jars need safety guards to protect against breaking glass.

Use only recommended air handling parts acceptable for pressure not less than 70 psi.

Keep fingers and objects away from openings and rotating parts.

When provided, motor terminal covers must be in place for safe operation.

Check that coupling guard and shroud are in place before operating.

Product surfaces may become hot during operation, allow product surfaces to cool before handling.

Do Not direct air stream at body. Air stream from product may contain solid or liquid material that can result in eye or skin damage, wear proper eye protection.

Do Not spray flammable or combustible liquid.

Wear hearing protection. Sound level from motor may exceed 85 dBA.

Failure to follow these instructions can result in burns, eye injury or other serious injury.

It is your responsibility to operate this product at recommended pressures or vacuum duties and room ambient temperatures. Do Not start against a vacuum or pressure load.

Start Up

If motor fails to start or slows down significantly under load, shut off and disconnect from power supply. Check that the voltage is correct for motor and that motor is turning in the proper direction. Vane life will be drastically reduced if motor is not operating properly. Vanes can break or be damaged if motor/pump runs in the wrong direction.

MAINTENANCE

WARNING



Electrical Shock Hazard

Disconnect electrical power supply cord before performing maintenance on this product.

If product is hard wired into system, disconnect electrical power at the circuit breaker or fuse box before performing maintenance on this product.

Failure to follow these instructions can result in death, fire or electrical shock.

WARNING

Injury Hazard

Product surfaces may become hot during operation, allow product surfaces to cool before handling.

Do Not direct air stream at body. Air stream from product may contain solid or liquid material that can result in eye or skin damage, wear proper eye protection.

Clean this product in a well ventilated area.

Failure to follow these instructions can result in burns, eye injury or other serious injury.

It is your responsibility to:

- **Regularly inspect and make necessary repairs to product in order to maintain proper operation.**
- **Make sure that pressure and vacuum is released from product before starting maintenance.**

Check intake and exhaust filters after first 500 hours of operation. Clean filters and determine how frequently filters should be checked during future operation. **This one procedure will help to assure the product's performance and service life.**

Clean filters when necessary by removing and washing in a solvent or soap and water. After cleaning, dry with compressed air to make sure all moisture is removed before replacing filters.

Flushing

Flushing this product to remove excessive dirt, foreign particles, moisture or oil that occurs in the operating environment will help to maintain proper vane performance. If your pump is not getting the vacuum or pressure level expected, flushing is required. Vanes will stick when dirty and may cause pump to be noisy or inefficient.

Use only Gast AH255B Flushing Solvent or other non-petroleum based flushing solvent. Do Not use kerosene or ANY other combustible solvent to flush product.

1. Disconnect electrical power supply.
2. Release all pressure and vacuum from pump.
3. Remove all accessories at the inlet and exhaust ports.
4. Remove filter.
5. Start product. Place towel over exhaust port to clean up solvent. If using liquid solvent, pour several tablespoons directly into inlet port. If using Gast AH255B Flushing Solvent, spray solvent for 5-10 seconds into inlet port.
6. Block the inlet port and draw a deep vacuum for 15-20 seconds. Release the vacuum.
7. Listen for changes in the sound of the motor. If motor sounds smooth, go to next step. If motor does not sound like it is running smoothly, repeat steps 5 and 6 until you can hear a difference in the operating sound of the pump.
8. Start the pump and let it run for 1 minute, then turn pump off.
9. Replace all accessories at the inlet and exhaust ports.
10. Replace filter before resuming operation.

Check that all external accessories such as relief valves and gauges are attached to cover and are not damaged before re-operating product.

SHUTDOWN PROCEDURES

It is your responsibility to follow proper shutdown procedures to prevent product damage. NEVER ADD OIL TO THIS OIL-LESS PUMP.

Proper shutdown procedures must be followed to prevent pump damage. Failure to do so may result in premature pump failure. The Gast Manufacturing Rotary Vane Oil-Less Vacuum Pumps and Compressors are constructed of ferrous metals or aluminum which are subject to rust and corrosion when pumping condensable vapors such as water. Follow the steps below to assure correct storage and shutdown between operating periods

1. Disconnect plumbing.
2. Operate product for at least 5 minutes without plumbing.
3. Run at maximum vacuum for 10-15 minutes.
4. Repeat step 2.
5. Disconnect power supply.
6. Plug open ports to prevent dirt or other contaminants from entering product.

SERVICE KIT INSTALLATION

WARNING



Electrical Shock Hazard

Disconnect electrical power supply cord before installing Service Kit.

If product is hard wired into system, disconnect electrical power at the circuit breaker or fuse box before installing Service Kit.

Disconnect air supply and vent all air lines to release pressure or vacuum.

Failure to follow these instructions can result in death, fire or electrical shock.

Gast will NOT guarantee field-rebuilt product performance. For performance guarantee, the product must be returned to a Gast Authorized Service Facility.

Service Kit contents vary. Most contain vanes, gaskets and filter parts.

Do Not attempt to remove the rotor. It is held in place by Loctite and can only be serviced by a Gast Authorized Service Facility.

Do Not loosen or adjust motor thru-bolts to prevent misalignment and damage to the pump.

Disassembly

1. Remove two fan/coupling guard screws. Remove guard.
2. Remove four motor bolts. Remove motor.
3. Loosen two set screws in coupling flange. Remove coupling flange from drive end shaft.
4. Remove four screws from the dead end fan guard. Remove guard. Use a pulley puller to remove fan.
5. Remove eight dead end plate bolts with the special adapter tool.
6. Use a small hammer to carefully tap on dead end plate to remove. Do Not use a screwdriver.
7. Remove the dowel pins from the body and dead end plate.
8. Remove vanes. If vanes are stuck, use needle nose pliers to help loosen and remove vanes.
9. Use snap ring pliers to remove snap ring.
10. Remove Belleville springs, flat washer, bearing and deflector. Note how items are placed for reassembly.
11. Place unit with the drive end shaft in an upright position on a protected surface. Remove rotor.
12. Use an adjustable spanner wrench or a special adapter tool to remove drive end cap, bearing and deflector from drive end plate.

Do Not disassemble any further parts. The factory has determined the exact top and overall end clearances. Further disassembly will change these settings.

Cleaning

1. Clean all parts with solvent and remove all solvent from parts.
2. Use a 12" smooth file on the faces of end plates and body to remove burrs.
3. Use file to carefully clean out vane slots in rotor.
4. Use emery cloth to clean and remove burrs from body bore and rotor outside diameter.
5. Clean filed parts again with solvent then remove all solvent from parts.

Reassembly

1. Place drive end plate on shim aligning bolt holes.
2. Install eight drive end bolts by hand. Do Not tighten at this time.
3. Drive two dowel pins into body through drive end plate.
4. Torque bolts to 75-125 in. lbs.
5. Place rotor with drive end up in a fixture on an arbor press.
6. Place body and drive end plate assembly over shaft so that drive end plate is on the face of rotor.
7. Place deflector and bearing on shaft and slide both down to bearing journal.
8. Use bearing pusher and arbor press to press bearing down all the way. Bearing pusher must make contact with both inner and outer race of bearing.
9. Flip unit over so the dead end is up.
10. Install vanes into rotor.
11. Replace dead end plate over shaft and body aligning bolt holes.
12. Place deflector and bearing on shaft and slide both down to bearing journal.
13. Drive two dowel pins into body through drive end plate.
14. Torque bolts to 75-125 in. lbs.
15. Place large cupped end of one Belleville spring down against the outer bearing race. Place a flat washer on top of Belleville spring.

16. Use snap ring pliers to place snap ring over Belleville spring and press into groove in dead end plate.
17. Secure a dial indicator onto dead end shaft to check axial movement. Push in indicator to allow for a free travel of .01" to the rear.
18. Install drive end cap onto drive end plate. Hand tighten until end cap bottoms out on bearing.
19. Tighten drive end cap with a spanner wrench or a special adapter tool until drive end cap is tight. Dial indicator should move back to .007" or .0075" for the 2067/2567 Series models, .0049" to .0055" for the 1567 Series model and .0035" to .004" for the 1067 Series model to assure proper clearance. If reading does not fall into range for the model in question, disassemble and add or remove shims until proper clearance range is achieved.
20. Remove drive end cap and apply several drops of Loctite 222 to threads. Replace drive end cap and tighten until clearance dial indicator moves to .002" back for 1567 and 2067/2567 Series models and .001" back for the 1067 Series model. Clearances should be:

End	2067/2567 Series	1567 Series	1067 Series
Drive	.002"	.002"	.001"
Dead	.005"-.0055"	.0029"-.0035"	.0035"

21. Press dead end cooling fan on and center it so it will not hit dead end plate or fan guard.
22. Replace dead end fan guard and attach with four bolts.
23. Replace drive end coupling on drive end shaft. Tighten set screws.
24. Place motor on motor bracket and attach with four motor bolts.
25. If motor is 3-phase, check that motor rotates properly.
26. Push motor coupling flange against coupling sleeve until tight. Tighten set screws in motor coupling flange.
27. Replace coupling fan guard and attach with two guard bolts.

Replacing New Body or Rotor

1. Use a micrometer to read the rotor length and body thickness. Subtract rotor length from body thickness. This overall clearance should be .007" to .0075" for the 2067/2567 Series models, .0049" to .0055" for the 1567 Series model and .0035" to .004" for the 1067 Series model. If clearance is less, add shims to drive end to get the required clearance.
2. For desired rotation, the inlet port needs to be to the left of the body for counter-clockwise rotation or to the right for clockwise rotation.
3. If gasket is needed, place one or more gaskets on body face.
4. Place rotor through body bore.
5. Place drive end plate on body gasket.
6. Install all screws and hand tighten.
7. Place motor with drive down in fixture and apply pressure to hold against drive end plate.
8. Place a .003" shim between rotor and body bore. Tap body toward or away from rotor until shim is snug and resists being moved.
9. Tighten bolts at the 9:00 and 3:00 o'clock positions.

10. Release shaft and rotate rotor to next position. Check rotor lobe. Set each clearance to the tightest setting. Repeat until all lobes have been checked.
11. Remove from fixture and tighten remaining screws.
12. Either leave dowel pins out or drill new dowel pin holes and use new dowel pins. **Do Not re-use old dowel pins.**

Check that all external accessories such as relief valves and gauges are attached to cover and are not damaged before re-operating product.

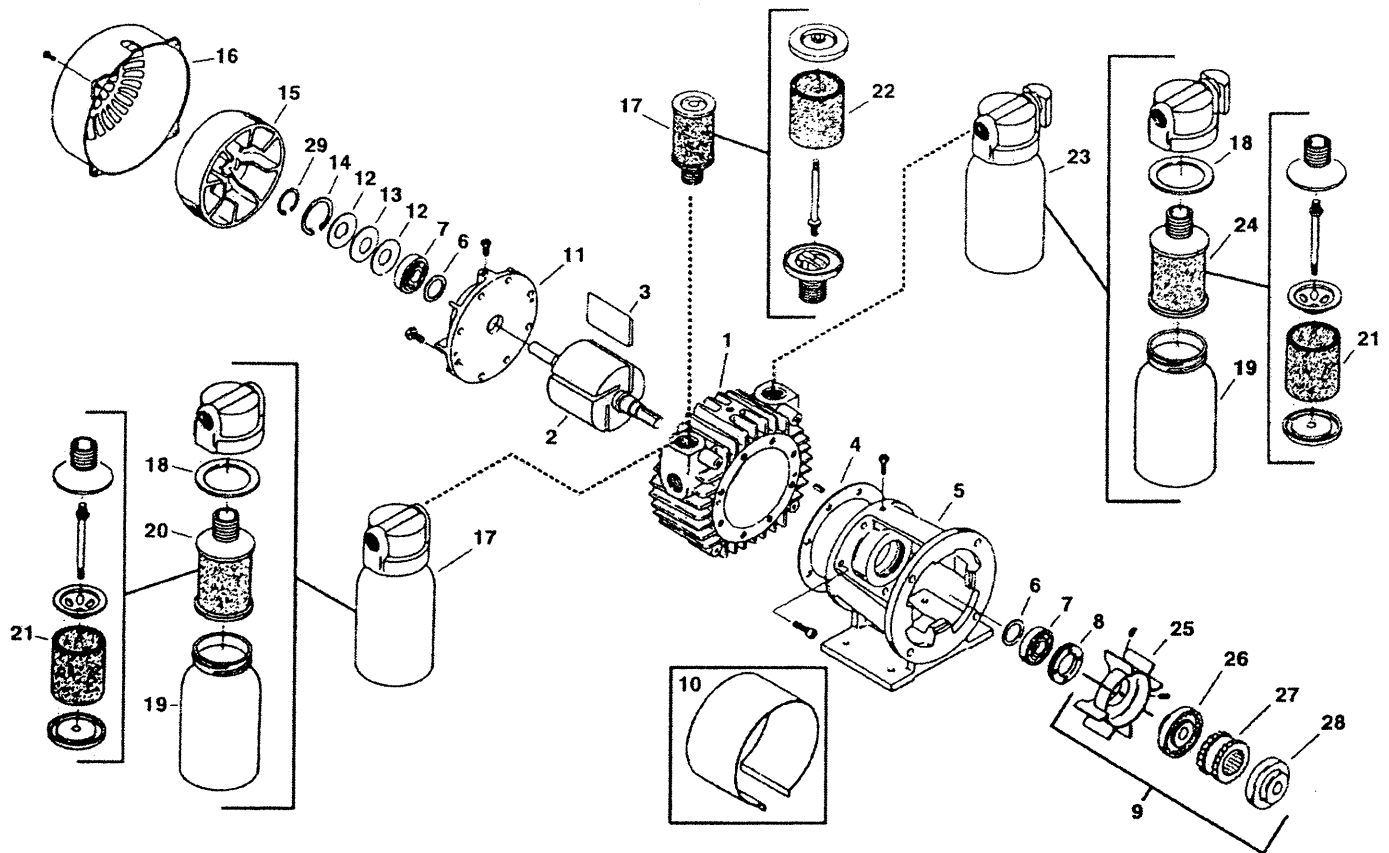
If pump still does not produce proper vacuum or pressure, send unit to a Gast Authorized Service Facility for repair.



Disposal (Please note current regulations)
Parts of the rotary vane pumps and compressors, shafts, iron or aluminum castings, plastic or glass parts or bearings, may be recycled as scrap materials.

EXPLODED PRODUCT VIEW, PARTS & ORDERING INFORMATION

For the following exploded view, please reference Series and Model parts chart on facing page.



	PRODUCT SERIES Pump or Compressor Model #		SERIES 1067 Vacuum Pump 1067-V103	SERIES 1067 Compressor 1067-P102	SERIES 1567 1567-101	SERIES 2067 Vacuum Pump 2067-V103	SERIES 2067 Compressor 2067-P102	SERIES 2567 Vacuum Pump 2567-V103	SERIES 2567 Compressor 2567-P102
REF	DESCRIPTION	QTY							
1	BODY	1	AH345	AH345	AH291	AH191	AH191	AH355	AH355
2	ROTOR ASSEMBLY	1	AH428	AH428	AH292	AH192	AH192	AH192	AH192
3 Δ	VANE	4	AH430	AH430	AB125B	AH195	AH195	AH195	AH195
4 Δ	BODY GASKET	1	AH567	AH567	AH567	AH567	AH567	AH567	AH567
5	FOOT BRACKET	1	AH208	AH208	AH208A	AH208	AH208	AH208	AH208
6 Δ	DEFLECTOR	2	AH193	AH193	AH193A	AH193	AH193	AH193	AH193
7 Δ	BALL BEARING (Drive & Dead)	2	AC894	AC894	AC894	AC894	AC894	AC894	AC894
8	END CAP, DRIVE	1	AB339	AB339	AB339	AB339	AB339	AB339	AB339
9	FAN COUPLING ASSEMBLY	1	—	—	AH198-1	AH198-1	AH198-1	AH198-1	AH198-1
10	FAN GUARD	1	AH194	AH194	AH194	AH194	AH194	AH194	AH194
11	END PLATE, DEAD	1	AH205	AH205	AH205B	AH205	AH205	AH205	AH205
12	BELLEVILLE SPRINGS	2	AB337	AB337	AB337	AB337	AB337	AB337	AB337
13	WASHER	1	AB338	AB338	AB338	AB338	AB338	AB338	AB338
14	SNAP RING	1	AB335	AB335	AB335	AB335	AB335	AB335	AB335
15	FAN	1	AC326B	AC326B	AC326B	AC326B	AC326B	AC326B	AC326B
16	FAN GUARD	1	AC102C	AC102C	AC102C	AC102C	AC102C	AC102C	AC102C
17	INTAKE FILTER ASSEMBLY	1	AA800C	AA905F	—	AA900D	AA905G	AA900D	AA905G
18	GASKET	2	AA405	—	—	AA405	—	AA405	—
19	JAR	2	AA401	—	—	AA401	—	AA401	—
20	FILTER ASSEMBLY	1	AC434-1	—	—	AC435-1	—	AC435-1	—
21 Δ	CARTRIDGE	2	AC393	—	—	AC393	—	AC393	—
22 Δ	FILTER FELT	1	—	D344B	—	—	D344B	—	D344B
23	MUFFLER	1	AA800F	—	—	AA900F	—	AA900F	—
24	MUFFLER ASSEMBLY	1	AC434-1	—	—	AC436-1	—	AC436-1	—
25	FAN	1	AH197	AH197	AH197	AH197	AH197	AH197	AH197
26	FLANGE	1	AH196	AH196	AH196	AH196	AH196	AH196	AH196
27	SLEEVE	1	AE546	AE546	AE546	AE546	AE546	AE546	AE546
28	FLANGE	1	AE545B	AE545B	AE546B	AE545B	AE545B	AE545B	AE545B
29	RETAINER RING	1	AC447	AC447	AC447	AC447	AC447	AC447	AC447
	SERVICE KIT	1	K356	K356	K897	K350	K357	K350	K357

Δ Denotes parts included in the Service Kit.

Parts listed are for stock models. For specific OEM models, please consult the factory.

When corresponding or ordering parts, please give complete model and serial numbers.

WARRANTY

Gast finished products, when properly installed and operated under normal conditions of use, are warranted by Gast to be free from defects in material and workmanship for a period of twelve (12) months from the date of purchase from Gast or an authorized Gast Representative or Distributor. In order to obtain performance under this warranty, the buyer must promptly (in no event later than thirty (30) days after discovery of the defect) give written notice of the defect to Gast Manufacturing Incorporated, PO Box 97, Benton Harbor Michigan USA 49023-0097 or an authorized Service Center (unless specifically agreed upon in writing signed by both parties or specified in writing as part of a Gast OEM Quotation). Buyer is responsible for freight charges both to and from Gast in all cases.

This warranty does not apply to electric motors, electrical controls, and gasoline engines not supplied by Gast. Gast's warranties also do not extend to any goods or parts which have been subjected to misuse, lack of maintenance, neglect, damage by accident or transit damage.

THIS EXPRESS WARRANTY EXCLUDES ALL OTHER WARRANTIES OR REPRESENTATIONS EXPRESSED OR IMPLIED BY ANY LITERATURE, DATA, OR PERSON. GAST'S MAXIMUM LIABILITY UNDER THIS EXCLUSIVE REMEDY SHALL NEVER EXCEED THE COST OF THE SUBJECT PRODUCT AND GAST RESERVES THE RIGHT, AT ITS SOLE DISCRETION, TO REFUND THE PURCHASE PRICE IN LIEU OF REPAIR OR REPLACEMENT.

GAST WILL NOT BE RESPONSIBLE OR LIABLE FOR INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND, however arising, including but not limited to those for use of any products, loss of time, inconvenience, lost profit, labor charges, or other incidental or consequential damages with respect to persons, business, or property, whether as a result of breach of warranty, negligence or otherwise. Notwithstanding any other provision of this warranty, BUYER'S REMEDY AGAINST GAST FOR GOODS SUPPLIED OR FOR NON-DELIVERED GOODS OR FAILURE TO FURNISH GOODS, WHETHER OR NOT BASED ON NEGLIGENCE, STRICT LIABILITY OR BREACH OF EXPRESS OR IMPLIED WARRANTY IS LIMITED SOLELY, AT GAST'S OPTION, TO REPLACEMENT OF OR CURE OF SUCH NONCONFORMING OR NON-DELIVERED GOODS OR RETURN OF THE PURCHASE PRICE FOR SUCH GOODS AND IN NO EVENT SHALL EXCEED THE PRICE OR CHARGE FOR SUCH GOODS. GAST EXPRESSLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE WITH RESPECT TO THE GOODS SOLD. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTIONS SET FORTH IN THIS WARRANTY, notwithstanding any knowledge of Gast regarding the use or uses intended to be made of goods, proposed changes or additions to goods, or any assistance or suggestions that may have been made by Gast personnel.

Unauthorized extensions of warranties by the customer shall remain the customer's responsibility.

CUSTOMER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF GAST PRODUCTS FOR CUSTOMER'S USE OR RESALE, OR FOR INCORPORATING THEM INTO OBJECTS OR APPLICATIONS WHICH CUSTOMER DESIGNS, ASSEMBLES, CONSTRUCTS OR MANUFACTURES.

This warranty can be modified only by authorized Gast personnel by signing a specific, written description of any modifications.

PART NO. 70-235 G365PL (Rev. E)

TROUBLESHOOTING CHART

Low		High		Pump Overheat	Motor Overload	Reason and remedy for problem.
Vacuum	Pressure	Vacuum	Pressure			
•	•	At pump		•	•	Filter dirty. Clean or replace.
	•		At pump	•	•	Muffler dirty. Clean or replace.
•		At pump		•	•	Vacuum line collapsed. Repair or replace.
•			•	•	•	Relief valve set too high. Inspect and adjust.
•	•					Relief valve set too low. Inspect and adjust.
•	•	At pump	At pump	•	•	Plugged vacuum/pressure line. Inspect and repair.
•	•					Vanes sticking. Clean or replace.
•	•					Vanes worn. Replace.
•	•					Shaft seal worn. Replace.
•	•			•	•	Dust or offset powder in pump. Inspect and clean.
•	•			•		Motor not wired correctly. Check wiring diagram and line voltage.
		•	•	•	•	Running at too high an RPM. Check wiring diagram and line voltage.

AUTHORIZED SERVICE FACILITIES

Gast Manufacturing Inc.
2550 Meadowbrook Road
Benton Harbor, MI 49022
TEL: 269-926-6171
FAX: 269-925-8288
www.gastmfg.com

John Henry Foster Co.
4700 Lebourget Drive
St. Louis, MO 63134-0820
TEL: 314-427-0600
TEL: 800-444-0522
FAX: 314-427-3502
www.jhf.com

D & F Distributors
1144 Indy Court
Evansville, IN 47725
TEL: 812-867-2441
FAX: 812-867-6822
www.dfistrib.com

Hydraulic & Pneumatic Sales
11100 Park Charlotte Blvd.
Charlotte NC 28273
TEL: 704-588-3234
FAX: 704-588-1569
www.hpsalesinc.com

James E. Watson & Co.
29 Doran Ave.
Marietta, GA 30060
TEL: 770-422-1154
www.jwatsonco.com

Gast Manufacturing Inc.
505 Washington Avenue
Carlstadt, NJ 07072
TEL: 201-933-8484
FAX: 201-933-5545
www.gastmfg.com

Air-Oil Products Corp.
301 30th Street NE 31, #112
Auburn, WA 98002
TEL: 800-282-2672
FAX: 877-808-4601
www.air-oil.com

Brenner Fiedler & Assoc
13824 Bentley Place
Cerritos, CA 90701
TEL: 800-843-5558
TEL: 310-404-2721
FAX: 310-404-7975
www.brenner-fiedler.com

Wainbee Limited
215 boul Brunswick
Pointe Claire, Quebec
Canada H9R 4R7
TEL: 514-697-8810
FAX: 514-697-3070
www.wainbee.ca

Wainbee Limited
5789 Coopers Avenue
Mississauga, Ontario
Canada L4Z 3S6
TEL: 905-568-1700
FAX: 905-568-0083
www.wainbee.ca

Kinequip, Inc.
365 Old Niagara Falls Blvd.
Buffalo, NY 14228-1636
TEL: 716-694-5000
TEL: 800-982-8894
www.kinequip.com

Gast Manufacturing Co., Ltd.
Beech House
Knives Beech Business Centre
Loudwater, High Wycombe
Bucks, England HP10 9SD
TEL: 011-44-1628-532600
FAX: 011-44-1628-532470
www.gastltd.com

Japan Machinery Co., Ltd
Central PO Box 1451
Tokyo, 100-91 Japan
TEL: 81-3-3573-5421
FAX: 81-3-3571-7865
or: 81-3-3571-7896
www.japanmachinery.com



ISO 9001 & 14001 CERTIFIED

www.gastmfg.com

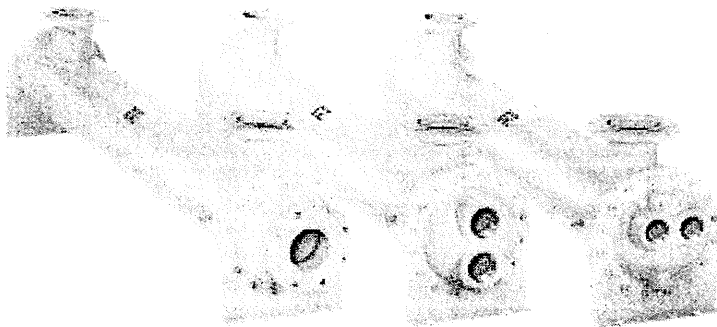
American Industrial **Heat Transfer Inc.**®

Manufacturers of Quality Heat Exchangers

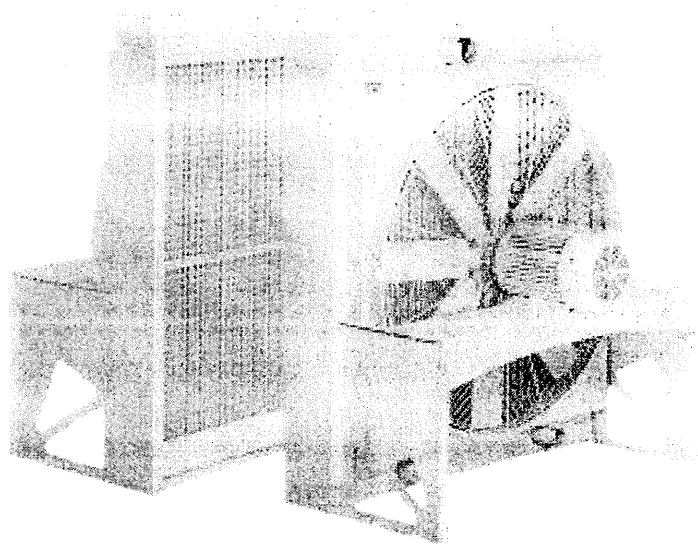


Visit our web site at
www.aihti.com

INSTALLATION & MAINTENANCE MANUAL **2001**



Shell & Tube Heat Exchangers



Air Cooled Heat Exchangers

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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. *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 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 warranty 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.

d) 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 warranty 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.

Installation:

a) American Industrial recommends that the equipment supplied should be installed by qualified personnel 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 air cooled heat exchanger series cooler. If the system pressure or temperature does not fall within the parameters on model rating 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 installed as indicated on the model diagram, with the process flow entering into the INLET port and exiting out the OUTLET port (see illustrations pages 9-10). Flexible hose or non rigid plumbing can be used to reduce the risk of failure due to thermal expansion of the core or hydraulic vibration. We suggest that preventative filtration should be located ahead of the cooler to catch any scale or sludge for the system before it enters the cooler.

For hydraulic oil coolers it is suggested that a three-way thermal

bypass valve or a direct acting low-pressure (30psi or 60psi) relief valve be installed at the inlet to the cooler to protect it in cold weather environments.

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) 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.

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 fan 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.

h) It is important to apply the catalog recommended flow rate for the hydraulic motor that corresponds with the specific model being used. A case drain is required for hydraulic motor installation. Failure to connect case drain can result in motor failure. The proper flow rate and direction to the hydraulic motor are critical to ensure fan direction and RPM. Exceeding the recommended RPM could result in fan failure and cause severe damage to the heat exchanger. See fan rotation (pages 9-10)

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 suit-

AIR COOLED GENERAL INSTALLATION & MAINTENANCE

able 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) Air cooled 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.

Brazed Core Maintenance

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.

Serviceable Core® Maintenance

Units containing a Serviceable Core® have bolted manifold covers that can be removed for cleaning or repair purposes. Most AOCH or AOCS cores manufactured after January 1, 1998 are Serviceable Cores®.

Servicing Sequence

American Industrial has gone to great lengths to provide components that are repairable. If the heat exchanger core 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 plumbing from the unit.

b) Be sure the unit is drained of all water etc...

c) Place the heat exchanger in an area that it can be accessed from

all sides. Remove the core from the cabinet if required (AOCH, AOCS).

d) Mark the cover ① and tube-sheet ③ for both covers so that they can be replaced into the same position when finished. Remove the manifold cover bolts ② 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 ① from both sides.

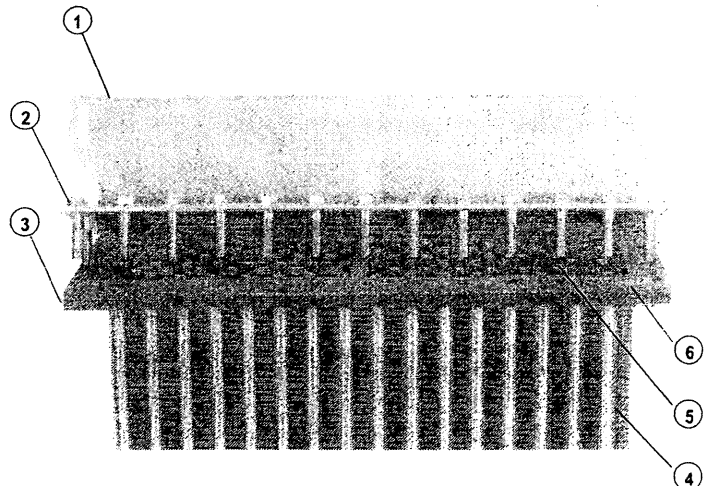
f) The tubes √ and turbulators ⑤ are now accessible for cleaning. Note: turbulators are installed on AOCH & AOCS cores only. If you need to remove the turbulator that runs through the tubing, it will be necessary to first squeeze the flattened end of the protruding turbulator ⑤, so that on end will fit through the tube. From the opposite end pull the turbulator ⑤ out. You may need to use pliers to grip and pull the turbulators ⑤ out, especially if there is debris lodged inside. As the turbulators ⑤ come out, most of the dirt will too, so be prepared. *It is suggested that gloves be worn when handling the turbulators ⑤ as they may be sharp.*

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.

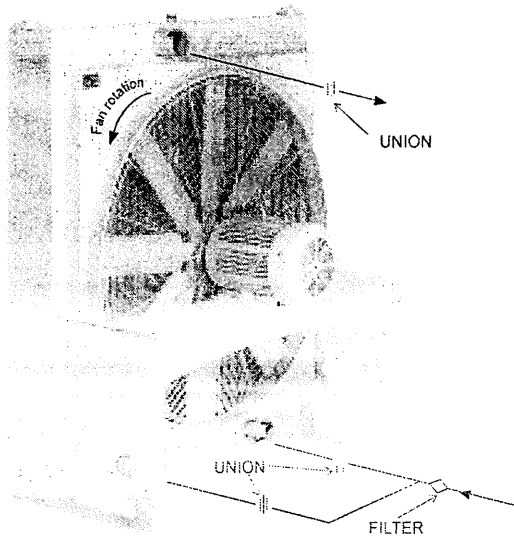
g) If there are any leaking tubes √ you may plug them by carefully forcing a soft metal plug into the hole and tapping it tight. You may in some cases weld the leaking tube shut however, care should be taken since excessive heat may cause surrounding tube joints to loosen and leak.

h) When finished cleaning or repairing, be sure to replace ALL of the turbulators ⑤ back into any open tubes √. When the turbulators ⑤ protrude from the opposite end flatten them again so they are tight and cannot be removed.

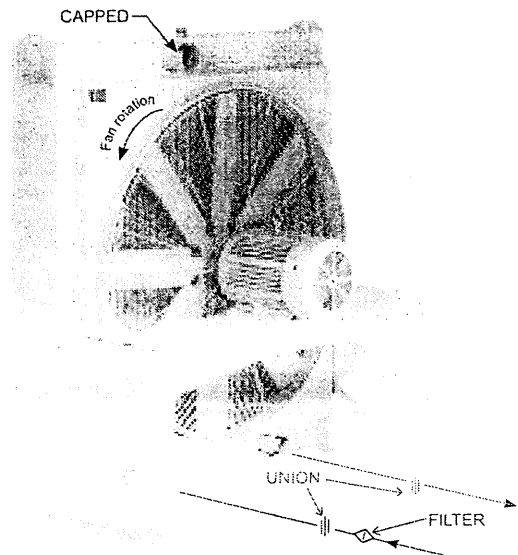
i) When finished reattach the manifold covers ① in the same position they were removed, using new gaskets ≈, bolts ②, and hardware. We suggest using a torque wrench to final tighten the bolts ②. *For 5/16" bolts 22-23 ft-lbs, for 3/8" bolts to 38-42 ft-lbs.* Since bolts and hardware can physically fatigue during application we suggest new bolt kits be used when reassembling.



AIR COOLED HEAT EXCHANGER PIPING HOOK-UP

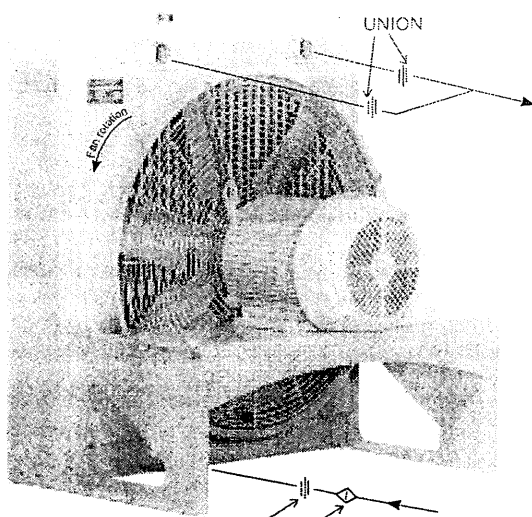


ONE PASS

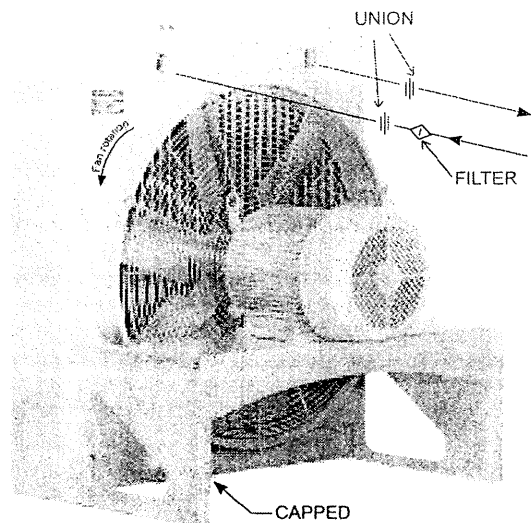


TWO PASS

AOCS - 1005 through AOCS - 3015

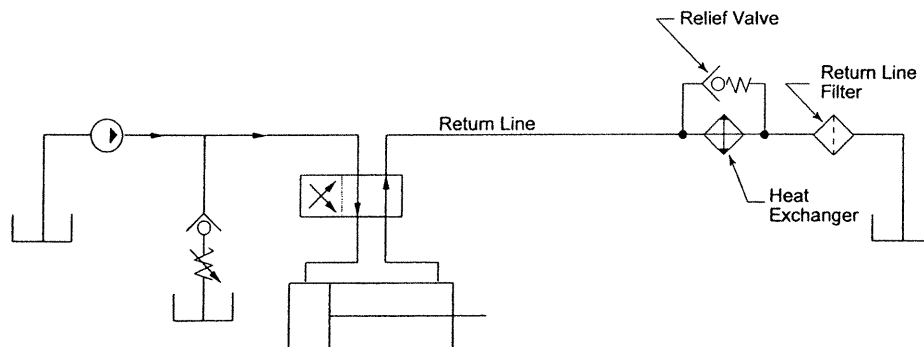


ONE PASS



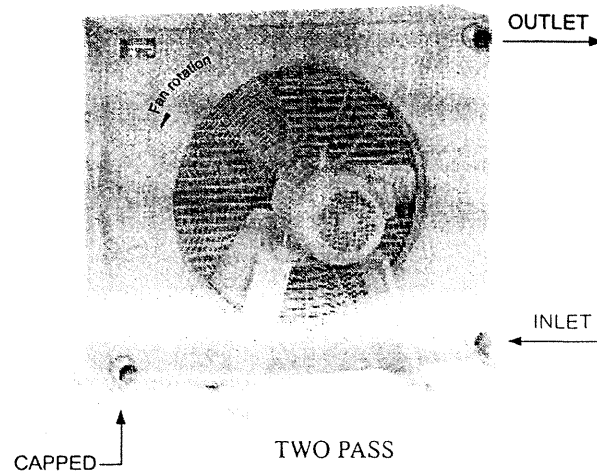
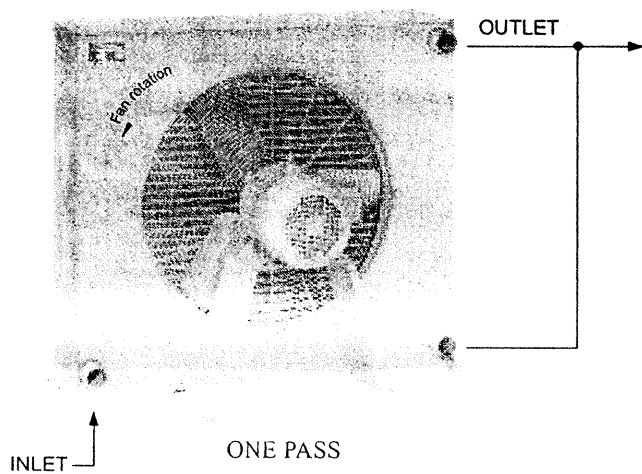
TWO PASS

AOCS - 201 through AOCS - 603

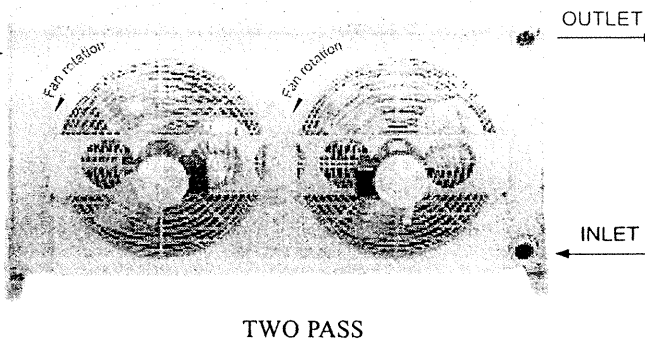
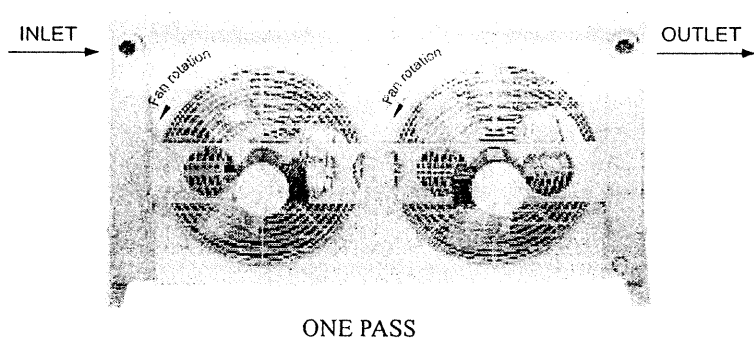


TYPICAL HYDRAULIC CIRCUIT
with air cooled heat exchanger

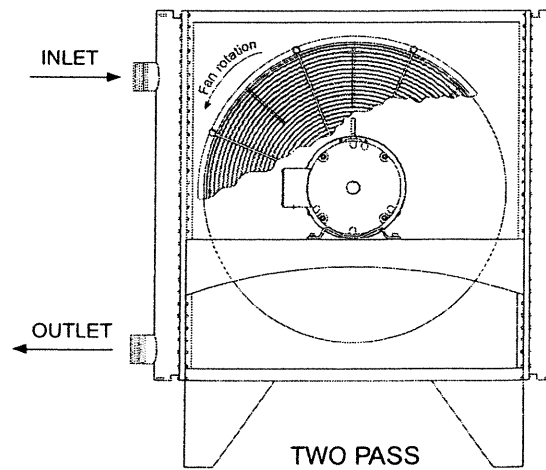
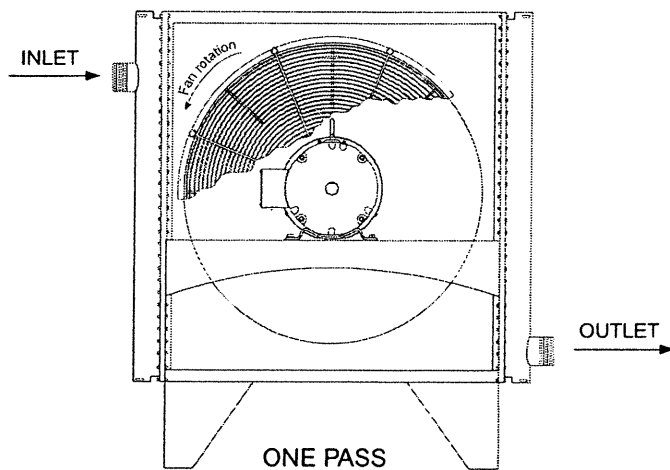
AIR COOLED HEAT EXCHANGERS PIPING HOOK-UP



AC, ACF & AOC Series



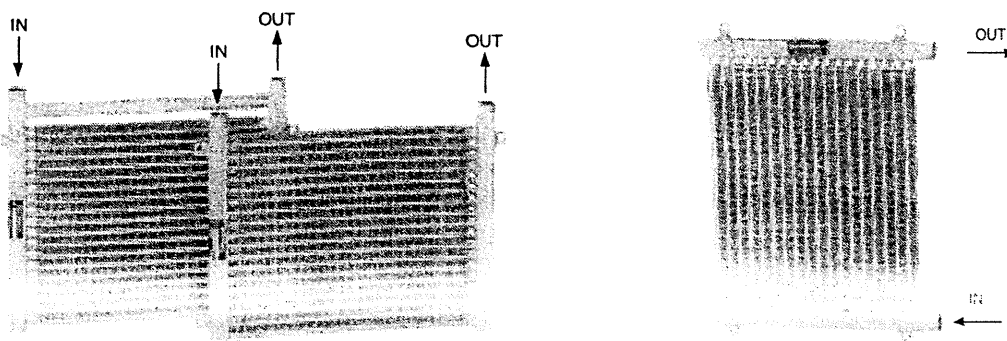
EOC Series



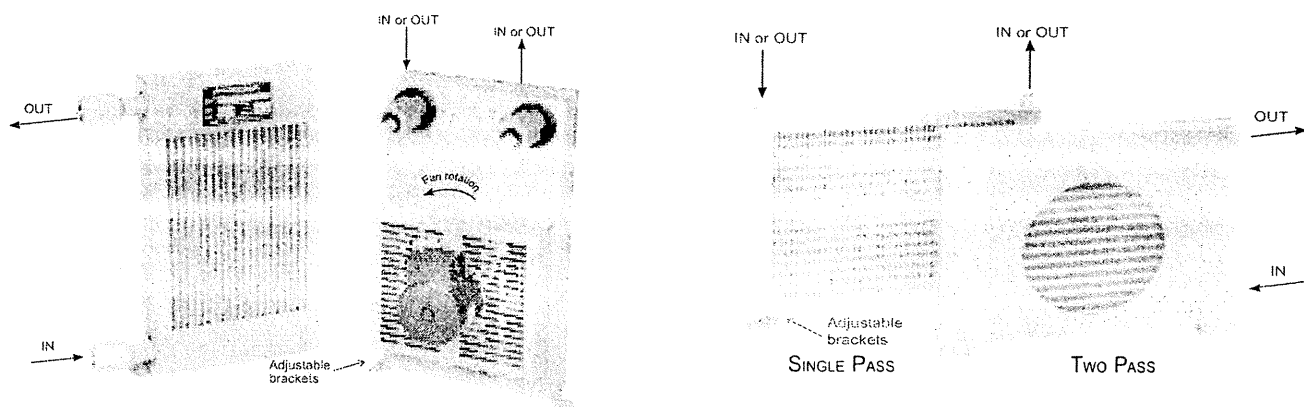
ACA Series

AIR COOLED HEAT EXCHANGER PIPING HOOK-UP

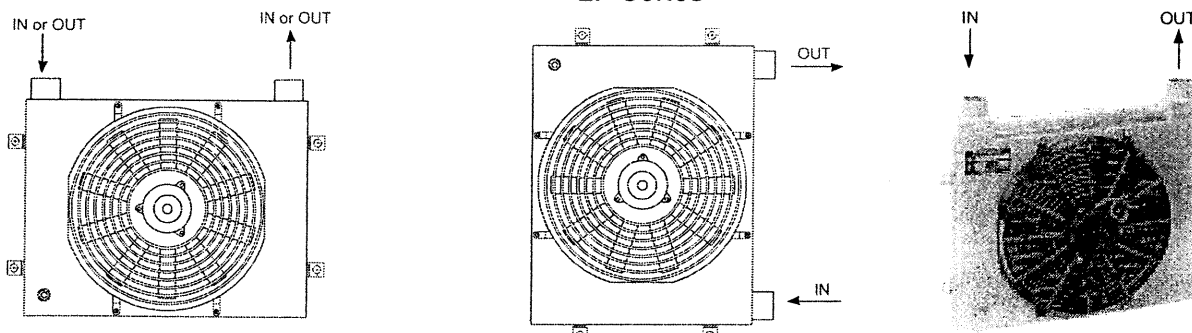
AOM & AOMR Series



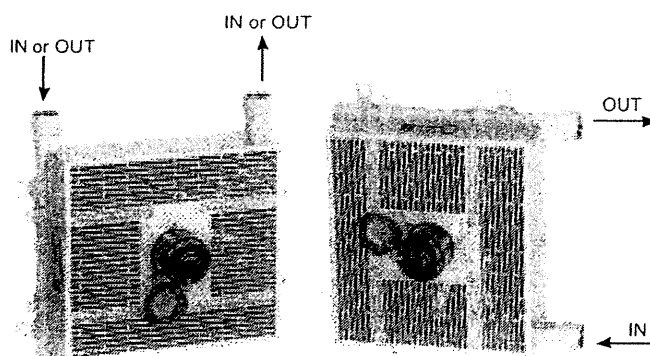
BM Series



LP Series



AOMF



AIR COOLED ACCESSORIES

ELECTRICAL TEMPERATURE CONTROLLER WITH BULB WELL ASSEMBLY (for Air/Oil Coolers)

SPECIFICATIONS:

A) Material: Copper

B) Power Limits:

- 1) For three phase motor operation, use only with a magnetic starter, 125 VA max. (VA = volts x amps)
- 2) For pilot duty, 125 VA max.
- 3) For direct connection to motor:
120v AC/8.0 amps max 230v AC/5.1 amps max
277v AC/4.2 amps max 460v AC/2.0 amps max
- 4) Temperature operating range: 55°F to 175°F.

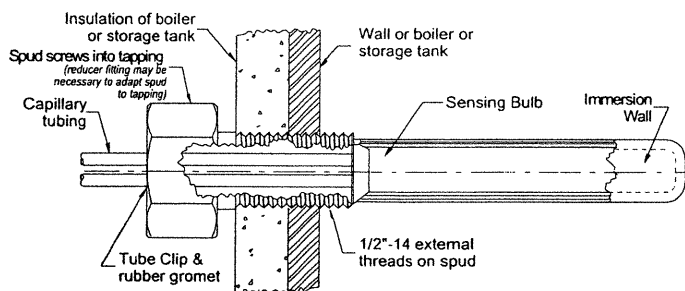
APPLICATIONS (Temperature Controller)

The TC511 temperature controllers are designed to control the temperature of air or liquids in ducts, pipes, tanks, and boilers. Typical uses include control of dampers and valves in heating, cooling, or heating-cooling systems. The TC511 has 1 spdt switch. It makes or breaks a circuit on a change in temperature at the sensing bulb. Fast response models with adjustable differential are available for duct installation. They respond approximately 4 times faster than standard models.

INSTALLATION

When installing this product:

1. Read instructions carefully. Failure to follow the instructions could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in the instructions.



LOCATION AND MOUNTING.

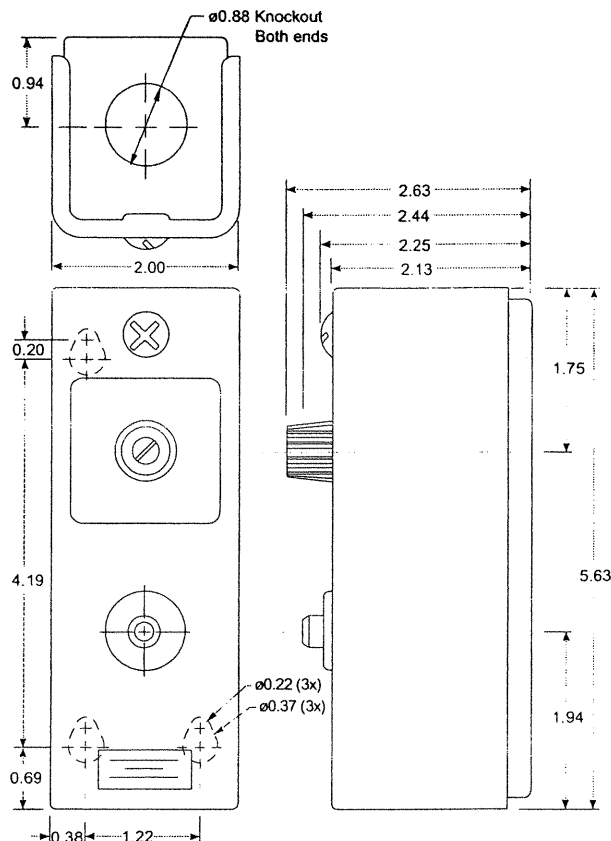
The controller may be installed in any convenient position. Mount it with 3 screws through the slotted holes in the back of the case. Be sure to consider the length of the capillary before mounting the controller.

Install the sensing element where it is exposed to the average temperature of the controlled medium. The sensing bulb may be directly immersed or mounted in a well. Fast response models must use the capillary holder furnished with the device. The remote sensing bulb of standard models should be held in place with a capillary holder, immersion well, or compression fitting. Sharp bends or kinks in the capillary tubing affect the efficiency of the controller and must be avoided. Excess capillary should be carefully coiled and left directly beneath the controller.

NOTE: When pressure fittings are used in areas of vibration (such as pipe lines) the bulb must be adequately supported.

OPERATION

As the temperature of the controlled medium falls below the set point less differential, the TC511 switch makes terminal R to B and energizes a normally close solenoid valve to provide heat. In cooling applications, the TC511 makes terminal R to W as the temperature rises above the set point, energizing cooling equipment.

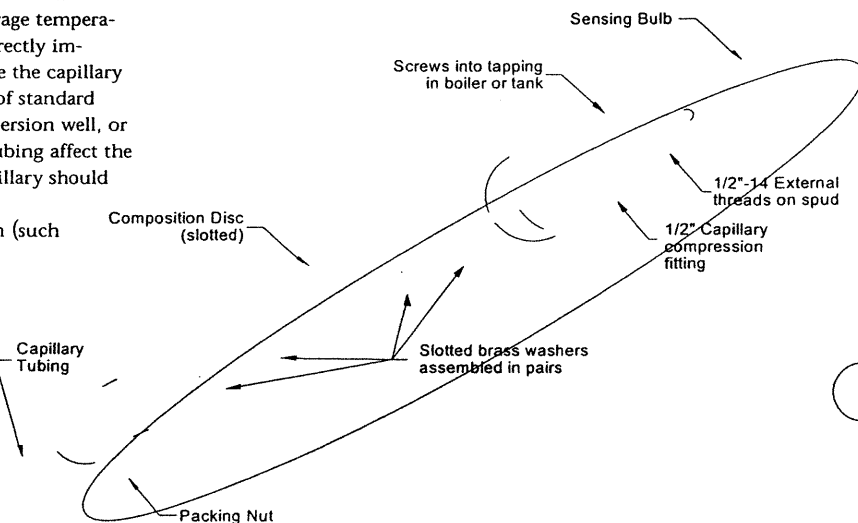


ELECTRICAL RATINGS:

TC511 models with adjustable differential:

TC511 models with fixed differential - 125 VA at 120/208/240/277 Vac.

MAXIMUM BULB PRESSURE: 50 psi (344.7 kPa) for direct immersions.



STANDARD TERMS AND CONDITIONS OF SALE (1/3)

STANDARD TERMS AND CONDITIONS OF SALE

April 1, 2000 Supersedes all prior "Standard Terms And Conditions Of Sale"

All sales by American Industrial Heat Transfer Inc. ("Seller") to the party to whom a Seller's Acknowledgment is addressed ("Purchaser") are subject to the following terms and conditions in addition to the terms and conditions contained in any acknowledgement or sales order confirming your order ("Seller's Acknowledgement"). Where terms of any such Seller's Acknowledgement conflict with the following terms and conditions, the terms and conditions of Seller's Acknowledgement shall control. These Terms and Conditions shall apply to all transactions between Seller and Purchaser unless superseded by new Terms and Conditions delivered by Seller or by the express terms and conditions contained in Seller's Acknowledgement.

Acceptance. All purchase orders are accepted by Seller at its General Offices in Zion, Illinois. Seller's acceptance of any purchase order it receives is expressly limited to the exact terms contained here and in this Seller's Acknowledgement. Additional or different terms contained in Purchaser's offer or any attempt by Purchaser to vary any of the terms here and in Seller's Acknowledgement shall be rejected but such proposal shall not operate as a rejection of Purchaser's offer unless such variances are in the terms of the description, quantity, price or delivery schedule of the goods or services to be provided hereunder, in which case such additional or different terms shall be deemed material and such offer shall be deemed accepted without said additional or different terms or attempted variations. Acceptance by Seller of any purchase order containing terms additional to or different from the terms contained in this Seller's Acknowledgement or containing modifications of the terms contained here and in Seller's Acknowledgement shall not be deemed as assent to those additional, different or modified terms. Purchaser's receipt of Seller's Acknowledgement without prompt written objection thereto, or Purchaser's acceptance of all or any part of the goods or services ordered from Seller, shall constitute assent by Purchaser to the terms contained here and in Seller's Acknowledgement. If this Seller's Acknowledgement shall be deemed an offer by Seller to sell goods or services to Purchaser, such offer is expressly limited to the exact terms contained herein. The dispatch of a purchase order by Purchaser shall then constitute Purchaser's acceptance of these Standard Terms and Conditions of Sale and Seller's Acknowledgement. If this Seller's Acknowledgement is deemed an offer as aforesaid, any proposal by Purchaser for additional or different terms or any attempt by Purchaser to vary any of the terms of this Seller's Acknowledgement in Purchaser's purchase order is hereby objected to and rejected; provided, however, that any such proposal by Purchaser shall not operate as a rejection of Seller's offer unless it contains variances in the terms of the description, quantity, price or delivery of the goods or services to be provided hereunder, in which case any such proposal shall be deemed material, and this Seller's Acknowledgement shall be deemed accepted without said additional or different terms or attempted variations.

Payment Terms. The full amount billed or contracted for is due and payable thirty (30) days from delivery of the goods or performance of services. A finance charge computed at the periodic rate of one and one-half percent (1.5%) per month (which is an annual rate of eighteen percent (18%)) on the unpaid balance will be made on accounts not paid when due, and Purchaser agrees to pay such charges and pay attorneys' fees if action is brought to collect from Purchaser. Unless otherwise specified, 100% of the price quoted for any tooling is to be paid with the placement of the order to Seller. Samples submitted shall be deemed approved and accepted if written notice of rejection is not received within thirty (30) days after date of submittal. Purchaser agrees that Seller shall have a possessory lien on all tools and other property of Purchaser which is in Seller's possession for the total amount owing by Purchaser to Seller for all tooling and other work and for all parts, materials and services of all kinds supplied or rendered by Seller to Purchaser, which lien shall be enforceable in the manner provided in the Uniform Commercial Code.

Taxes. Any tax which the Seller may be required to pay or collect through assessment or otherwise, under any existing or future law upon or with respect to the sale, purchase, delivery, transportation, storage, processing, use or consumption of any goods or services described herein, including, without limitation, taxes upon or measured by receipt from sales or services (but excluding taxes based upon the income of Seller), shall be for the account of Purchaser and be added to the price of such goods or services. Purchaser shall promptly pay the amount thereof to Seller upon demand but may in lieu of such payment, furnish to Seller evidence of the issuance of tax exemption certificates acceptable to the appropriate taxing authorities.

Prices. Except as otherwise provided, all price quotations are valid for thirty (30) days. Prices are based on costs prevailing on the date of quotation and, therefore, are subject to change at any time to reflect increased costs. Prices are quoted on samples, blueprints, or drawings on hand, and any modification thereof subjects this quotation to adjustment. Quotations are based on the continuous production of the quantity specified, smaller runs subject to increase in price. If higher quantity level is desired by Purchaser, Seller will render a quotation based upon the revised requirements set forth by Purchaser.

Credit. All orders are subject to the approval of Seller's Credit Department, and Seller may at any time refuse to make shipment or delivery if Purchaser fails to fulfill the terms and conditions of payment or fails to provide security satisfactory to Seller's Credit Department. Seller reserves right to refuse or cancel credit and require full payment prior to shipment. If in Seller's opinion the financial condition of Purchaser at any time does not justify continuation of production or shipment on the terms of payment specified, Seller may require full or partial payment in advance or such further assurance as Seller shall require to justify such continued production or shipment.

Default in Payment and Bankruptcy of Purchaser. If Purchaser fails to make payments on any agreement between Purchaser and Seller in accordance with Seller's terms, Seller, in addition to any other remedies available to it, may, at its option, (a) defer further shipments until such payments are made and satisfactory credit arrangements are reestablished, (b) cancel the unshipped balance of any order or (c) take any other action available under applicable law. In the event of any proceedings, voluntary or involuntary, in bankruptcy or insolvency by or against Purchaser, the inability of Purchaser to pay its debts as they become due, or in the event of the appointment, with or without Purchaser's consent, of an assignee for the benefit of creditors or of a receiver, then Seller shall be entitled, in its sole discretion, to cancel the unshipped balance of any order without any liability.

Transportation Charges. All prices, quotations, shipments and deliveries by Seller are F.O.B. Seller's plant and risk of loss passes to Purchaser once goods are tendered for such delivery. All transportation and other charges including handling fees are for the account of Purchaser, including any increase or decrease in such charges prior to shipment.

Method of Shipment. Method and route of shipment is at Seller's discretion, unless Purchaser supplies explicit instructions, which are subsequently accepted by Seller in writing. Seller does not assume responsibility for any damage directly or indirectly resulting from delays in delivery. When parts are broken or damaged in transit from Seller to Purchaser, it is considered the responsibility of Purchaser to file a claim with the carrier for said breakage or damage. If the method of shipment specified by Purchaser is deemed by Seller to be unavailable or otherwise unsatisfactory, Seller reserves right to use an alternate method or route or both whether or not at a higher cost to Purchaser. Seller shall promptly notify Purchaser of any such change. The risk of loss or damage to the goods shipped shall pass to the Purchaser when the goods are delivered to the carrier for shipment and Purchaser shall be responsible for insuring such goods thereafter.

Producing or Shipping Point. Seller reserves right to produce and ship all or any part of the goods specified in any order from any of its plants or facilities.

Force Majeure. Seller shall not be liable for any delay in the performance of orders, or in the delivery or shipment of goods, or for any damages suffered by Purchaser as a result of such delay when such delay is occasioned by causes beyond Seller's control. Such causes shall include but are not limited to an act of God or the public enemy, fire, explosion, flood, unusually severe weather, drought, war, riots, sabotage, vandalism, accident, embargo, government priority, government action or failure of the government to act when action is required, requisition or allocation or other action of any governmental authority, interruption of or delay in transportation, inadequacy or shortage or failure of supply of materials or equipment, breakdowns, non-scheduled shutdowns for repairs, plant accidents, labor shortage, strikes, labor trouble, or by compliance with any order or request of the United States Government or any officer, department, agency, instrumentality or committee thereof. It is understood and agreed that economic conditions affecting the ability or desirability of the performance of this agreement by either party shall not be deemed to constitute "force majeure" circumstances as contemplated by this paragraph. The Seller shall have the right to cancel the entire agreement with Purchaser or any part thereof in the event of the happening of any such cause beyond the Seller's control without any resulting liability.

Good Delivery. Shipments made by Seller within a reasonable time after the specified date of delivery shall constitute a good delivery. No right of cancellation shall accrue to Purchaser based on such a delivery.

Permissible Variations. Goods shipped by Seller shall be within the limits and sizes published by Seller, subject, however, to Seller's right to ship overages or underages in accordance with Seller's standard practices and goods shipped by Seller will be subject to standard variations provided such variations are non-functional or are not material in nature.

LIMITED WARRANTY. SELLER MAKES NO WARRANTIES EXPRESSED OR

STANDARD TERMS AND CONDITIONS OF SALE (2/3)

IMPLIED, INCLUDING BUT NOT BY WAY OF LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ON ANY ORDER EXCEPT THAT SELLER WARRANTS TITLE TO ALL GOODS FURNISHED BY SELLER AND EXCEPT THAT SELLER WARRANTS FOR A PERIOD OF ONE YEAR FROM THE DATE MARK LOCATED ON THE SELLER'S IDENTIFICATION TAG THAT ALL GOODS DESCRIBED ON SELLER'S ACKNOWLEDGMENT OF PURCHASER'S PURCHASE ORDER WILL BE MANUFACTURED IN ACCORDANCE WITH THE SPECIFICATIONS, IF ANY, SET FORTH IN SAID PURCHASE ORDER AND EXPRESSLY ACCEPTED IN SELLER'S ACKNOWLEDGMENT SUBJECT TO SELLER'S STANDARD MANUFACTURING VARIATIONS AND PRACTICES. IN THE CASE OF COMPONENTS OR ACCESSORIES FURNISHED BY SUPPLIERS TO SELLER, PURCHASER'S WARRANTY FROM SELLER SHALL BE LIMITED TO THE WARRANTY OF THE COMPONENT OR ACCESSORY SUPPLIER. THE FOREGOING WARRANTIES ARE THE SOLE AND EXCLUSIVE WARRANTIES APPLICABLE TO THE GOODS DELIVERED, AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY, ARE HEREBY EXPRESSLY DISCLAIMED AND NEGATED. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, PURCHASER ACKNOWLEDGES THAT SELLER'S PRODUCTS ARE NOT PACKAGED OR PROTECTED FOR LONG PERIODS OF STORAGE AND THUS MAY CORRODE OR RUST OVER TIME.

Damaged Goods. If any goods should arrive at Purchaser's destination in a damaged condition or should a shortage occur, Purchaser shall immediately report the damage or shortage to the delivering carrier and to Seller. Any loss or shortage occasioned by damage or otherwise occurring in transit will be for account of Purchaser. Allegedly defective goods or parts are to be returned by Purchaser to a destination specified by Seller, freight charges prepaid by Purchaser. All repairs and replacements are subject to verification and inspection by Seller. Seller shall not be responsible for costs of de-installation and re-installation of goods or parts returned.

Claims. Claims respecting the condition of goods, compliance with specifications or any other matter affecting goods shipped to Purchaser must be made promptly and, unless otherwise agreed to in writing by Seller, in no event later than twenty-one (21) days after receipt of the goods by Purchaser. Purchaser shall set aside, protect and hold such goods without further processing until Seller has an opportunity to inspect and advise of the disposition, if any, to be made of such goods. In no event shall any goods be returned, reworked or scrapped by Purchaser without the express written authorization of Seller. If field service is rendered by the Seller at Purchaser's request and the alleged defect is found not to be with the Seller's product, component or accessory, the Purchaser shall pay for the time and expenses of the field representative. Bills for service, labor or other expenses that have been incurred by the Purchaser, their customer or agent, without approval or authorization by the Seller, will not be accepted. Changes or repairs attempted or made in the field without Seller's written authorization automatically void all warranties.

LIMITATION OF PURCHASER'S REMEDIES. PURCHASER'S REMEDIES WITH RESPECT TO ANY CLAIM ARISING OUT OF ANY ORDER, ANY GOODS DELIVERED PURSUANT TO ANY ORDER AND EXPRESSLY ACCEPTED IN SELLER'S ACKNOWLEDGMENT, OR SELLER'S PERFORMANCE IN CONNECTION WITH ANY ORDER, INCLUDING, WITHOUT LIMITATION, ANY CLAIM ARISING OUT OF ANY RECALL, DEFECT OR ALLEGED DEFECT IN ANY GOODS OR SERVICES FURNISHED BY SELLER, SHALL BE LIMITED EXCLUSIVELY TO THE RIGHT OF REPAIR OR REPLACEMENT OF SUCH GOODS OR SERVICES, AT SELLER'S OPTION. WITHOUT IN ANY WAY LIMITING THE GENERALITY OF THE FOREGOING, IN NO EVENT SHALL SELLER BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, ANY LOSS OF ANTICIPATED PROFITS INCURRED BY PURCHASER WITH RESPECT TO ANY GOODS OR SERVICES FURNISHED BY SELLER, OR ANY DAMAGES ARISING FROM INJURIES TO PERSONS AS A RESULT OF PURCHASER'S OR A THIRD PARTY'S NEGLIGENCE. SELLER'S WARRANTY DOES NOT COVER FAILURES RESULTING FROM THE IMPROPER INSTALLATION, MOUNTING DESIGN OR APPLICATION OR FROM CORROSION. THE PROVISIONS OF THIS PARAGRAPH ARE A MATERIAL TERM OF THIS TRANSACTION.

Warranty Procedures. If Purchaser experiences a problem with Seller's goods and believes that it is covered by Seller's warranty, or Purchaser has equipment that needs to be repaired or replaced, contact Seller through Purchaser's local distributor. The basic information that Purchaser will need to begin the process is the complete nameplate data. Products will not be accepted for return unless an RGA (Return Goods Authorization) number has been assigned by Seller and the product for return or repair is shipped prepaid. Products returned for warranty evaluation must be complete (without missing components), and unaltered (not disassembled, manipulated cleaned or the like). The product(s) must have the original model tag fully intact. Products returned for warranty consideration are subject to a \$100 minimum fee plus any

additional handling charges in the event that the reason for the return is not covered by Seller's warranty. Additional handling fees are to cover the cost of failure analysis, testing and the like. All handling charges will be waived for products that are subject to a valid warranty claim. Products to be returned for warranty are to be shipped prepaid via Seller assigned carrier.

Returns and Returns Procedures. In order to return a product for credit, test, or repair, Purchaser must follow the procedures outlined in this paragraph and, in the case of repairs, the immediately following paragraph. Failure to follow return procedures could result in lost items, delays, additional service charges, warranty denial or refusal of shipment. All items being returned to Seller must be accompanied with an RGA (Return Goods Authorization) number for identification purposes. Products returned without a clearly marked RGA number will not be processed. RGA numbers can be obtained only through Seller. Products being returned for restock and credit must be complete (without missing components), unused, and within one year of original factory purchase. The products must have the original model tag fully intact. Returned products must be free of dents, customer applied paint, rust, or any permanent alterations of any type. Products shipped for restock are to be shipped prepaid. Heat exchangers being returned for credit are subject to a 30% restocking charge. Other items such as, without limitation, valves and temperature controls are subject to a 15%-50% restocking charge to be determined by the products' usage or salability. Restocking charges are applied to cover the cost or the retest and refitting equipment to new condition. Seller will issue credit only after a thorough inspection has been performed. NO DEBITS WILL BE HONORED UNTIL AFTER RETURN INSPECTION APPROVAL.

Repairs. Products being returned for repair, refit, test or similar matters must be drained completely prior to shipment. Purchaser must clearly label the product with information to identify the Purchaser and Seller's RGA number. Purchaser should also include a note with instructions for service, failure, nature of problem and the fluids that are used inside of the product. A base handling charge of \$100 will be applied for each product regardless of condition that it is in when returned for evaluation. Products being returned for evaluation must be shipped prepaid. Quotations for repair, test, cleaning, and similar matters will be issued shortly after return to Seller. All products returned shall be considered abandoned by Purchaser and may be scrapped if the Purchaser or shipper renders no disposition instructions after 45 days from notification by written quotation. Seller does not warranty any repaired products under any circumstances. Products repaired and the repairs are the sole responsibility of the owner of the products. Products sent to Seller for evaluation will be returned, upon request and at the owner's expense.

Quality Assurance. Seller shall have no obligation to ensure that any goods or services purchased from Seller meet any special quality assurance specifications and/or other requirements unless such specifications and/or other requirements are set forth in Purchaser's purchase order or separately provided in writing to Seller and, in either case, expressly accepted in this Seller's Acknowledgment and Purchaser represents that goods which it purchases from Seller will not be applied by Purchaser or resold by Purchaser for application to, any critical end use, including, without limitation, use in connection with or in any way related to the construction or operation of a nuclear facility unless the appropriate specification and/or other requirement for such end use is set forth in Purchaser's purchase order and is expressly accepted in a separate writing by Seller. In the event that any such goods or any services supplied by Seller in connection therewith are applied to a critical end use without the appropriate specification and/or other requirement therefor having been set forth in Purchaser's purchase order and expressly accepted in a separate writing by Seller, Purchaser shall indemnify and hold Seller harmless against any and all damages or claims for damages made by any person for any injury, fatal or nonfatal, to any person or for any damage to the property of any person incident to or arising out of such application, including, without limitation, any loss resulting from radioactive, toxic, explosive, or other hazardous properties of source material, special nuclear material, or by-product material as such terms are defined in the Atomic Energy Act of 1954 or any law amendatory thereof or regulations adopted pursuant thereto. The Seller reserves the right to improve its products through changes in design or material, as it may deem desirable without being obligated to incorporate such changes in products of prior manufacture.

Cancellation. Purchaser Orders cannot be cancelled without cause by Purchaser without the express written consent of the Seller. Should Purchaser attempt to cancel an order without cause, Purchaser shall reimburse Seller against all loss occasioned by such cancellation, including loss of anticipatory profits and liability for commitments made by Seller relating to the Purchase Order and shall purchase any existing inventory and work in process which Seller has in its possession to fulfill Seller's existing orders for Purchaser at the time of cancellation. As used herein, "cause" shall mean a material breach of Seller's duties and obligations hereunder and the failure to cure such breach after Purchaser notifies Seller of such breach and affords Seller a reasonable time to cure same.

STANDARD TERMS AND CONDITIONS OF SALE (3/3)

Confidentiality and Publicity. Purchaser shall consider all information furnished by Seller to be confidential and shall not disclose any such information to any person, firm or corporation, other than Purchaser's or Seller's employees, subcontractors or government inspectors, unless authorized to do so by Seller in writing. Purchaser shall not disclose in any manner to third parties, including, without limitation to, advertising, or publishing concerns, Seller's identity or the identity of any subsidiaries or affiliates of Seller. Unless otherwise agreed to in writing, no commercial, financial or technical information disclosed in any manner or at any time by Purchaser to Seller shall be deemed secret or confidential and Purchaser shall have no rights against Seller with respect thereto except such rights as may exist under patent laws.

Tooling. If and to the extent any Purchase Order relates to the purchase of tools, jigs, die fixtures, equipment, drawings and specifications (collectively, "tooling") or specifically requires tooling for completion by Seller, then Seller shall at all times be and remain the owner of such tooling and shall bear the risk of loss and be responsible for insuring same. If any Purchase Order requires the development of such tooling, then the price quoted by Seller is based on a minimum production of a specified quantity of parts from such tooling and, in the event Purchaser does not ultimately purchase such quantity of parts, an equitable adjustment in the purchase price for products shall be made to reflect such lower quantity and Seller's unamortized cost of the tooling so produced. Seller's price quotation is based upon estimated usage of tooling but no representations or warranties are made by Seller that the tooling so built will ultimately be capable of producing product in accordance with such anticipated usage. Purchaser agrees to pay for changes in tooling made necessary by changes in specifications accepted by Seller, such changes to be made at Purchaser's risk. Parts produced from Purchaser's supplied tooling cannot be guaranteed by Seller. Purchaser provided tooling is not insured and Seller shall not be responsible or liable for any loss or damage thereto or for any materials or equipment owned or furnished by Purchaser. Purchaser shall be solely responsible for insuring such tooling and Purchaser waives any claim or right of subrogation it may have against Seller arising out of Seller's failure to insure such tooling. Seller reserves the right to charge Purchaser the reasonable costs and expenses of refurbishing any tooling if so required by Seller to fulfill any Purchase Order. When for a period of one (1) year no orders are received for parts to be produced from tooling, Seller may notify Purchaser in writing at Purchaser's last known address in Seller's files that tooling is no longer proprietary to Purchaser and, with respect to Purchaser supplied tooling, such tooling shall become Seller's property or, at Seller's option, Seller may return such tooling to Purchaser at Purchaser's expense.

Prototypes. If this Purchase Order relates to the production of a prototype by Seller for or on behalf of Purchaser, (a) such prototypes will be manufactured in accordance with Purchaser's specifications including material selection and (b) actual product produced by Seller may vary from such prototype in a non-material and non-functional manner. Seller's sole liability in the event it is unsuccessful in producing a prototype in accordance with Purchaser's specifications shall be limited to the purchase price paid by Purchaser with respect thereto. Purchaser shall be responsible for the cost of all tooling necessary for the development of the prototype as provided in the paragraph Captioned "Tooling" above.

Technical Assistance and Advice. Seller's warranty shall not be enlarged and no obligation or liability shall arise out of Seller's rendering of technical assistance, technical advice facilities, service or recommendations made by Seller in connection with Purchaser's purchases of the goods hereunder. Said technical services, advice, assistance or recommendations made by Seller or any representative of Seller concerning any use or application of any goods furnished hereunder is believed to be reliable, but SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, AND THE SAME ARE HEREBY EXPRESSLY DISCLAIMED as to the same and the results to be obtained. Purchaser assumes all responsibility for loss or damage resulting from the use of any such goods.

Indemnification. Purchaser agrees to indemnify, save harmless and defend Seller from and against any and all liability for loss, damage or injury to person or property in any manner arising out of or incident to the performance of any Seller's Acknowledgment or other sale by Seller or its servants, employees, agents or representatives. Without limiting the generality of the foregoing, Purchaser will indemnify and hold harmless Seller, its officers, employees, agents, successors, assigns, customers and users of its products from and against any and all losses, expenses, claims, suits and liabilities (including incidental and consequential damages and court costs and attorneys fees) arising as a result of any claim that the manufacture, use, sale or resale of goods delivered by Seller in accordance with Purchaser's specifications or designs infringes on any patent, utility model, industry design, copyright or other intellectual property rights in any country. Without limiting the generality of the paragraph captioned "LIMITATION OF PURCHASER'S REMEDIES" above, in the case of any claim of infringement or the sale of products is enjoined, Seller shall have no obligation to procure for Purchaser the right to continue using such products or to replace same with equivalent non-infringing products or to modify the products so they become non-

infringing.

Setoffs. Purchaser shall make no deduction or setoff for any claim arising out of or from any transaction with Seller nor shall Purchaser take any discount, credit or allowance without Seller's written consent.

Assignment. Purchaser shall not assign any order or any interest therein without the written consent of Seller. Any such actual or attempted assignment without Seller's prior written consent shall entitle Seller to cancel such order upon written notice to Purchaser.

Termination. Seller may terminate any order or any part thereof for any reason at Seller's convenience upon written notice to Purchaser. Upon such termination, Purchaser agrees to waive all claims for damages including, without limitation, any loss of anticipated profits, and to accept as its sole remedy for termination the reasonable additional costs of obtaining substitute goods of the same quantity and quality; provided that in no event shall such costs exceed the price of the order or part thereof so terminated as stated on Seller's Acknowledgment. Any claim for adjustment not asserted within sixty (60) days from the date of such termination shall be deemed to have been waived by Purchaser.

Allocation of Risk. Purchaser acknowledges that these Standard Terms and Conditions of Sale and Seller's Acknowledgment allocates risks with respect to goods and or services sold to Purchaser and this risk allocation is reflected in the prices to be paid by Purchaser for said goods and/or services purchased hereunder. Purchaser warrants that it has read this provision, understands it and is bound by its terms.

Packaging. Seller will use all reasonable means to comply with any packaging, loading or bracing requirements specified in any order. Seller will charge for compliance with Purchaser's special requirements in accordance with Seller's price list for extras in effect at time of shipment. If no packaging, loading or bracing requirements are specified by Purchaser, Seller shall comply with the minimum requirements customarily applied by Seller to the method of transportation used for such goods.

Entire Agreement. These Standard Terms and Conditions of Sale and Seller's Acknowledgment and any other documents referred to on the face thereof constitute the entire agreement between Seller and Purchaser.

Modification. No addition or modification of the terms and conditions of these Standard Terms and Conditions of Sale and Seller's Acknowledgment shall be binding on Seller unless specifically agreed to by Seller in writing.

Waiver. Seller's failure to insist on performance of any of these Standard Terms and Conditions of Sale and Seller's Acknowledgment or to exercise any right or privilege or Seller's waiver of any breach hereunder shall not thereafter waive any other terms, conditions, or privileges, whether of the same or similar type.

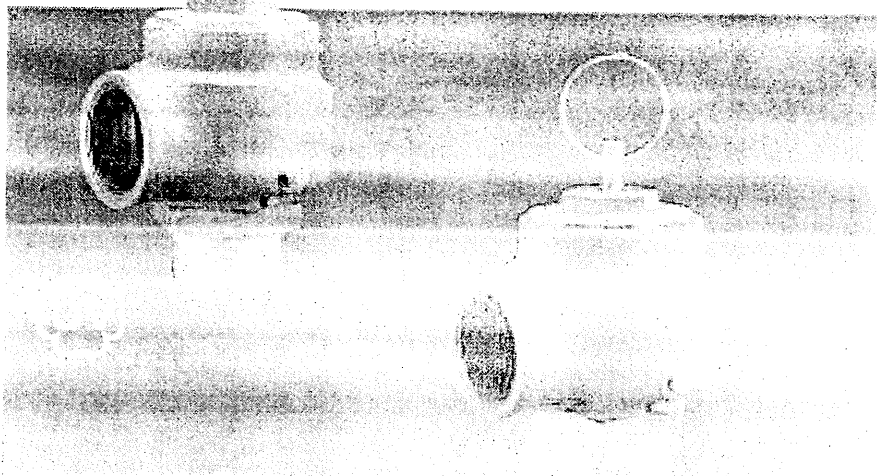
Governing Law. Seller and Purchaser's agreement shall be governed by and interpreted in accordance with the laws of the State of Illinois of the United States of America. Manufacture, shipment and delivery are subject to any prohibition, restriction, priority, allocation, regulation or condition imposed by or on behalf of the United States of America or any other governmental body with appropriate jurisdiction which may prevent or interfere with fulfillment of any order.

Re-orders. Re-orders, if accepted by Seller, are considered as placed under the same terms and conditions as Purchaser's previous order, when such orders are not placed pursuant to a formal written proposal and acceptance.

Disclosure. Seller shall have the right to disclosure of the identity of Purchaser and the nature of the work Seller is performing on Purchaser's behalf to Seller's customers and prospective customers and in any promotional materials provided such disclosure does not contain any confidential and proprietary information concerning Purchaser.

DISPUTES. SELLER AND PURCHASER AGREE TO SUBMIT ANY DISPUTES REGARDING ANY ORDER, ANY GOODS DELIVERED PURSUANT TO ANY ORDER AND EXPRESSLY ACCEPTED IN SELLER'S ACKNOWLEDGMENT, OR SELLER'S PERFORMANCE IN CONNECTION WITH ANY ORDER, INCLUDING WITHOUT LIMITATION SELLER'S LIMITED WARRANTY OBLIGATION, TO MEDIATION BY AN INDEPENDENT MEDIATOR TO BE MUTUALLY AGREED UPON BY SELLER AND PURCHASER. THE COST OF SUCH MEDIATION SHALL BE BORNE EQUALLY BY SELLER AND PURCHASER. IN THE EVENT SUCH MEDIATION DOES NOT RESOLVE THEIR DISPUTE, SELLER AND PURCHASER AGREE TO SUBMIT SUCH DISPUTE TO AN INDEPENDENT ARBITRATOR, TO BE MUTUALLY AGREED UPON BY SELLER AND PURCHASER OR, OTHERWISE, CHOSEN BY THE MEDIATOR. SELLER AND PURCHASER AGREE THAT ALL MEDIATION AND ARBITRATION SHALL BE CONDUCTED IN ZION, ILLINOIS. THE NON-PREVAILING PARTY AT THE ARBITRATION SHALL PAY THE PREVAILING PARTY'S ATTORNEYS' FEES AND COSTS INCURRED IN PARTICIPATING IN THE ARBITRATION.

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.

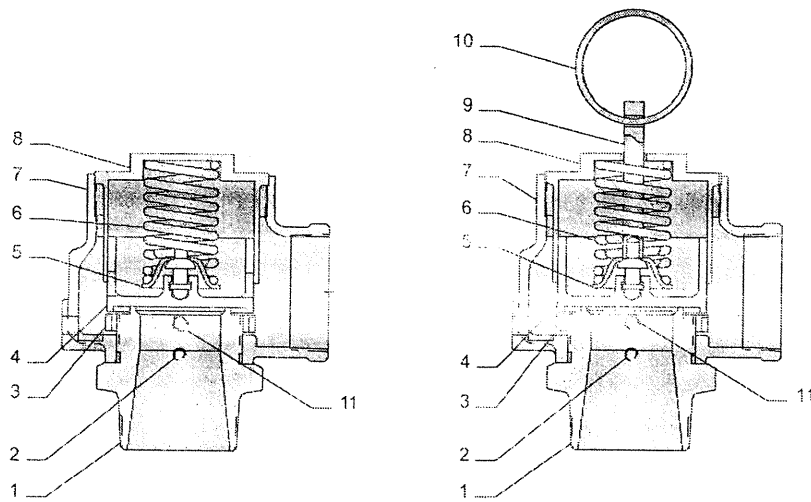
Model Description:

- **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, 337



Model 215V

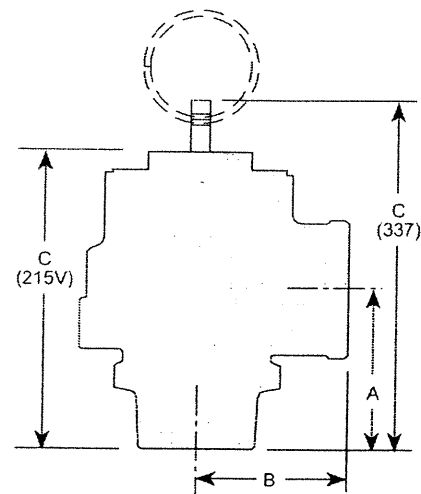
Model 337

No.	Part Name	215V	337
1	Nozzle ¹	Bronze, B62	Bronze, B62
2	Set Screw	Steel A108-1018 Brass Plated	Steel A108-1018 Brass Plated
3	Regulator Ring	Bronze B584 Alloy 84400	Bronze B584-C84400
4	Disc ¹	Bronze B584 Alloy 84400	Bronze B584-C84400
5	Spring Step	Steel A-109 Cadmium Plated	Steel A109, CAD Plated
6	Spring	SS, A313-TY 302	SS A313-302
7	Body	Cast Iron, Zinc Plated, B633	Iron A-126, CL A or B
8	Compression Screw	Bronze, B-584 Alloy 84400	Bronze, B584-C84400
9	Stem ²	N/A	Brass B16
10	Lift Ring ²	N/A	SS A313-302
11	Regulator Ring Set Screw	N/A	Brass B16

1. Disc and nozzle available in SSA-479 TY 316.
2. Stem and lift ring available on Model 337 only.

Specifications

Size Inlet and Outlet	Dimensions, in (mm)				Weight lb (kg)	
	A	B	C 215V	C 337		
2" [50.8 mm]	3 1/4 [82.5]	3 [76.2]	6 1/2 [165.1]	7 [177.8]	8 [3.6]	
2 1/2" [63.5 mm]	3 3/4 [95.2]	3 1/2 [88.9]	7 5/8 [194.6]	8 [203.2]	12 [5.4]	
3" [76.2 mm]	4 1/4 [107.9]	4 [101.6]	8 1/2 [215.9]	9 [228.6]	20 [4.1]	



Model 337

Model 215V

Non-code Vacuum Air (SCFM) - Flow Coefficient

Relief Set (in. HG)	Valve Inlet and Outlet Size		
	2"	2 1/2"	3"
	Orifice Area, in ²	Orifice Area, in ²	Orifice Area, in ²
2	229	347	503
5	338	512	742
10	415	630	910
15	426	646	936
20	426	646	936

Non-code Vacuum Air (SCFM) - Flow Coefficient

Relief Set (in. HG)	Valve Inlet and Outlet Size		
	5.04 cm	6.35 cm	7.62 cm
	Orifice Area (in ² 0.001)	Orifice Area (in ² 0.001)	Orifice Area (in ² 0.001)
50	328	498	722
100	450	682	988
150	533	807	1170
200	593	899	1303
250	638	966	1400
300	669	1014	1470
350	690	1046	1516
400	701	1062	1540
450	704	1067	1546
500	704	1067	1546
550	704	1067	1546
600	704	1067	1546
650	704	1067	1546
700	704	1067	1546
750	704	1067	1546

Model 337

Model 337 and ASME Section VIII, Div. 1, Code for Unfired Pressure Vessels

Set Pressure (psig)	Valve Inlet and Outlet Size		
	2"	2 1/2"	3"
1	240	364	527
5	531	805	1166
10	741	1124	1628
15	948	1436	2081
20	1092	1656	2391
25	1237	1875	2718
30	1382	2095	3036
35	1542	2337	3386
40	1701	2578	3736
45	1860	2820	4086
50	2020	3061	4436
55	2179	3303	4786
60	2338	3544	5136

1. No code stamp or 'NB' on nameplate below 15 psig set.

Model 337 and ASME Section VIII, Div. 1, Code for Unfired Pressure Vessels

Set Pressure (barg)	Valve Inlet and Outlet Size		
	50 mm	63 mm	80 mm
0.5	1049	1589	2303
1.0	1457	2208	3200
1.5	1888	2861	4147
2.0	2235	3387	4910
2.5	2613	3959	5739
3.0	2995	4538	6579
3.5	3377	5117	7418
4.0	3760	5696	8258

1. No code stamp or 'NB' on nameplate below 1.1 barg set.

Models 215V, 337

**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				
---	---	---	---	---	---	---	---	---	---	---	--	--	--	--

Model
215V
337

Inlet Size

- H - 2-inch [50.8 mm]
- J - 2½-inch [63.5 mm]
- K - 3-inch [76.2 mm]

Variation (01 through 99)

- 01 - Bronze Disc and Nozzle
- 03 - SS Disc and Nozzle
- 60 - BSP Connections

Design Revision

indicates non-interchangeable
revision. Current Design is at Revision 'A'

Valve Service

- K - Air ASME Section VIII (Model 337 only)
- Q - Vacuum (Model 215V only)
- N - Non-code Air/Gas (Model 337 only)

Spring Material

- E - SS

Set Pressure

Model 337, 1 psig [0.7 barg] (0001) through 60 psig [4.1 barg] (0060)

Model 215V, 2-inch HG [68 mbarg] (0002) through 22-inch HG [743 mbarg] (0022) vacuum



INSTRUMENTS PARTS LIST

File Name:

Parts List

Customer:

WHITMAN

Site Reference:

BRONX NEW YORK

Date:

8/18/2008

Reference	Qty	Units	Description	Material	Part Number
FI 100	1	each	VENTURI FLOWMETER, 3" FPT, 50-250 SCFM	ALUMINUM	ROTRON-FM30C250Q-550605
FI 200	1	each	VENTURI FLOWMETER, 2" FPT, 25-125 SCFM	ALUMINUM	ROTRON-FM20C125Q-550602
FP 300	1	each	MAGNETIC FLOW METER, 1/2" - 4" PIPE SIZE, WITH INTEGRAL DISPLAY AND RELAYS	PP, 316L SS	GF SIGNET-3-2551-P0-21
LS WELL FLOATS	56	each	LEVEL SWITCH, VERTICAL, SINGLE LEVEL SWITCHING, CABLE RESTRAINT MOUNT, 50' TFFN CORD, ACETAL FLOAT, BRASS BODY	BRASS/ACET AL	PLC-SDA0-SFT275-NORMALLY OPEN
LSH LSL 300	2	each	LEVEL SWITCH, VERTICAL, SINGLE LEVEL SWITCHING, CABLE RESTRAINT MOUNT, 25' TFFN CORD, ACETAL FLOAT, BRASS BODY	BRASS/ACET AL	PLC-SDA0-SFT175
LSHH 300	1	each	LEVEL SWITCH, VERTICAL, SINGLE LEVEL SWITCHING, CABLE RESTRAINT MOUNT, 25' TFFN CORD, ACETAL FLOAT, BRASS BODY	BRASS/ACET AL	PLC-SDA0-SFT175
LSHH 701, SUMP	1	each	LEVEL SWITCH, VERTICAL, SINGLE LEVEL SWITCHING, CABLE RESTRAINT MOUNT, 25' TFFN CORD, ACETAL FLOAT, BRASS BODY	BRASS/ACET AL	PLC-SDA0-SFT175-NORMALLY CLOSED
LSLL CP	1	each	LEVEL SWITCH, VERTICAL, SINGLE LEVEL SWITCHING, CABLE RESTRAINT MOUNT, 25' TFFN CORD, ACETAL FLOAT, BRASS BODY	BRASS/ACET AL	PLC-SDA0-SFT175
PSH 200	1	each	DIFFERENTIAL AIR PRESSURE SWITCH, 12 - 60" WC, NEMA 4, 7PSI MAX, 5/32" HOSE CONNECTION		DUNGS AA-A2-4-6
PSH 300	1	each	ADJUSTABLE PRESSURE SWITCH, FIELD ADJUSTABLE, THREE WIRE, 2-50 PSIG SETPOINT RANGE, SPDT, BLACK COMMON, WHITE NO, RED NC, 12" EPOXY SEALED LEADS, SINGLE 1/8" MNPT PROCESS CONNECTION FOR COMPATIBLE LIQUIDS OR GASSES, -65 - 225F, NOT NEMA RATED	17-7 PH SS, 303 SS	DWYER-APS-250
PSH 600	1	each	ADJUSTABLE PRESSURE SWITCH, FIELD ADJUSTABLE, THREE WIRE, 0.8-30 PSIG SETPOINT RANGE, SPDT, BLACK COMMON, WHITE NO, RED NC, 12" EPOXY SEALED LEADS, SINGLE 1/8" MNPT PROCESS CONNECTION FOR COMPATIBLE LIQUIDS OR GASSES, -65 - 225F, NOT NEMA RATED	17-7 PH SS, 303 SS	DWYER-APS-150

Measurement Accessories

Blower Connection Key

NPT – American National Standard Taper Pipe Thread (Male)

NPSC – American National Standard Straight Pipe Thread for Coupling (Female)

SO – Slip On (Smooth – No Threads)

Air Flow Meter

FEATURES

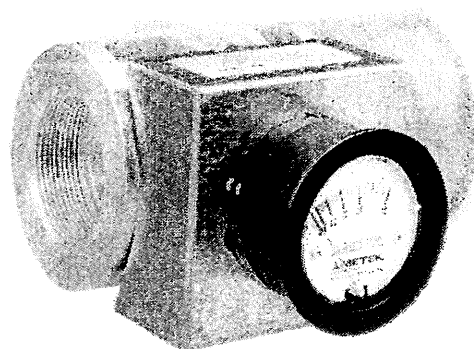
- Direct reading in SCFM
- Low pressure drop (2-4" typical) across the flow meter
- Non-clogging, low impedance air stream
- Light weight aluminum
- No moving parts
- Large easy-to-read dial
- Accurate within 2% at standard conditions
- Good repeatability
- Available in 2", 3" and 4" sizes
- Factory configured for quick installation
- .048" Allen key supplied for gauge adjustment

OPTIONS

- For 4-20 mA outputs and digital readouts see page G-9
- High temperature version (above 140°F)
- Corrosion-resistant version with Chem-Tough™ or in stainless steel
- FDA-approved Food Tough™ surface conversion
- High pressure version (100 PSI)

BENEFITS

- **OPTIMIZE SYSTEM EFFICIENCY**
Measuring the correct air flow can assist you in fine-tuning to your system's optimal efficiency.
- **BALANCE MULTI-PIPING SYSTEMS**
When evacuating CFM from more than one pipe, different run lengths or end system impedance can cause one pipe to handle more CFM than the other. With an accurate CFM reading, piping can be balanced by bleeding air in/out or by creating an extra impedance.
- **DETECT CHANNELING OR PLUGGING**
For systems in which channeling or plugging can occur, a change in the CFM measured can help indicate the unseen changes in your system.

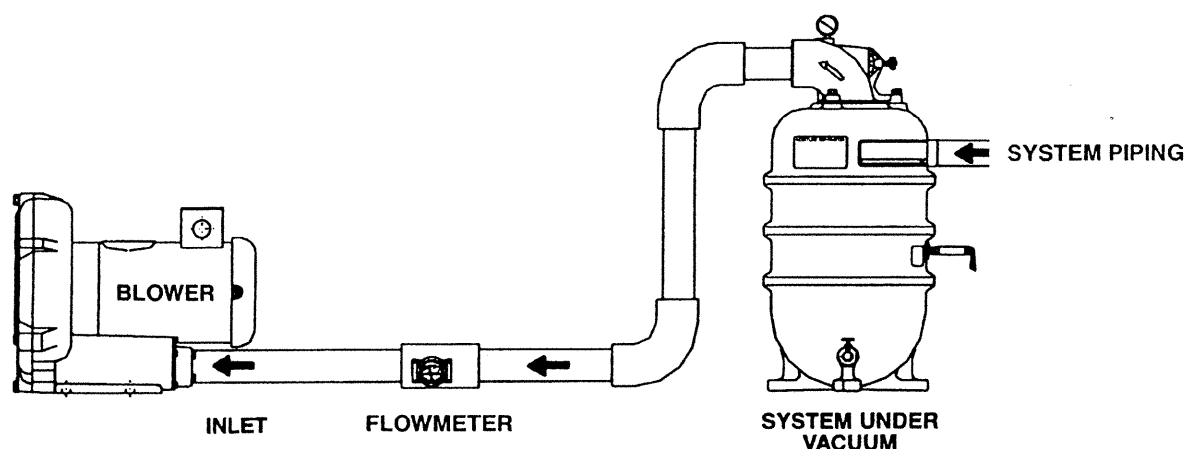
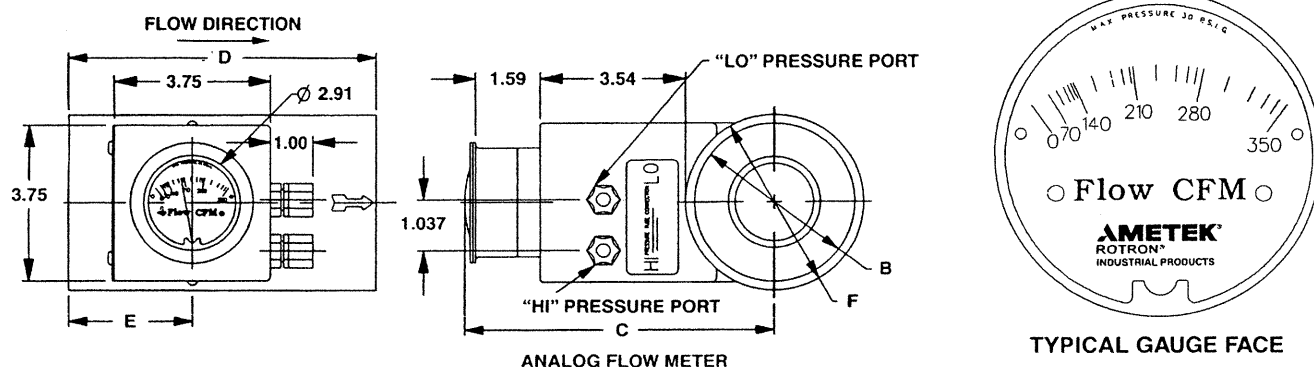


Current Models		Flow Range (SCFM)	B Threads	C Length	D Width	E	F
Model	Part #						
FM20C030Q	550599	6-30	2" - 11.5 NPSC	7.18"	7.0"	2.0"	3.75"
FM20C045Q	550600	9-45					
FM20C065Q	550601	13-65					
FM20C125Q	550602	25-125					
FM20C175Q	550603	35-175					
FM20C225Q	550604	45-225					
FM30C250Q	550605	50-250	3" - 8 NPSC	7.52"	7.4"	2.5"	4.43"
FM30C350Q	550606	70-350					
FM30C475Q	550607	95-475					
FM40C450Q	550608	90-450	4" - 8 NPSC	8.00"	7.7"	2.7"	5.43"
FM40C600Q	550609	120-600					
FM40C850Q	550610	170-850					

Blower Model Reference Key	
A = SPIRAL	E = DR/EN/CP 656, 6, 623, S7
B = DR/EN/CP 068, 083, 101, 202	F = DR/EN/CP 707, 808, 858, S9, P9 (Inlet Only)
C = DR/EN/CP 303, 312, 313, 353	G = DR/EN/CP 823, S13, P13 (Inlet Only)
D = DR/EN/CP 404, 454, 513, 505, 555, 523	H = DR/EN/CP 909, 979, 1223, 14, S15, P15 (Inlet Only)

Measurement Accessories

TYPICAL FLOW METER ARRANGEMENT



HIGH TEMPERATURE/PRESSURE CORRECTION

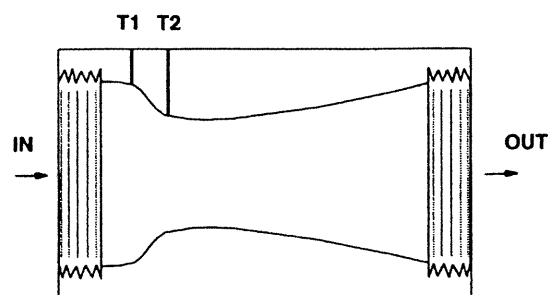
$$SCFM_2 = \frac{SCFM_1}{-\left(\frac{14.7}{Pf_2}\right) \times \left(\frac{530}{Tf_2 + 460}\right)}$$

Pf_2 = Absolute Pressure in PSIA

Tf_2 = Temperature in °F

- Use on inlet to limit need to correct for high pressure or elevated outlet temperature
- Standard model limits = 140°F and 30 PSIG

HOW IT WORKS



Rotron's flow meter is a venturi style design. After air enters the inlet, the pressure is measured in the T1 tap. The second tap, T2, measures the pressure at the throat. The differential between T1 and T2 registers across a special calibrated CFM gauge to provide accurate readings. The throat is then expanded back to the original size to keep pressure loss to under 2-4 IWG.



SAFETY INSTRUCTIONS

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature/pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.



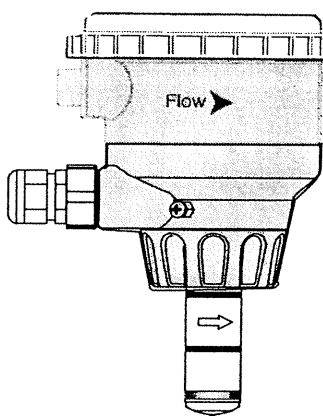
1.0 Description

The 2551 Magmeter measures the flow rate in a full pipe by monitoring the voltage produced when the (conductive) fluid moves through a magnetic field.

Output options include a traditional frequency signal, a serial data (digital) output, and a 4-20 mA output.

The 2551 Magmeter is available in three sizes that will accommodate pipes from ½ inch through 12 inch diameters.

Select from four different material combinations to match the magmeter to the application requirements.



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2.0 Specifications

Wetted Materials:

- Sensor body and Electrodes and Grounding ring:
 - P0, -P1, -P2: Polypropylene and 316L SS
 - T0, -T1, -T2: PVDF and Titanium
 - V0, -V1, -V2: PVDF and Hastelloy-C
 - W0, -W1, -W2: PVDF and 316L SS
 - O-rings: FPM (standard)
EPDM, Kalrez® (optional)



The user is responsible for determining the chemical suitability of these materials for a specific application.

- Case: PBT
- Display window: Polyamide

Power Requirements

- 4 to 20 mA: 21.6 to 26.4 VDC, 22.1 mA max.
400 mV p-p maximum ripple voltage
- Frequency: 5 to 26.4 VDC, 15 mA max.
- Digital: 5 to 6.5 VDC, 15 mA max.
- Auxiliary (only required for units with relays): 9 to 24 VDC, 0.4A max
- Reverse polarity and short circuit protected

Performance

- Pipe size range: DN15 to DN300 (½ to 12 in.)
- Flow Range: Minimum: 0.05 m/s (0.15 ft/s)
(Bi-directional) Maximum: 10 m/s (33 ft/s)
- Linearity: ±1% of reading +0.01m/s (0.033 ft/s)
- Repeatability: ±0.5% of reading @ 25°C (77°F)
- Minimum Conductivity: 20 µS/cm

Output Specifications

Current output (4 to 20 mA)

- Max Loop Resistance: 300Ω
- Loop Accuracy: 32 µA max. error (25°C @ 24 VDC)
- Temp. drift: ±1 µA per °C max.
- Power supply rejection: ±1 µA per V
- Isolation: Low voltage <48 VAC/DC
from electrodes and aux power
- Maximum cable: 300 m (1000 ft.)
- Error condition: 22.1 mA

Frequency output:

- Output modes: Freq, Freq+10, or Mirror Relay 1
- Max. Pullup Voltage: 30 VDC
- Reverse Polarity Protected to -40 V
- Max. Current Sink: 50 mA, current limited
- Maximum cable: 300 m (1000 ft.)

Digital (S³L) Output:

- Serial ASCII, TTL level 9600 bps
- Compatible with Signet 8900

Standards and Approvals

- CE
- UL, CUL (for display versions with relays)
- NEMA 4X / IP65 Enclosure (with cap installed)
- EMC: EN55011: 1998 +A1:99+A2:02
Class B Emissions
EN61326: 1997 +A1:98+A2:01
EN61000-6-2:2001
- Safety: EN61010-1:2001
- U.S. Patent No. 7,055,396 B1

Relay Specifications

- Relay 1 and 2 Type: Mechanical SPDT
Rating: 5 A @ 30 VDC max., 5 A @ 250 VAC max.
- Relay 3 Type: Solid State
Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC
- Hysteresis: Adjustable, plus timer delay
- Trigger Delay: Adjustable (0 to 9999.9 sec.)

Relay Modes: Off, Low, High, Window, and Proportional Pulse

Relay Source: Flow Rate, Resettable Totalizer

Error Condition: Selectable; Fail Open or Fail Closed

Display

- Characters: 2 x 16
- Contrast: User-set in four levels
- Backlighting (only on relay versions): Requires external 9-24 VDC, 0.4 mA max.

Environmental Requirements

Storage Temperature:

-20° to 70°C (-4° to 158°F)

Relative Humidity:

0 to 95% (non-condensing)

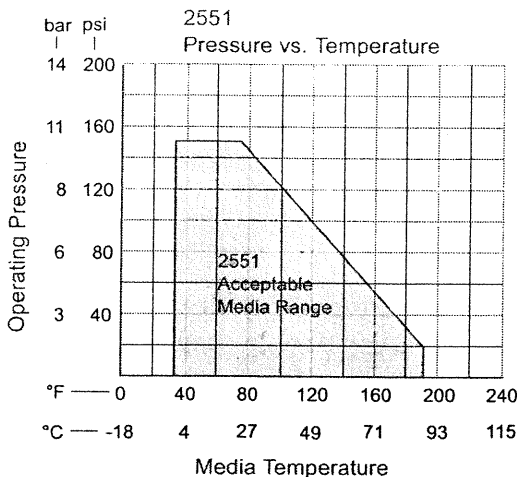
Operating Temperature

- Ambient: -10° to 70°C (14° to 158°F)
- Media: 0° to 85°C (32° to 185°F)

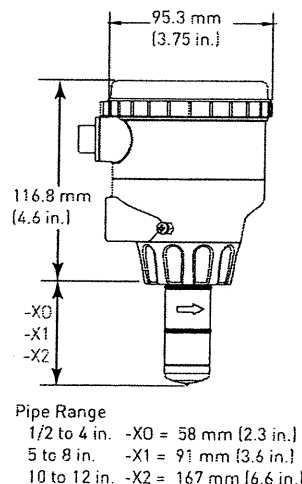
Max. operating pressure:

10.3 bar @ 25°C (150 psi @ 77°F)

1.4 bar @ 85°C (20 psi @ 185°F)



Dimensions



X = Sensor Body P, T, V, or W

3.0 Installation: Pipe fittings

George Fischer Signet offers a wide selection of installation fittings that control the position of the magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the K-factor table in section 7.3.

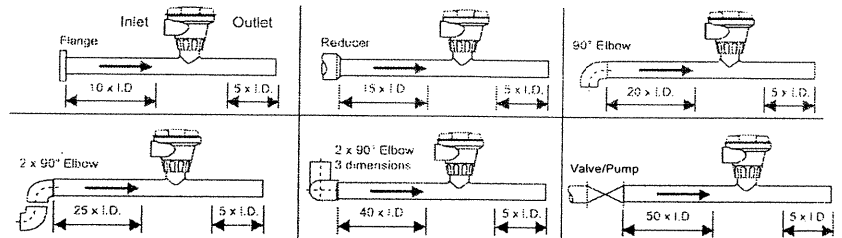
Type	Description	Type	Description
Plastic tees 	0.5 to 4 inch versions - PVC or CPVC	Iron, Carbon Steel, 316 SS Threaded tees 	0.5 to 2 in. versions - Mounts on threaded pipe ends
PVC Glue-on Saddles 	- Available in 10 and 12 inch sizes only - Cut 2-1/2 inch hole in pipe - Weld in place using solvent cement	Carbon steel & stainless steel Weld-on Weldolets 	2 to 4 inch, cut 1-7/16 inch hole in pipe - Over 4 inch, cut 2-1/8 inch hole in pipe
PVC Saddles 	2 to 4 inch, cut 1-7/16 inch hole in pipe 6 to 8 inch, cut 2-1/8 inch hole in pipe	Fiberglass tees & saddles: FPT  FPS 	1.5 in. to 8 in. PVDF insert > 8 in. PVC insert
PP Clamp-on Saddles 	- Available in 10 and 12 inch sizes only - Cut 2-1/8 inch hole in pipe	Metric Union Fitting 	- For pipes from DN 15 to 50 mm - PP or PVDF
Iron Strap-on saddles 	2 to 4 inch, cut 1-7/16 inch hole in pipe - Over 4 inch, cut 2-1/8 inch hole in pipe		

3.1 Location of Fitting

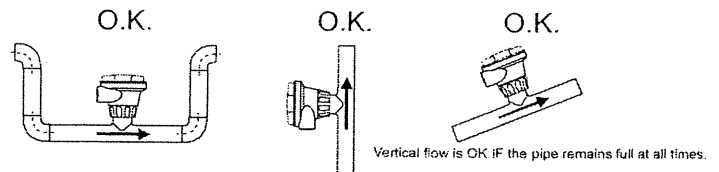
The 2551 can only measure flow if the pipe is full.

If the piping system has entrained air pockets, take steps to locate the sensor so the air pockets will not contact the electrodes.

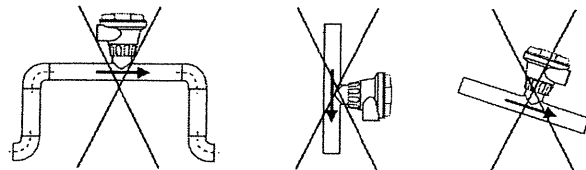
Select a location with sufficient distance of straight pipe immediately upstream of the sensor.



These configurations guarantee that the pipe is always filled. The sensor cannot be exposed to air bubbles.



Avoid these situations unless you are certain that the sensor will not be exposed to air bubbles.

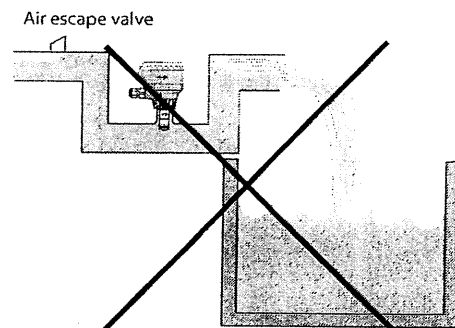


In a gravity-flow system, the tank must be designed so the level does not drop below the outlet. This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.

3.2 Empty Pipe Detection

If the pipe is not full, or the electrodes are not immersed, the flow display will show zero and all output functions will behave accordingly.

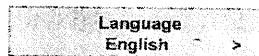
If the magmeter electrodes are exposed to flow transitions and air bubbles, the measurement may be incorrect until the conditions are stabilized.



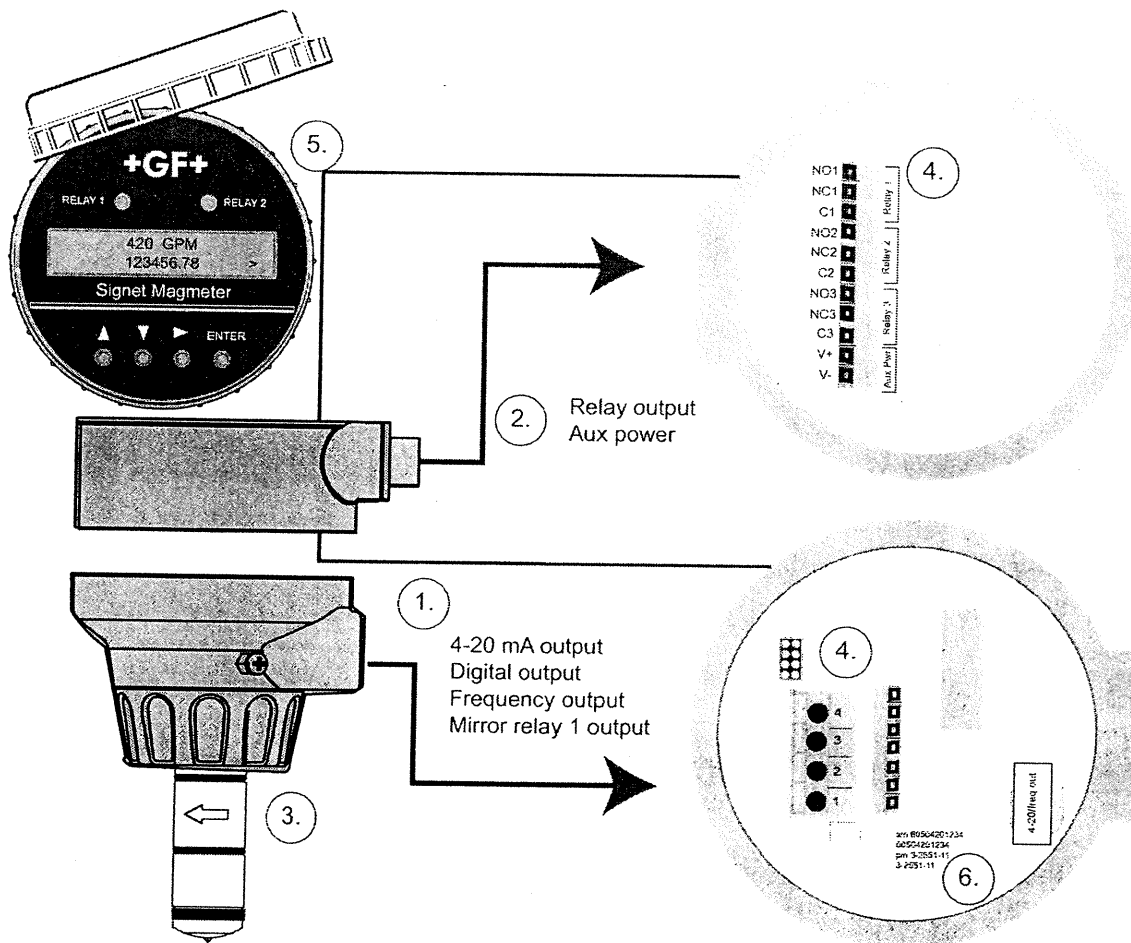
4.0 Overview of 2551 Display Magmeter

2551 Display Magmeters use a dual-sided electronics module and dual conduit ports. Unused ports must be sealed to protect the electronics from water damage.

- ① The lower set of conduit ports provide access to the wiring terminals for:
 - Loop Power
 - Flow Output Signal (current loop, frequency or Mirror Relay 1 output).
- ② The upper set of conduit ports provide access to the wiring terminals for:
 - Relay output wiring
 - Auxiliary power for relay coils and display backlight
- ③ The sensor is marked with a directional arrow to indicate the direction identified as forward flow. An adhesive decal is also provided that can be affixed to the pipe to indicate the direction of forward flow. Flow in the opposite direction from the arrow will be identified as reverse flow on the display by a "-" symbol.
- ④ The terminals in the magmeter are designed to accommodate 16 to 22 AWG conductors.
- ⑤ The display includes two LEDs that light when Relay 1 or Relay 2 are activated.
 - All three relays can be monitored by scrolling to the Relay Status display located in the View menu.
 - If the Language option has not been made, new magmeters will always open with the Select Language display.



- ⑥ The part number, serial number and output type are identified on the electronics module.

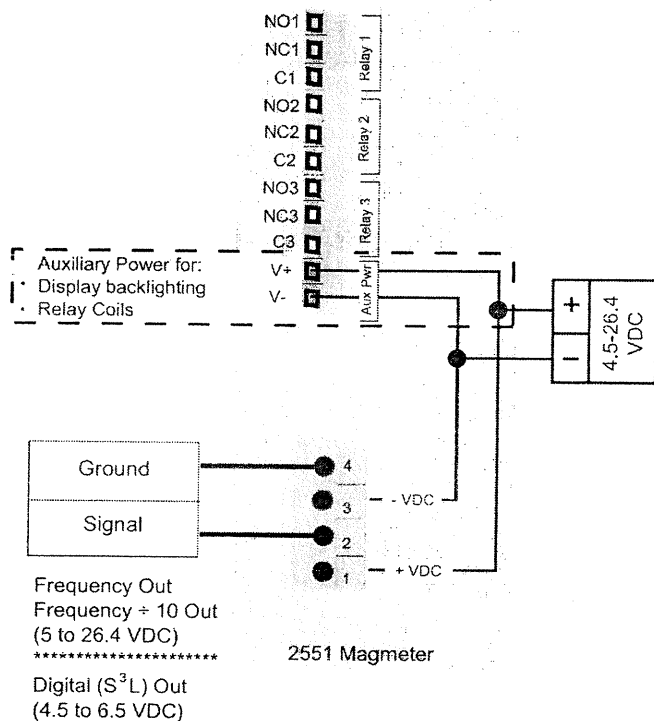


5.0 Wiring

5.1 Basic Wiring

Frequency output

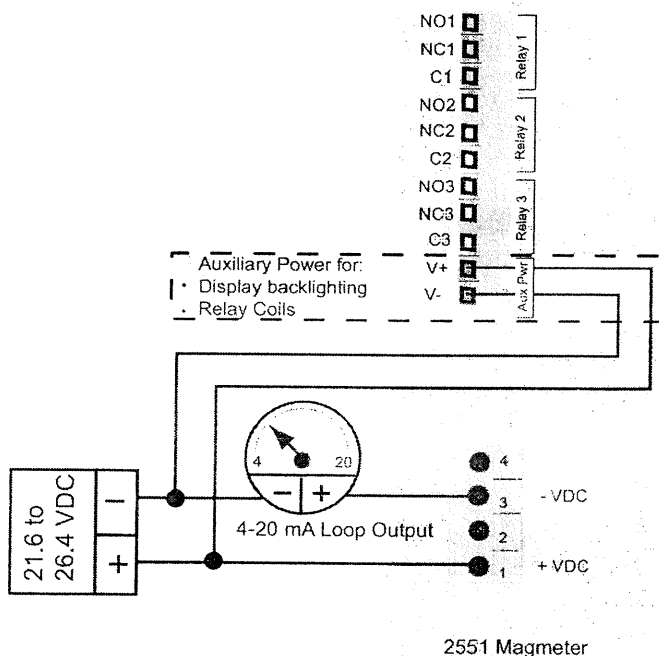
- 3-2551-21 and 3-2551-41 Magmeters may be programmed to provide an open collector FREQUENCY output.
- The maximum frequency output is 1000 Hz (@ 10 meters per second)
- If the Frequency ÷ 10 output is selected, the maximum frequency is 100 Hz (@ 10 meters per second)
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



4-20 mA output

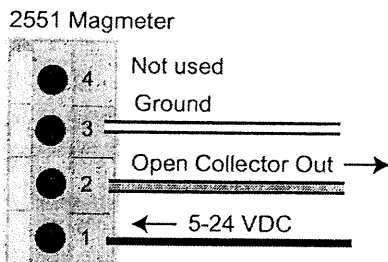
The 3-2551-22 and 3-2551-42 Magmeters provide a passive 4-20 mA loop output.

- External loop power (24 VDC) is required.
- Factory standard calibration is 4 - 20 mA = 0 - 5 m/s.
- The 4-20 mA output can be spanned to any range, from -10 m/s to +10 m/s.
- AUX PWR must be connected to power the display backlighting and to power the relay coils if included.



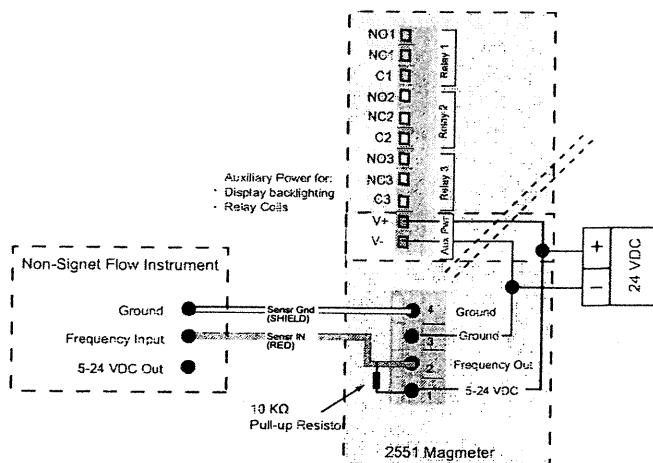
5.2 Wiring: Mirror Relay 1 output

The 3-2551-21 and -41 Magmeter can be configured to provide an Open Collector output in lieu of the sensor signal provided by Frequency or Digital output selections. The Open Collector Output can be programmed via the Relay 1 menu.



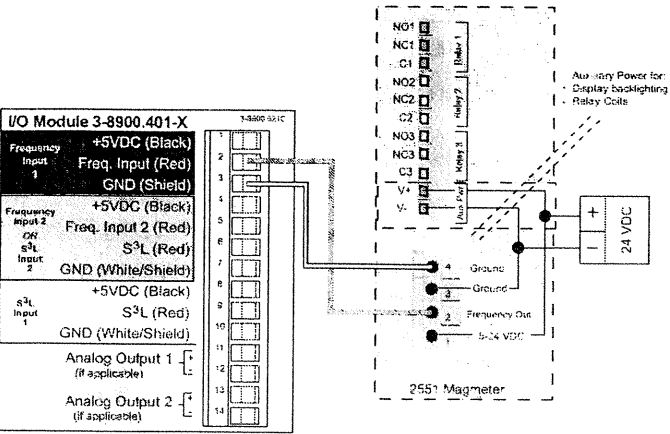
5.3 2551 and other manufacturer's instruments

When using the 2551 in a system with other manufacturer's equipment, a pull-up resistor may be required to power the open collector output.

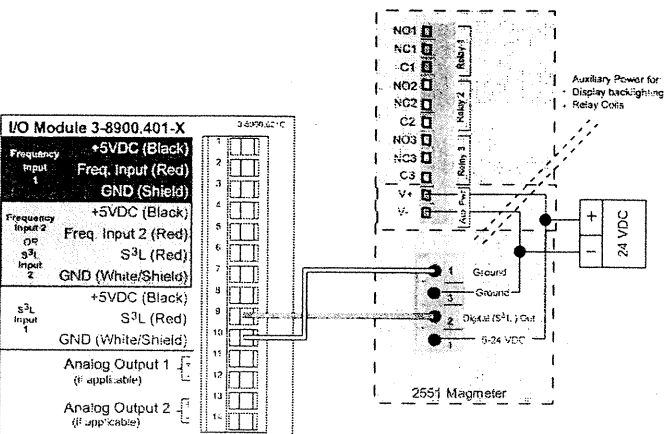


5.4 Wiring to Signet Flow Instruments

2551 and 8900 Multi-Parameter Controller: Frequency Out

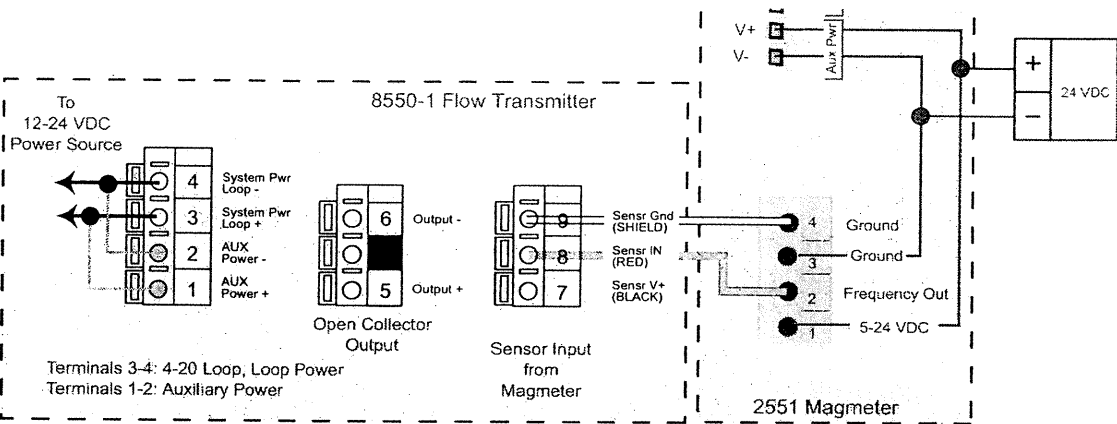


2551 and 8900 Multi-Parameter Controller: Digital Out

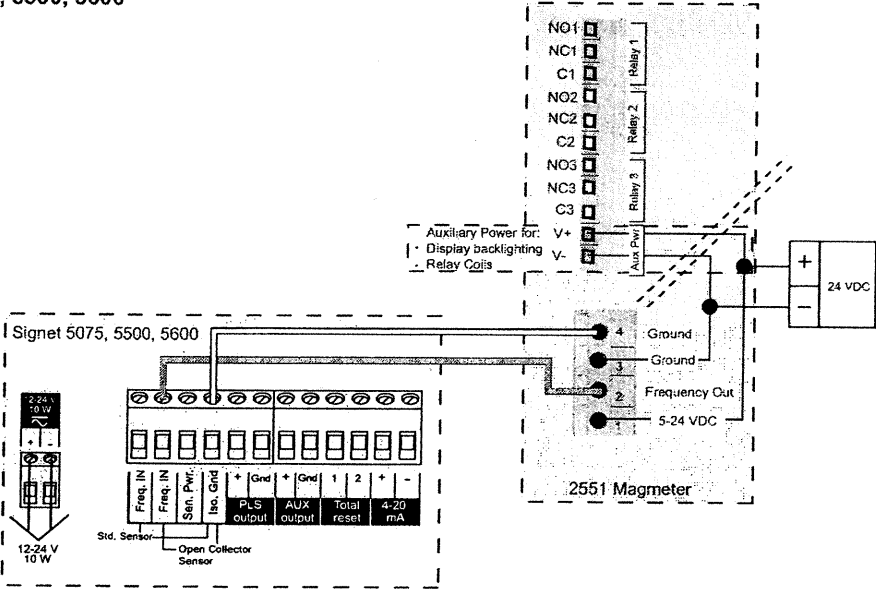


2551 and ProcessPro 8550 Flow Transmitter

When connecting the 2551 to any 8550 model, the AUXILIARY power in the 8550 must always be connected.



2551 and ProPoint 5075, 5500, 5600



5.5 Wiring Relays

Relay 1, Relay 2 Type: Mechanical SPDT
 Rating: 5A @ 30 VDC max., 5 A @ 250 VAC max

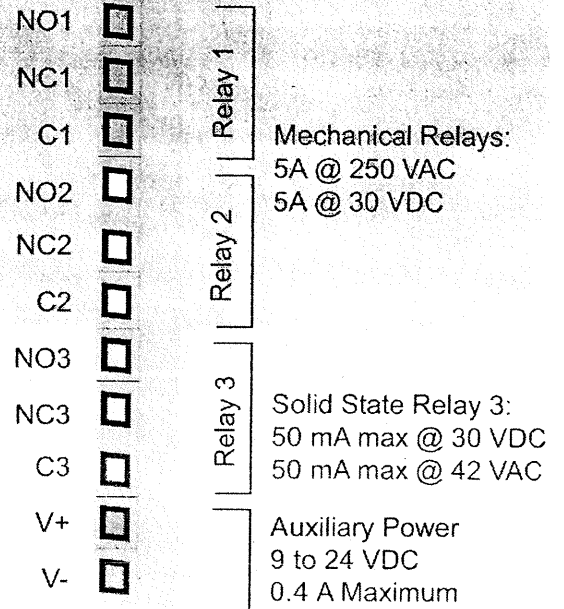
Relays 1 and 2 are dry contact relays rated for 5 A maximum current.
 Relays 1 and 2 are best suited for switching high voltage loads, such as AC powered pumps and valves.

When used to switch inductive loads, dry contact relays may be damaged by arcing. Signet recommends the installation of a filter device to prevent such damage.

3-8050.396 159 000 617 RC Filter kit (for relay use)

Relay 3 Type: Solid State
 Rating: 50 mA @ 30 VDC, 50 mA @ 42 VAC

Relay 3 is a solid state relay. It can be applied exactly the same as a dry contact relay, but the current rating is 0.2 A (200 mA) maximum. Relay 3 is best suited to pulse applications and low voltage loads.



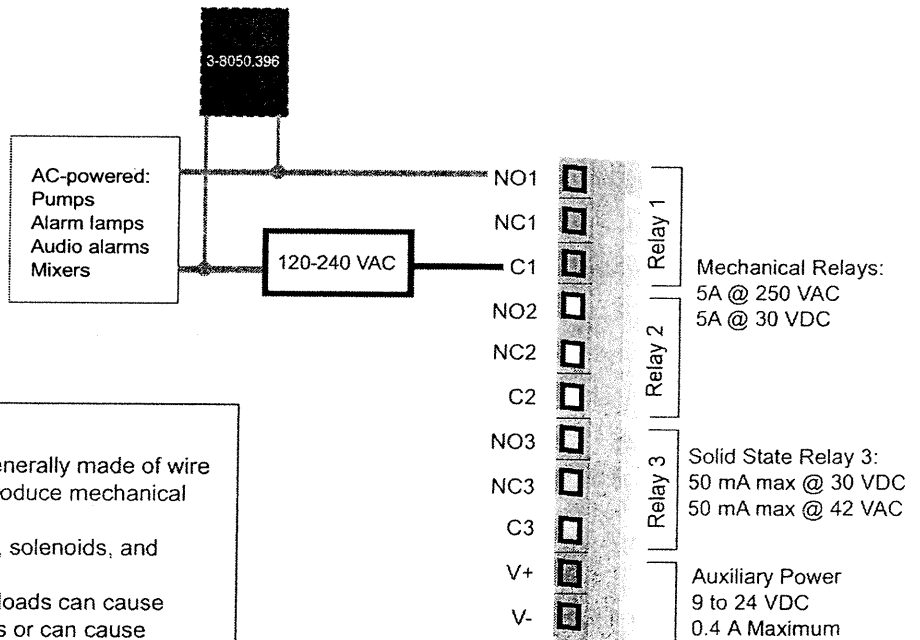
Auxiliary power must be connected to operate the relays and to power the display backlighting. Auxiliary power is fully isolated. The Loop Power supply may be used for Aux power if the power source provides a sufficient current rating.

Relay Terminal Legend:

NO: Normally Open
 NC: Normally Closed
 C: Common

Application Notes: Relay Wiring

- Inductive relay loads may generate transient voltage spikes well in excess of the relay contact ratings. This will cause arcing across the contacts and consequently rapid relay wear. Signet recommends a RC-style filter ("snubber"), installed as illustrated here.
- The filter kit (3-8050.396) is available as an accessory item. See ordering information on back cover.
- Signet product warranty does not cover damage to relays due to contact burnout.



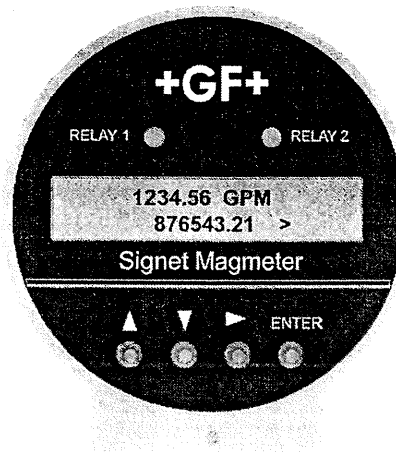
Definition:

An **inductive load** is an electrical device generally made of wire that is coiled to create a magnetic field to produce mechanical work when energized. Examples of inductive loads include motors, solenoids, and relays. High voltage transients from these types of loads can cause arcing across mechanical switching contacts or can cause damage to solid-state contacts.

6.0 View Menu

The VIEW menu contains all of the basic information available from the magmeter.

- The normal operating display shows the FLOW RATE on the top line of the display and the Resettable Totalizer on the lower line of the display.
- The Right Prompt symbol (>) always indicates a sub-menu associated with the current display. In this display it points the way to the TOTALIZER RESET function. See section 6.1 for detailed instructions.
- With AUXILIARY power connected to the magmeters with Relays, the display will be backlit. There is no switch to turn the backlight off.
-  A flashing character or text on the display indicates that the item is being edited. This manual uses a (red) star to illustrate a flashing display.
- The following information is viewed by scrolling UP or DOWN. These displays will remain in the display for 10 minutes, then the normal operating display will return.



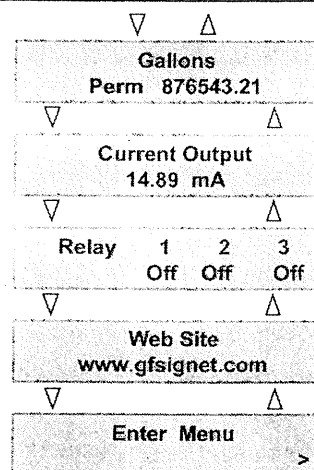
Show the permanent total. This totalizer cannot be reset.

Shows the current output. For 4-20 mA Output models only.

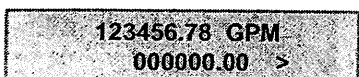
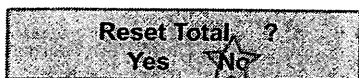
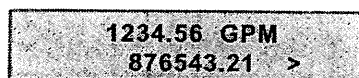
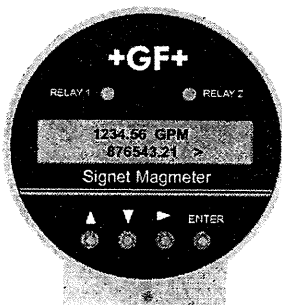
Relay States shown for units with a relay board.

This display is a reminder to visit the Signet website for updates and information about Signet products.

Enter menus from this display. See section 6.2.



6.1 Resetting the Resettable Totalizer



1. From the normal operating display, press the RIGHT arrow key.
2. The resetable totalizer can be configured to require the security code before allowing the reset. If the Total Reset set to "RESET OFF" this display will not appear. See section 11, Options Menu for instructions.
3. Press any arrow key to toggle the flashing selection from NO to YES.
4. Press the ENTER key. The totalizer will reset to 000000.00 and the display will immediately return to the normal operating display.

6.2 Navigating the Menus

Normal Operation Display

The normal operating display shows the Flow Rate on the top line and the Resettable Totalizer on the bottom line.

- All menu instructions in this manual assume that the instrument is showing this display.

2551 Menu Directory

The 2551 magmeter uses seven main menus to provide access to the calibration and programming features. Each menu serves a specific function.

Starting from the normal operating display, there are two ways to access the menus:

1. Press the UP arrow key to scroll to the Enter Menu display, then press the RIGHT arrow key.
2. Press the ENTER key and hold it for about three seconds.

Setup Menu

This menu contains all of the settings and information that the magmeter requires to operate, including the K-factor, the totalizer settings, low flow cutoff, and several display

Calibration Menu

The Calibration menu provides two different methods for adjusting the calibration. See section 8.0 for details related to this menu.

Relay Menus

Each of the available relays in the 2551-21 and -22 are programmed from their own dedicated menu. See section 9 for details related to these menus.

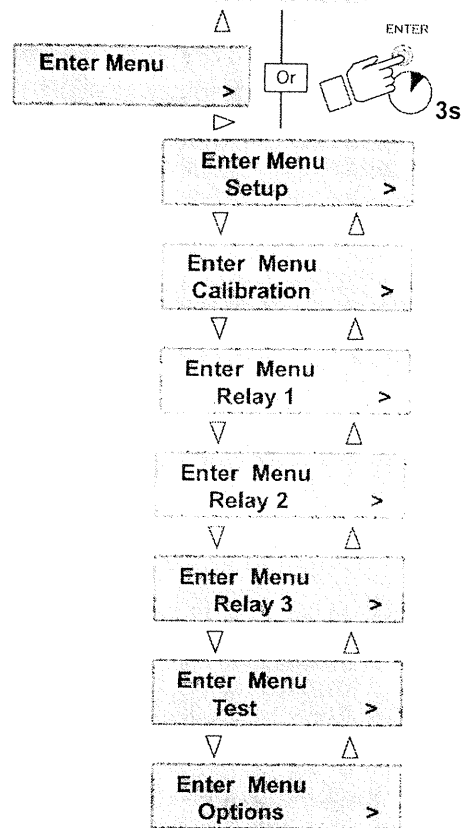
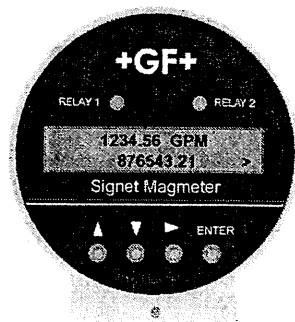
Note: Menu items associated with Relay 2 and relay 3 are suppressed in models without relays. See section 9.0 for details related to this menu.

Test Menu

The Test menu is used to manually toggle relays or to induce a known value out of the 4-20 mA terminals. See section 10.0 for details related to this menu.

Options Menu

The Options menu contains those settings and values that are usually programmed during the initial installation, and then seldom modified, including the SECURITY CODE (see section 6.4). See section 11.0 for details related to the Options menu.



6.3 Keypad Functions



Scrolls UP through any menu.
If the display shows any flashing character or selection, scrolls UP to the previous value or selection.



Scrolls DOWN through any menu.
If the display shows any flashing character or selection, scrolls DOWN to the next value or selection.



Press the UP and DOWN keys together to abandon any unsaved edits and return to the previous display.



Opens the menu currently being displayed.
In Edit modes, advances the flashing character.
In menus with only two options (Yes or No, On or Off) toggles between selections.

ENTER Saves a new selection in any menu.
From Normal Operation display, jumps to first selection in Menu directory (when held for three seconds)

6.4 Security Code

The 2551 has a security code that can be programmed to any four digit numerical value.

- The factory setting is 0-0-0-0.
- To program the security code go to the Options menu.
- The security code will be required to edit any of the items in the menus. It is required only once for each editing session.
- Record the custom security code here or in a safe location.
- If the security code is lost, contact your Signet service center for instructions.



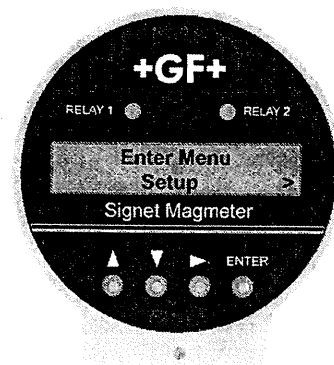
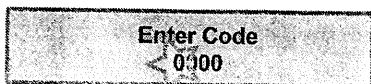
Security Code _____

WRITE IT DOWN!

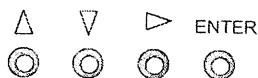
7.0 Setup Menu

The Setup menu contains all of the parameters necessary for the 2551 Magmeter to begin measuring flow.

NOTE: The Security Code must be entered before any changes can be made to the Setup menu. See the Options menu in section 11 for details.



Use the keypad to navigate through each setting.



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

K-Factor: See the charts in section 7.3 for values in pulses per U.S. Gallon or in pulses per Liter. To use other units, convert the published values as appropriate.

K-Factor
060.000 >

Pipe Size: Select the pipe size that is nearest to the nominal pipe size.

Pipe Size
2" DN50 >

Flow Units: Set the units for the application. Four characters are available. The first three characters can be set to any symbol or alpha character, upper or lower case. The following special symbols are located between the upper case and lower case menus:

- (centered dot) μ (micro) _ (blank)
- (dash) / (slash) 3 (for cubic units)

The last character selects the timebase for the flow rate measurement. Select S/s (seconds) M/m (minutes), H/h (hours) or D/d (days)

Flow Units
GPM >

Set 4 mA: In the 2551-22 and 2551-42 versions only, set the flow rate where the current output will be 4 mA.

Set 4 mA
-100 GPM >

Set 20 mA: In the 2551-22 and 2551-42 versions only, set the flow rate where the current output will be 20 mA.

Set 20 mA
100.00 GPM >

The 4-20 mA output may be spanned to monitor forward and reverse flow rates.

Total Factor: Set the factor by which the totalizer will count. This setting is made in the application units (ie; gallons, liters, etc..)

Total Factor
1000.0 >

Totalizer Units: Set the Totalizer Units. This setting serves as a label for the totalizer displays only. It has no effect on the measurement. The special characters listed in the Total Factor settings are available here also.

Totalizer Units
Gallons >

Low Flow Cutoff: Set a flow rate that the 2551 Magmeter will use as a minimum threshold. If the flow rate falls below this value, the 2551 will respond as if the flow were zero.

Low Flow Cutoff
0.5 GPM >

Averaging: Set the averaging period based on the installation and flow conditions. Smaller values allow the 2551 to respond to changes in flow rate quickly, while larger values smooth the fluctuations caused by installation and flow conditions. See section 7.1 for details.

Averaging
25 secs >

Sensitivity: Set a percentage of maximum range by which the flow must change to override the averaging feature and "jump" quickly to the new flow rate. See detailed explanation in section 7.1.

Sensitivity
100% >

7.1 Averaging and Sensitivity

Even the most carefully engineered flow systems may experience erratic and unstable conditions. If the instability is communicated to the output functions, the results may create problems for control devices.

To alleviate these issues, the 2551 provides two adjustments that operate in tandem. The information here will help in determining the appropriate settings for any specific application.

Averaging

- The AVERAGING setting dictates the time over which the magmeter will average the flow signal. The LCD display is updated every second. With averaging at 14 seconds, the flow rate on the display is an average of the previous 14 seconds input.

Short averaging times provide the fastest display and output response to changes in the flow rate.

Higher averaging times help to smooth the display and current output where the flow in the pipe is erratic or unstable due to installation limitations.

Sensitivity

- The SENSITIVITY setting determines how the 2551 responds to sudden surges in the flow rate. It "overrides" the Averaging function just long enough to allow an actual change in flow rate to be displayed, then resumes the averaging. The result is a smooth flow display and a quick response to large shifts in the flow rate.

The settings for Sensitivity represent a percentage of the magmeter's maximum range, or 10 m/s.

Example: A sensitivity setting of 25% means that the flow rate must change instantly and by more than 2.5 m/s before the function is enabled.

NOTE: The SENSITIVITY function is ineffective if the Averaging function is set to zero.

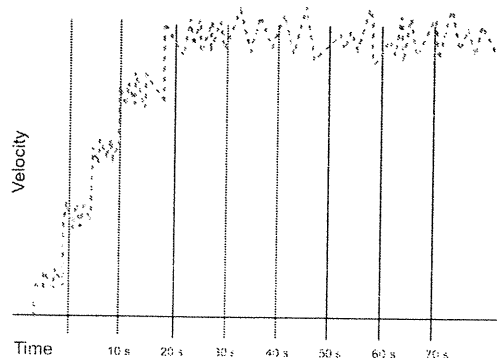


CAUTION

The SENSITIVITY function changes the response characteristics of the magmeter. If used as part of a tuned closed loop control system such a change may be undesirable.

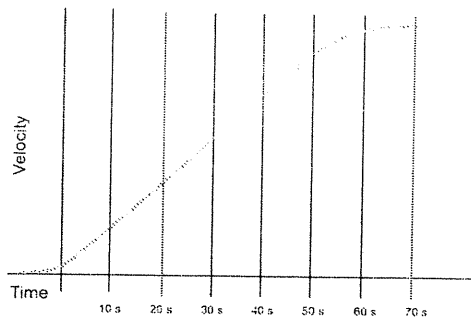
No Averaging

With AVERAGING set to zero, the flow rate will be displayed immediately and with no filtering. This line represents the actual output of the flow sensor as it responds to unstable flow conditions in the pipe.



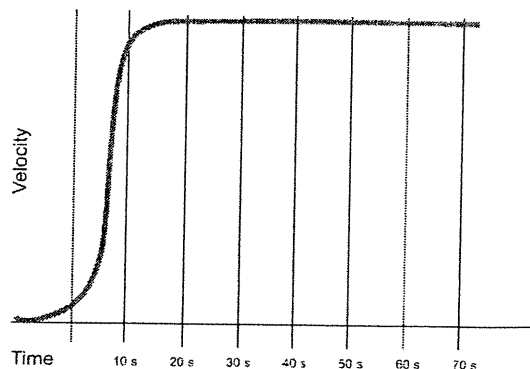
Averaging Only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented on the display or at the output for 50 seconds or longer.



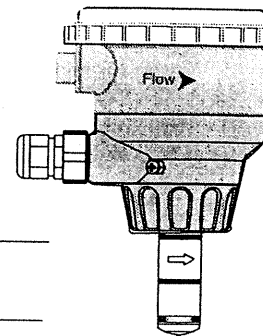
Averaging and Sensitivity

With AVERAGING at 50 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly.



7.2 Bi-Directional Flow

- The 2551 magmeter is designed to measure bi-directional flow.
- The forward flow direction is indicated by the directional arrow molded into the side of the 2551 sensor.
- The conduit ports are assembled at the factory to point UPSTREAM. They may be reversed by disassembling the components of the magmeter and reassembling.



Flow Rate Display: The "+" sign is suppressed during forward flow.
"-123.45 GPM" during reverse flow.

Totalizer Display: The totalizer will count during forward flow conditions only.
During reverse flow the totalizer will not increment.

Relay Outputs: May be set to detect reverse flow: "Low Setpoint at -25GPM."

4-20 mA output: May be scaled to span any flow range:
For example: "4 to 20 mA = -100 GPM to +100 GPM"

Frequency output, Frequency ÷ 10 output: Reverse flow is processed same as forward flow in the frequency output magmeters.

Digital (S3L) output: Reverse flow results in 0 flow rate output.

7.3 Calibration Data: K-factors

Carbon Steel Tees and Weld-o-Lets
Stainless Steel Tees and Weld-o-Lets
Galvanized Iron Tees

PVC Tees and Saddles

PIPE SIZE (IN.)	FITTING TYPE	K-Factor Gallons	K-Factor Liters
--------------------	-----------------	---------------------	--------------------

SCH 80 PVC TEES FOR SCH 80 PVC PIPE

1/2	PV8T005	2289.37	604.85
3/4	PV8T007	1430.41	377.92
1	PV8T010	876.86	231.67
1 1/4	PV8T012	447.06	118.11
1 1/2	PV8T015	324.19	85.65
2	PV8T020	206.69	54.61
2 1/2	PV8T025	131.46	34.73
3	PV8T030	82.52	21.80
4	PV8T040	44.78	11.83

SCH 80 PVC TEES FOR SCH 80 CPVC PIPE

1/2	CPV8T005	2496.03	659.45
3/4	CPV8T007	1381.48	364.99
1	CPV8T010	857.98	226.68
1 1/4	CPV8T012	445.17	117.61
1 1/2	CPV8T015	325.56	86.01

SCH 80 PVC SADDLES FOR SCH 80 PVC PIPE

2	PV8S020	193.83	51.21
2 1/2	PV8S025	138.01	36.46
3	PV8S030	83.89	22.16
4	PV8S040	40.88	10.80
6	PV8S060	22.53	5.95
8	PV8S080	12.52	3.31
10	PV8S100	7.94	2.10
12	PV8S120	5.71	1.51

SCH 80 PVC SADDLES FOR SCH 40 PVC PIPE

2	PV8S020	180.01	47.56
2 1/2	PV8S025	123.72	32.69
3	PV8S030	75.81	20.03
4	PV8S040	41.87	11.06
6	PV8S060	19.71	5.21
8	PV8S080	11.73	3.10
10	PV8S100	7.43	1.96
12	PV8S120	5.23	1.38

PIPE SIZE (IN.)	FITTING TYPE	K-Factor Gallons	K-Factor Liters
--------------------	-----------------	---------------------	--------------------

CARBON STEEL TEES ON SCH 40 PIPE

1/2	CS4T005	1572.66	415.50
3/4	CS4T007	1086.73	287.11
1	CS4T010	582.34	153.86
1 1/4	CS4T012	377.48	99.73
1 1/2	CS4T015	267.79	70.75
2	CS4T020	167.85	44.35

STAINLESS STEEL TEES ON SCH 40 PIPE

1/2	CR4T005	1601.26	423.05
3/4	CR4T007	937.78	247.76
1	CR4T010	606.18	160.15
1 1/4	CR4T012	279.68	73.89
1 1/2	CR4T015	147.65	39.01
2	CR4T020	111.90	29.56

STAINLESS STEEL WELDOLETS ON SCH 40 PIPE

2 1/2	CR4W025	106.31	28.09
3	CR4W030	72.27	19.09
4	CR4W040	36.84	9.73
5	CR4W050	29.28	7.73
6	CR4W060	20.29	5.36
8	CR4W080	11.73	3.10
10	CR4W100	7.45	1.97
12	CR4W120	5.24	1.39

CARBON STEEL WELDOLETS ON SCH 40 PIPE

2 1/2	CS4W025	105.70	27.93
3	CS4W030	70.68	18.67
4	CS4W040	36.38	9.61
5	CS4W050	29.28	7.73
6	CS4W060	20.29	5.36
8	CS4W080	11.73	3.10
10	CS4W100	7.45	1.97
12	CS4W120	5.24	1.39

GALVANIZED IRON TEES ON SCH 40 PIPE

1	IR4T010	558.50	147.56
1 1/4	IR4T012	334.45	88.36
1 1/2	IR4T015	248.97	65.78
2	IR4T020	146.00	38.57

7.3 Calibration Data: K-factors

Polypropylene True Union Tees and Wafers
Polypropylene Clamp-on Saddles
PVDF True Union Tees and Wafers
PVC True Union Tees and Wafers

PIPE SIZE (Metric)	FITTING TYPE	K-Factor Gallons	K-Factor Liters
POLYPROPYLENE FITTINGS (DIN/ISO ,BS, ANSI)			
DN15	PPMT005	2192.73	579.32
DN20	PPMT007	1327.81	350.81
DN25	PPMT010	737.16	194.76
DN32	PPMT012	453.46	119.81
DN40	PPMT015	275.03	72.66
DN50	PPMT020	164.17	43.35
DN65	PPMT025	112.02	29.59
DN80	PPMT030	77.40	20.45
DN100	PPMT040	51.76	13.68
DN125	PPMT050	40.14	10.61
DN150	PPMT060	24.51	6.47
DN200	PPMT080	15.66	4.14

POLYPROPYLENE CLAMP-ON SADDLES ON SCH 80 PP PIPE

10	PPS100	7.94	2.10
12	PPS120	5.71	1.51

POLYPROPYLENE CLAMP-ON SADDLES ON SCH 40 PP PIPE

10	PPS100	7.43	1.96
12	PPS120	5.23	1.38

PVDF FITTINGS (DIN/ISO ,BS, ANSI)

DN15	SFMT005	1946.49	514.26
DN20	SFMT007	1158.05	305.96
DN25	SFMT010	749.09	197.91
DN32	SFMT012	439.51	116.12
DN40	SFMT015	248.93	65.77
DN50	SFMT020	146.85	38.80
DN65	SFMT025	104.84	27.70
DN80	SFMT030	72.01	19.02
DN100	SFMT040	46.82	12.37
DN125	SFMT050	31.93	8.44
DN150	SFMT060	18.78	4.96
DN200	SFMT080	11.86	3.13

PVC FITTINGS (DIN/ISO ,BS, ANSI)

DN15	PVMT005	2067.76	546.30
DN20	PVMT007	1136.61	300.29
DN25	PVMT010	716.52	189.31
DN32	PVMT012	446.07	117.85
DN40	PVMT015	278.83	73.67
DN50	PVMT020	159.36	42.10
DN65	PVMT025	110.11	29.09
DN80	PVMT030	73.92	19.53
DN100	PVMT040	47.86	12.64
DN125	PVMT050	36.18	9.56
DN150	PVMT060	21.56	5.70
DN200	PVMT080	13.81	3.65

Iron Saddles

PIPE SIZE (IN.)	FITTING TYPE	K-Factor Gallons	K-Factor Liters
--------------------	-----------------	---------------------	--------------------

SCH 80 IRON SADDLE ON SCH 80 PIPE

2	IR8S020	194.85	51.48
2½	IR8S025	142.28	37.59
3	IR8S030	87.53	23.13
4	IR8S040	40.62	10.73
5	IR8S050	29.28	7.74
6	IR8S060	22.30	5.89
8	IR8S080	12.52	3.31
10	IR8S100	7.94	2.10
12	IR8S120	5.65	1.49

SCH 80 IRON SADDLE ON SCH 40 PIPE

2	IR8S020	185.35	48.97
2½	IR8S025	127.47	33.68
3	IR8S030	76.62	20.24
4	IR8S040	40.23	10.63
5	IR8S050	27.32	7.22
6	IR8S060	19.71	5.21
8	IR8S080	11.61	3.07
10	IR8S100	7.36	1.94
12	IR8S120	5.18	1.37

Bronze and Copper Tees and Brazoletts

PIPE SIZE (IN.)	FITTING TYPE	K-Factor Gallons	K-Factor Liters
--------------------	-----------------	---------------------	--------------------

BRONZE TEES ON SCH 40 PIPE

1	BR4T010	582.34	153.86
1¼	BR4T012	330.54	87.33
1½	BR4T015	254.76	67.31
2	BR4T020	157.36	41.58

COPPER TEES FITTING ON COPPER PIPE SCH K

½	CUKT005	2459.19	649.72
¾	CUKT007	1108.02	292.74
1	CUKT010	649.87	171.70
1¼	CUKT012	422.03	111.50
1½	CUKT015	281.43	74.35
2	CUKT020	136.02	35.94

COPPER TEES FITTING ON COPPER PIPE SCH L

½	CUKT005	2406.30	635.75
¾	CUKT007	1174.77	310.37
1	CUKT010	672.28	177.62
1¼	CUKT012	402.84	106.43
1½	CUKT015	294.99	77.94
2	CUKT020	149.63	39.53

COPPER/BRONZE BRAZOLET ON SCH 40 PIPE

2½	BR4B025	117.31	30.99
3	BR4B030	78.62	20.77
4	BR4B040	45.13	11.92
5	BR4B050	32.79	8.66
6	BR4B060	22.73	6.01
8	BR4B080	13.14	3.47
10	BR4B100	8.34	2.20
12	BR4B120	5.87	1.55

8.0 Calibration Menu

The K-factors published in this manual assume that the flow conditions in the pipe are ideal.

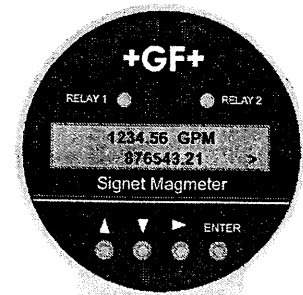
Many factors that affect the flow rate are beyond the control of the magmeter; variations in actual pipe dimensions, pipe smoothness, and other flow conditions will contribute to the total system error.

Performing a custom calibration with the magmeter in place will adjust the K-factor and can serve to compensate for installation conditions that may be less than ideal.

Select one of the calibration methods in this menu to achieve the most accurate measurement possible in a specific application.

NOTE: The Security Code must be entered before selecting the calibration method.

Enter Code
0000



Enter Menu

Δ

>

Or

ENTER

3s

Enter Menu
Setup

Enter Menu
Calibration

8.1 Volume method of calibration

Use the volume method of calibration if the fluid passing the magmeter can be measured by a volumetric method (as in a vessel of known volume, or by weight). It requires the ability to pump a known volume of water past the magmeter, and then input the volume into the 2551 program. It is most useful for small pipes and lower flow rates.

When performed properly, volumetric calibration is the most accurate method. For best results a five minute test period is recommended, and the test period should be no less than two minutes.

Press Enter
To Start

At START, the 2551 begins counting the flow past the sensor.

Press Enter
To Stop

At STOP, the 2551 stores the total flow accumulated since the START.

Enter Volume
000000. GPM

Enter the VOLUME that has been pumped past the sensor.

Value must be
more than 0.0

This error message appears if volume entered or the accumulated flow is zero. Repeat the test after checking the system.

K-Factor
Out of Range

This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, perform the volumetric flow again, and be certain that the volume entered is accurate.

K-Factor
45.6789

Using the information from the VOLUME method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

8.2 Rate method of calibration

Use this method if the 2551 Magmeter must be calibrated to match a reference flow meter. This is the method most commonly used by monitoring agencies, and for large pipes where volumetric calibration is impractical. The accuracy of this calibration method is largely dependent on the accuracy of the reference meter and the proximity of the reference to the Signet 2551 Magmeter.

Set New Flowrate
45.6789

The flow rate shown is based on the existing calibration of the 2551. Use the keypad to modify the flow rate to match the reference meter. The 2551 will automatically calculate a new K-factor based on the new flow rate.

K-Factor
Out of Range

This message appears if the new K-Factor is less than 0.0001 or greater than 999999. To correct the problem, reexamine the flow rate and make certain it is accurate.

K-Factor
56.7890

Using the information from the RATE MATCHING method, the 2551 will recalculate a new K-Factor. Press ENTER to accept the new value, or use the keypad to adjust the value.

9.0 Relay Menus

Magmeter models 3-2551-21 and 3-2551-22 have two dry contact relays (Relays 1 and 2) and one Solid State relay (Relay 3).

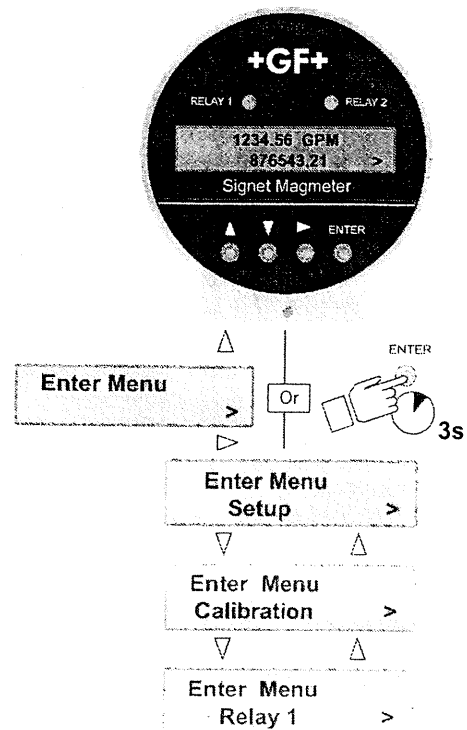
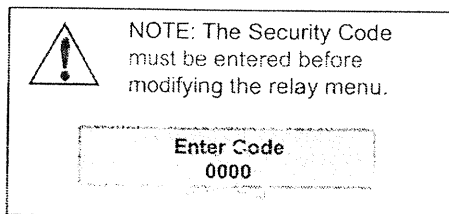
Any of these relays can be set to any of the operating modes listed below.

The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required.

For example, a LOW alarm might be set to activate if the flow rate falls below -10 GPM.

Negative values are not available for relays in PULSE or TOTAL modes.

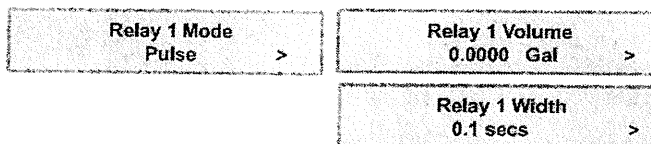
Off: If a relay is not used, it can be turned Off to prevent contact wear.



9.1 Pulse Relay mode

Program a relay to activate for a fixed period, for each volume of fluid that passes the sensor.

For example, program the relay to pulse once for 100 ms for every 3 gallons that pass by the sensor.



Relay Volume: Set the volume of fluid that the 2551 must measure before activating the relay for one pulse.

Pulse Width: Adjust the length of time the relay will remain activated. The pulse width setting is dependent on the type of external equipment being connected to the relay.

9.2 Total Relay mode

Program a relay to activate when the Resetable totalizer reaches a specific value. The maximum setting is 999999.

Application example: A filter must be replaced in a R.O. system every 10000 gallons. The service representative that installs a new filter sets relay 3 to Total mode, sets the setpoint at 10000 and resets the totalizer to 000000.00. When the totalizer is reset, the relay will be deactivated and the process begins anew.

Every time the Totalizer reaches 10000, the relay activates and lights a message indicator to remind the operator to contact the service representative to replace the filter.

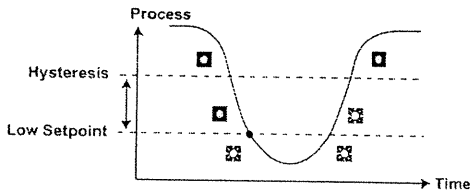
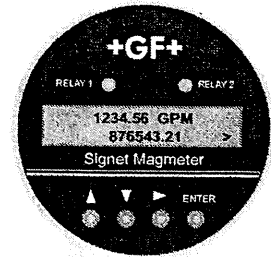


9.3 High, Low, or Window Relay modes

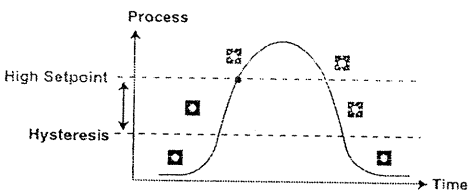
Program the relay to activate when the flow rate reaches a setpoint (High or Low) or when the flow rate moves outside of a prescribed range (Window).

Reverse Flow

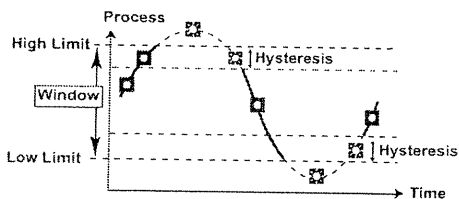
The setpoint values for HIGH, LOW and WINDOW modes can be set to negative values if required. For example, a LOW alarm might be set to activate if the flow rate falls to -10 GPM.



Relay behavior with LOW Setpoint



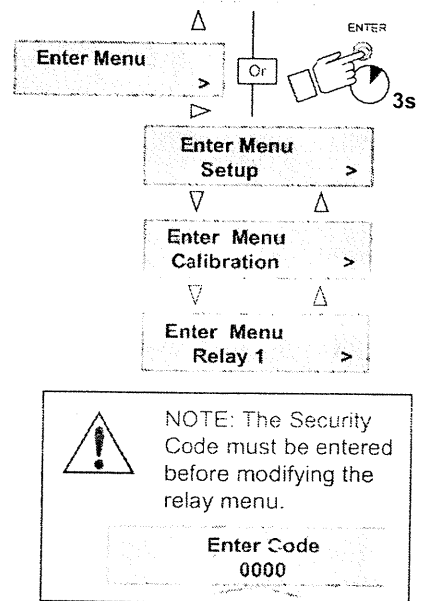
Relay behavior with HIGH Setpoint



Relay activated

Relay deactivated

Relay behavior with WINDOW Setpoints



The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

Set Low: Set the flow rate where a Low relay will be activated.

Relay 1 Mode Low >	Relay 1 Set Low 00.000 GPM >
	Relay 1 Hys 00.000 GPM >
	Relay 1 Delay 0.1 secs >

Set High: Set the flow rate where a High relay will be activated.

Relay 1 Mode High >	Relay 1 Set High 00.000 GPM >
	Relay 1 Hys 00.000 GPM >
	Relay 1 Delay 0.1 secs >

Hysteresis: Set a flow rate increment where the relay will be deactivated. The hysteresis setting serves to prevent relay "chatter" when the flow rate recovers from an alarm condition by requiring the low rate to move substantially within the setpoint.

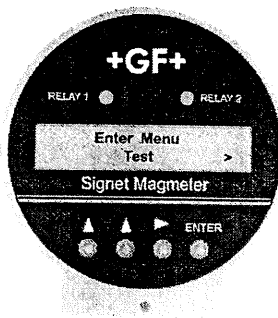
Delay: Set a time period for the relay to wait after reaching the setpoint. This delay serves to prevent the relay "chatter" by allowing the flow rate time to move back within the setpoint.

Relay 1 Mode Window >	Relay 1 Set Low 00.000 GPM >
	Relay 1 Set High 00.000 GPM >
	Relay 1 Hys 00.000 GPM >
	Relay 1 Delay 0.1 secs >

The menu repeats for Relay 2 and Relay 3.

10.0 Test Menu

The Test menu provides a simple method to verify that the system is operating properly. Auxiliary power **MUST** be connected to the 2551 to activate the relays



Test Output 4.20 mA	>
Test Relay 1 Open Closed	>
Test Relay 2 Open Closed	>
Test Relay 3 Open Closed	>

Shown for 4-20 mA models Only

Use the keypad to enter any current output from 4.0 mA minimum to 22.1 mA maximum.

Shown for Relay models Only

Toggle any of these relays ON and OFF to verify that the system is operating properly.

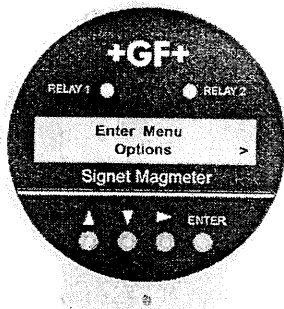
Auxiliary power **MUST** be connected to the 2551 to test the relays.



Auxiliary Power
9 to 24 VDC
0.4 A Maximum

11.0 Options Menu

The Options Menu contains those features and settings that will normally be set one time and then seldom changed. These include language preference, decimal placement, Security Code assignment, etc.



Language English	>
Security Code ****	>
Contrast 2	>
Total Reset Lock On	>
Noise Rejection 60 Hz	>
Flow Decimal ****. **	>
Total Decimal ***** **	>
Separator ddd.d	>
Output Mode Frequency	>

Select from English, German, French or Spanish.

This Selection will be displayed at first power-up of a new magmeter.

Security Code can be set to any four digit number. Factory standard setting is 0000.

Set for best view after the magmeter is installed. Larger number means display appears darker.

Lock ON requires the Security Code before resetting the Resettable Totalizer. Lock OFF reset with no security code.

Filters out common 50 or 60 Hz electrical noise.

Set the maximum resolution for the FLOW RATE display by limiting the decimal to this point. The Flow Rate display will auto-scale from this resolution up to whole units.

Set the maximum resolution for the TOTALIZER display by limiting the decimal to this point. The Totalizer display will always show this resolution.

Select decimal point or comma for use in numeric displays.

For Frequency/Digital models only: Select Freq output, Freq + 10 output, Mirror Relay 1 output or S³L Digital output.

The values shown for each menu item represent the factory standard setting. All 2551 magmeters are packaged with these settings.

11.1 Output Modes

In **FREQUENCY** output mode, the 2551 serves as a traditional flow sensor and provides an output pulse that is compatible with all Signet POWERED flow instruments. It is not compatible with the 5090 Self-Powered Flow Meter or the 8150-1 Battery-powered flow totalizer. The frequency output range is from 0 Hz to 1000 Hz.

The **FREQUENCY ÷ 10** output mode reduces the output frequency of the 2551 to a range that is useful for some programmable logic controllers (PLC). The frequency output range is from 0 Hz to 100 Hz. This shift does not affect the stated accuracy of the 2551 Magmeter's frequency output.

The **MIRROR RELAY 1** output mode allows 2551 Frequency/Digital models to use the Open Collector Output like a relay that can be programmed via the Relay 1 menu.

If the magmeter is equipped with relays, this mode will mirror the settings of Relay 1.

If the magmeter is not equipped with relays, this mode can still be selected and programmed via the Relay 1 menu.

The **S³L Digital** output mode switches the 2551 to the Signet serial data output called S³L (Signet Serial Sensor Link). In this mode the 2551 can be added to the serial bus of the Signet 8900 Multi-Parameter Controller.

12.0 Technical Information

12.1 Grounding

Precalibration conditioning: The magmeter may appear to be unstable immediately after installation. Allow the sensor to sit in a full pipe for **24 hours** before beginning calibration and operation.

- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- Use Teflon tape or a suitable sealant on cable ports.
- The 2551 magmeter must be carefully grounded to eliminate electrical noise that may interfere with the measurement.
- Grounding requirements will vary with each installation.
- The following recommendations should be applied in sequence until the interference is eliminated.

- ① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a conductor (14 AWG/1.5 mm² wire recommended) from this terminal directly to Earth ground to prevent electrical noise from interfering with the magmeter signal.

If the interference persists, apply step #2:

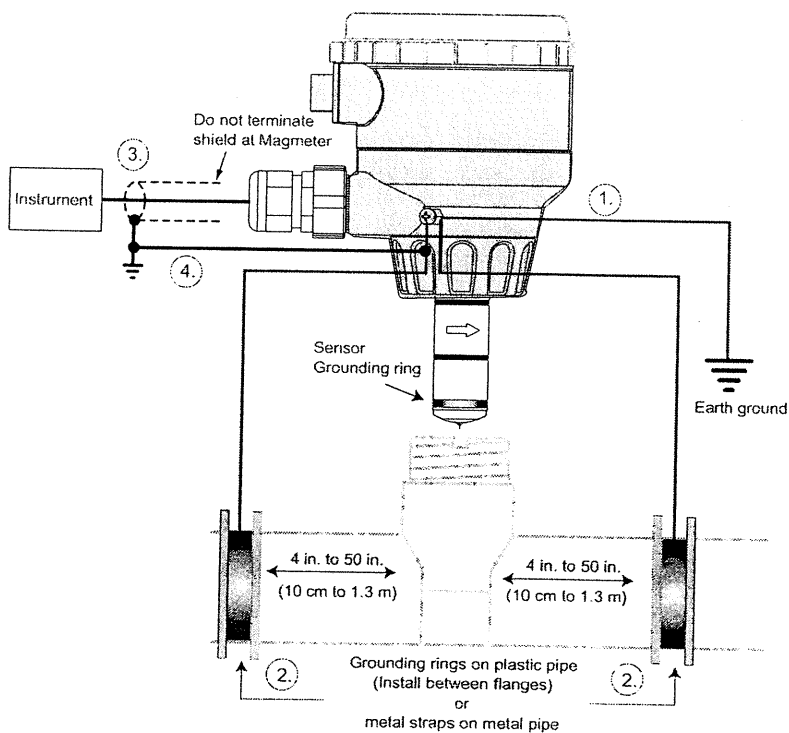
- ② Connect grounding rings, metal clamps or grounding electrodes to the pipe immediately upstream and downstream of the magmeter sensor location. These devices must be in contact with the fluid.

If the interference persists, apply step #3:

- ③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!

If the interference persists, apply step #4:

- ④ Connect an additional wire (minimum AWG 14/1.5 mm²) from the remote instrument ground to the magmeter ground terminal.



12.2 Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning regimen is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes.

Environmental Recommendations:

- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

12.3 Troubleshooting

Symptom	Possible Cause	Solution
Output is erratic and unstable.	- Magmeter installed too close to upstream obstruction. - Magmeter located in area exposed to air bubbles/pockets. - Magmeter is installed in pipe backwards. - Electrical noise is interfering with the measurement. - Electrodes are coated with deposits or chemical oxide layers.	- Relocate the magmeter to have straight uninterrupted pipe upstream of the sensor for at least 10 x the pipe diameter. - Eliminate air bubbles in the pipe. - Remove the magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM. - Review the grounding of the magmeter and the pipe. Install adequate Earth ground to allow the magmeter to operate properly.
Output is not 0 when flow is stopped.	- Electrodes not adequately conditioned in fluid. - Fluid is moving inside the pipe.	- Allow the sensor to sit in full pipe for 24 hours then restart. - Increase the Low Flow Cutoff. (section 7.0)
No 4-20 mA output.	Loop power not connected correctly.	Connect 24 VDC $\pm 10\%$ connected to loop terminals 1 and 3.
4-20 mA current output is incorrect.	4-20 mA is not scaled properly.	Check and reset in the Setup Menu.
- No Frequency output. - No S³L output.	2551 is wrong model. - Incorrect setting in Options Menu. - Wiring is not correct. - Frequency input to other manufacturer's flow instrument does not have pull-up resistor.	- Frequency/S³L model: 3-2551-21 (w/rlys) or -41 (w/o rlys) - Select Frequency in the Options menu. - Check wiring, make corrections. - Install 10kΩ resistor. (section 5.1)
No flow rate, current output is 22 mA.	- The fluid is too clean for magmeter. - Electronic component failure.	- Unsuitable application for magmeter. - Return 2551 to factory.
Blank display, no backlighting, no relay LEDS, but external equipment using output signal is still working.	2551 AUX power is not connected.	Connect AUX power (section 5.5) (9 to 24 VDC, 0.4 A max.)
Error Message: "Error Not Saved"	Main power is below specification	Correct the main power deficiency

Troubleshooting with the RED and BLUE lights

No Lights:

The power is off or the sensor is not connected

Solid Blue:

The power is on but there is no flow in the pipe.

Blinking Blue:

Normal operation, blink rate is proportional to the flow rate.

Alternating Red-Blue:

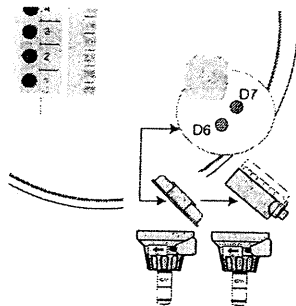
Empty pipe indication (electrodes are not wet.)

Blinking Red:

System errors (Electrical noise interference)

Solid Red:

Instrument error (defective electronic component)



Reverse flow:

- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S³L) output: Reverse flow results in 0 flow rate displayed on 8900
- 4-20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4-20 mA = -100 to +100 GPM)

Empty Pipe Detection

- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S³L) output will be locked to 0 if electrodes are not wet.
- 4-20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

13.0 Ordering Information

Sensor Part No.				
3-2551				
	Sensor Body (Transducer) and electrodes/grounding ring materials - Choose one			
	-P	Polypropylene and 316L SS		
	-T	PVDF and Titanium		
	-V	PVDF and Hastelloy C		
	-W	PVDF and 316L SS		
		Pipe size - Choose one		
	0	DN15 to DN100 (1/2 to 4 in.)		
	1	DN125 to DN200 (5 to 8 in.)		
	2	DN250 to DN300 (10 to 12 in.)		
		Display Options - Choose One		
	-2	With Display, two SPDT relays, one solid state relay		
	-4	With Display, no relays		
		Output options - Choose One		
		1	Open Collector Frequency out or Digital (S/L) out	
		2	4 to 20 mA output	
3-2551	-P	0	-2	2
Example Part Number				

Mfr. Part Number	Code	Mfr. Part Number	Code
3-2551-P0-21	159 001 267	3-2551-V0-21	159 001 269
3-2551-P0-22	159 001 273	3-2551-V0-22	159 001 275
3-2551-P0-41	159 001 261	3-2551-V0-41	159 001 263
3-2551-P0-42	159 001 279	3-2551-V0-42	159 001 281
3-2551-P1-21	159 001 268	3-2551-V1-21	159 001 270
3-2551-P1-22	159 001 274	3-2551-V1-22	159 001 276
3-2551-P1-41	159 001 262	3-2551-V1-41	159 001 264
3-2551-P1-42	159 001 280	3-2551-V1-42	159 001 282
3-2551-P2-21	159 001 435	3-2551-V2-21	159 001 456
3-2551-P2-22	159 001 438	3-2551-V2-22	159 001 457
3-2551-P2-41	159 001 432	3-2551-V2-41	159 001 462
3-2551-P2-42	159 001 441	3-2551-V2-42	159 001 463
3-2551-T0-21	159 001 436	3-2551-W0-21	159 001 271
3-2551-T0-22	159 001 439	3-2551-W0-22	159 001 277
3-2551-T0-41	159 001 433	3-2551-W0-41	159 001 265
3-2551-T0-42	159 001 442	3-2551-W0-42	159 001 283
3-2551-T1-21	159 001 437	3-2551-W1-21	159 001 272
3-2551-T1-22	159 001 440	3-2551-W1-22	159 001 278
3-2551-T1-41	159 001 434	3-2551-W1-41	159 001 266
3-2551-T1-42	159 001 443	3-2551-W1-42	159 001 284
3-2551-T2-21	159 001 454	3-2551-W2-21	159 001 458
3-2551-T2-22	159 001 455	3-2551-W2-22	159 001 459
3-2551-T2-41	159 001 460	3-2551-W2-41	159 001 464
3-2551-T2-42	159 001 461	3-2551-W2-42	159 001 465

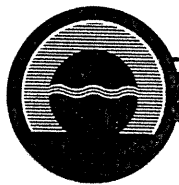
Replacement parts

Mfr. Part No.	Code	Description
1220-0021	198 801 186	O-ring, FPM (Viton®)
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FPM (Kalrez®)
3-8551.521	159 001 378	Clear plastic cap for display
3-8050.396	159 000 617	RC Filter kit (for relay protection)



George Fischer Signet Inc., 3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090





Product Level Control

Instrumentation Submersible Float

Product Level Control manufactures our own line of treatment sensors, custom-equipped for optimal on-site performance. By offering flexible product designs with a wide range of available options, we meet your individual project goals for the best possible value.

FEATURES

Constructed to meet client specifications

Easily changed between Normally Open (NO) and Normally Closed (NC) — simply remove the E-clip and invert the float

Various materials of construction allow for chemical resistance to contaminants

Delivered fully assembled

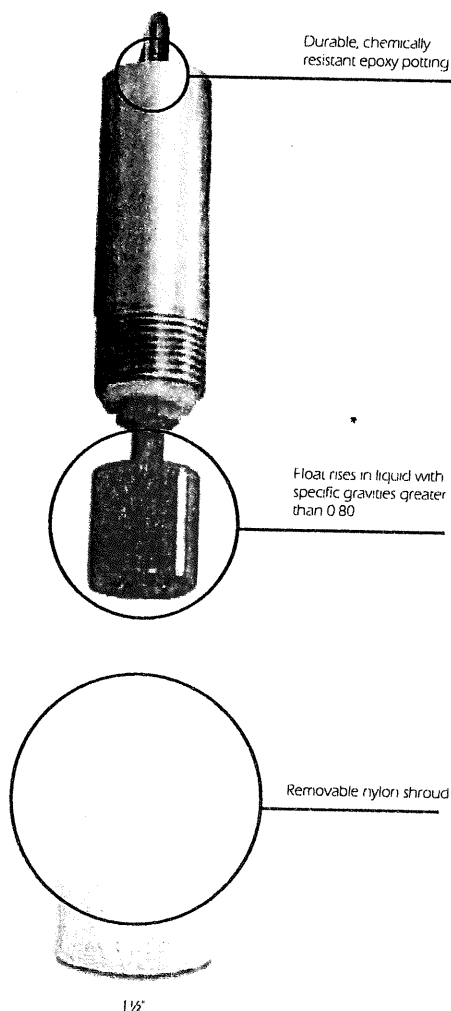
1-year warranty

ELECTRICAL SPECIFICATIONS

- Maximum contact ratings
0.080 Amp, 120V, 60 Hz Resistive
0.040 Amp, 240V, 60 Hz Resistive
3.36 VA, 240V, 60 Hz Pilot Study
1 Amp Max @ 24 VDC Resistive
- Single pole, single throw switch (SPST)
- 18/2 stranded copper conductors

MECHANICAL SPECIFICATIONS

- Maximum pressure rating of 100 PSI @ 20°C
- Maximum temperature rating of 100°C
- Minimum specific gravity rating of 0.8
- Operable at angles up to 30° from vertical
- Length equals 6.5"
- Diameter equals 0.5"

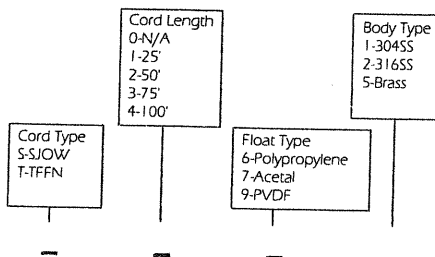


PROCESS OF OPERATION

Operating as a vertically-orientated level switch, a single float unit is used with a total fluid system to detect the presence of liquid in a recovery well or tank. When liquid is present, the float rises. Simply secure the sensor in a well or tank by restraining the power cord.

PLC PERSONALIZED ORDERING NUMBER

SDXX-SF



AA...A2 Differential Air Pressure Switch Installation Instructions

DUNGS®
Combustion Controls

SPECIFICATIONS

AA...A2 SPDT differential pressure switch in pressure and vacuum ranges. The differential pressure acts via the diaphragm against the force of the setting spring on the microswitch. The pressure switch operates without any auxiliary power.

Gases

Air and non-aggressive gases only. **Not** suitable for natural gas, propane, butane or other combustible gases.

Switch Type

SPDT

Switch Action

Pressure, vacuum or differential pressure switch.

Contact Rating

5 A resistive, 2.5 A inductive @120 Vac

Electrical Connection

Screw terminals via 1/2" NPT conduit connection

Enclosure Rating

NEMA Type 4

Maximum Operating Pressure

7 PSI (500 mbar)

Ambient / Medium Temperature

-40 °F to +140 °F (-40 °C to +60 °C)

Materials in contact with Gas

Housing: Polycarbonate
Switch: Polycarbonate
Diaphragm: NBR-based rubber
Switching contact: Silver (Ag)

Approvals

UL Listed: File # MH 16628

CSA Certified: File # 201527

FM Approved: File # J.I. 0D6A1.AF



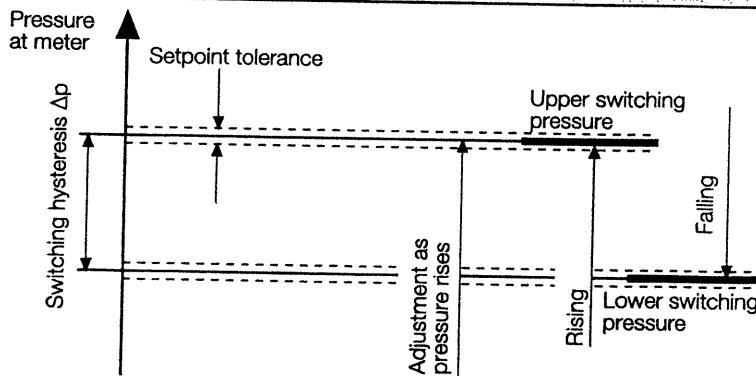
ATTENTION

- Read these instructions carefully.
- Failure to follow them and/or improper installation may cause explosion, property damage and injuries.
- The system must meet all applicable national and local code requirements such as but not limited to the following fuel gas codes: NFPA 54, IFGC (International Fuel Gas Code), or CSA B149.1 (for Canada) or the following equipment codes and standards: NFPA 86, ANSI Z83.4/CSA 3.7, ANSI Z83.18/CSA 4.9, ANSI Z21.13, CSD-1, UL 795, CSA B149.1, or CSA B149.3.
- Installation must be done with the supervision of a licensed burner technician.
- Check the ratings in the specifications to make sure that it is suitable for your application.
- Never perform work if gas pressure or power is applied, or in the presence of an open flame.
- Ensure that the switch is not subjected to vibration during operation.
- Once installed, perform a complete checkout including leak testing.
- Label all wires prior to disconnection when servicing. Wiring errors can cause improper and dangerous operation.
- Verify proper operation after servicing.

OPERATION

Definition of switching hysteresis Δp

The pressure difference between the upper and lower switching pressures.



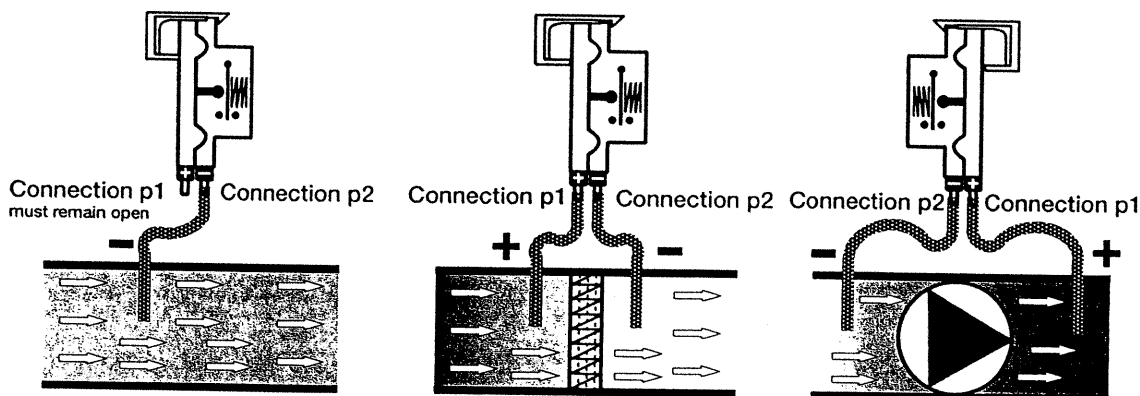
Installation position: Standard installation position is **vertical** diaphragm. When installed **horizontally**, the pressure switch trips at a pressure higher by approx. 0.2 in. W.C. When installed **upside down**, the pressure switch switches at a pressure lower by approx. 0.2 in. W.C. When installed in **other positions**, the pressure switch switches at pressure deviating from the set reference value by max. ± 0.2 in. W.C.

Karl Dungs, Inc.

524 Apollo Drive, Suite 10 Lino Lakes, MN 55014 U.S.A.

Phone: (651) 792-8912 Fax: (651) 792-8919 E-mail: info@karldungsusa.com

APPLICATION AND CONNECTION EXAMPLES



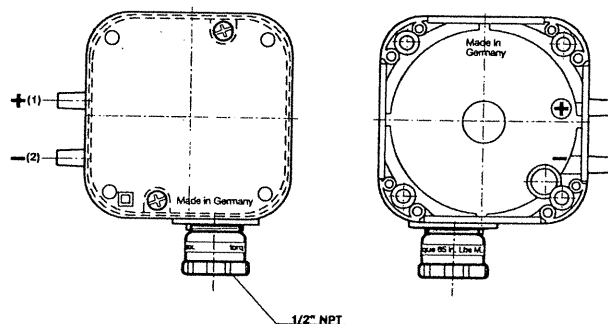
PRESSURE CONNECTIONS AND MOUNTING AA..A2-4

AA...A2-4 Hose Connection

- (1) Pressure connection (+)
- (2) Pressure connection (-)

AA...A2-4 Mounting Procedure

- Use suitable hoses for the medium.
- Use a maximum 5/32" ID. hose
- Secure the hoses with a cable tie or a cable clip.



PRESSURE CONNECTIONS AND MOUNTING AA..A2-6

AA...A2-6 Threaded Connection

- (1) Pressure connection (+)
- (2) Pressure connection (-)
- (3) Test nipple p (+)

AA...A2-6 Mounting Procedure

- Apply good quality pipe sealant to the male threads only.
- Use 13/16" Wrench to secure the switch to the pipe.

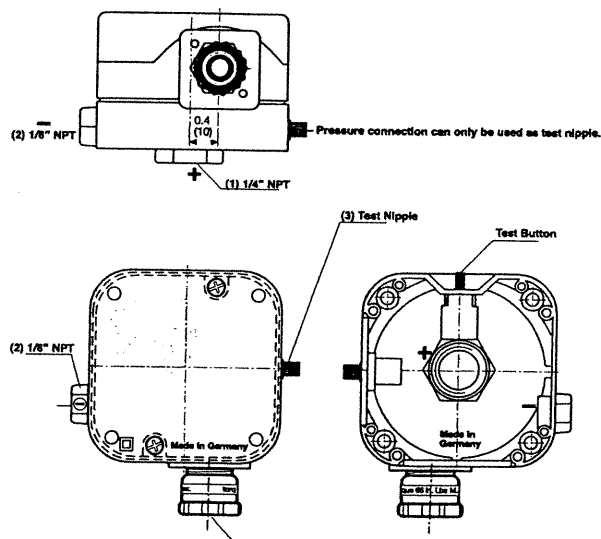
DO NOT Exceed 45 lb-in of Torque on 1/8" Connections

DO NOT Exceed 60 lb-in of Torque on 1/4" Connections

- After installation is complete, perform a leak test.

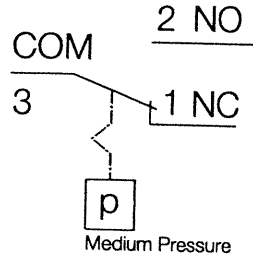
Test button (for AA-A2-6 series only)

When the test button is pressed the 1/4" NPT pressure connection is interrupted and the pressure below the diaphragm is relieved. The pressure switch changes the contact position from NO to NC. When the test button is released, the pressure is built up again and the switch changes to its original position.



WIRING

- Remove the clear cover from the switch.
- Use 14 or 16 AWG wire rated for at least 75°C
- Route the wires through the conduit connector
- Connect the wiring to the appropriate screw terminals.
- Replace the clear cover from the switch.



AA...A2 switching function

As pressure rises:

1 NC opens, 2 NO closes

As pressure falls:

1 NC closes, 2 NO opens



CAUTION: All wiring must comply with local electrical codes, ordinances and regulations.



CAUTION: Do not exceed the switch ratings given in the specifications and on the switch.

ADJUSTMENT AND OPERATION

Adjusting the Set Point

- Remove the clear cover from the switch.
- Adjust the switch to the desired set point by turning the dial. The white arrow on the dial indicates the set point.
- After adjusting the set point, verify that the pressure switch operates as intended by using an accurate pressure gauge connected upstream of the switch.

- Replace the clear cover.

Automatic Reset and Operation

The NC contact of the AA...A2 breaks when pressure rises above the set point. It makes automatically when pressure falls below set point.

PART DESCRIPTION, ACCESSORIES, AND REPLACEMENT PARTS

Type	Version	Description	Order No.	Setting range in. W.C	Switching hysteresis in. W.C.	Factory Calibration
AA-A2-4-...	AA-A2-4-2	Hose connection	217-060A	0.16 - 1.2	≤ 0.12	
	AA-A2-4-3	Hose connection	217-061A	0.4 - 4	≤ 0.20	
	AA-A2-4-5	Hose connection	217-062A	2 - 20	≤ 0.40	
	AA-A2-4-6	Hose connection	217-063A	12 - 60	≤ 1.20	
AA-A2-6-...	AA-A2-6-2	Threaded connection	217-329A	0.16 - 1.2	≤ 0.12	
	AA-A2-6-3	Threaded connection	217-330A	0.4 - 4	≤ 0.20	
	AA-A2-6-5	Threaded connection	217-331A	2 - 20	≤ 0.40	
	AA-A2-6-6	Threaded connection	217-332A	12 - 60	≤ 1.20	

Accessories for pressure switch

Order No.

Klima-Set (Duct mounting kit)	217-897
Replacement cover	228-732
Mounting bracket (flat plastic)	230-301 (recommended mounting bracket)
Mounting bracket (metal)	230-289 (optional mounting bracket)
120 VAC light mounting set (orange)	231-772
120 VAC light only (for switches with kit 231-772 already installed)	244-156
24 VDC/VAC light mounting set (orange)	231-774
Replacement conduit adapter	231-944
DIN connector	210-318

Bulletin A-30 - AVS/APS
INSTALLATION PROCEDURES FOR MODELS:
AVS - APS

VACUUM AND PRESSURE SWITCHES

Dwyer® Instruments Inc.

Dwyer Instruments, Inc.
Michigan City, IN 46361
Ph.219-879-8868

CAUTION

This instrument must not be subjected to temperatures, pressure or electrical loads exceeding those appearing on the name plate, and specifications in our published literature.

INSTALLATIONS AND ASSEMBLY INSTRUCTIONS

Before installing your DII pressure switch, please become familiar with the general information contained in the literature and Technical Specifications Sheet covering the specific switch.

"C" SET

Customer set and field adjustable.

Electric Connection If you switch has standard solder-type terminals, push-on receptacles may be used as interface between your wires and the terminals. These receptacles are available upon request. Should you choose to solder the connection, care must be used when soldering leads to the terminals of these switches, following the recommendations below.

We recommend that a soldering iron with an 1/8" diameter THERMOSTATICALLY controlled tip of 500 °F be used and that it not be on the terminal longer than 10 seconds.

Excessive heat and flux can cause serious damage to the switch.

Pressure Connection Use a wrench on the hex part of the fitting only. DO NOT TORQUE the switch body.

PRESSURE SET POINT ADJUSTMENT - JAM NUT STYLE ADJUSTING RING MODELS.

The C switches are readily adjustable throughout their prescribed range by loosening the adjusting ring. Turning the electrical switch clockwise will lower the set point, turning it counterclockwise will increase the set point. When desired set point is reached, the assembly is locked again by tightening the adjustable ring.

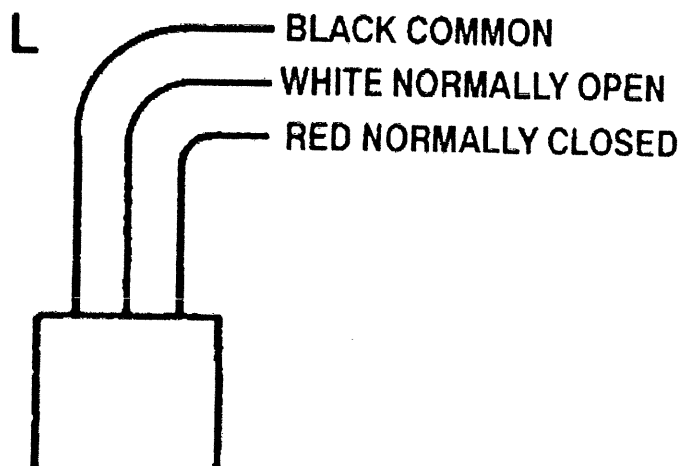
Entire adjustable range may covered by rotating approximately 250° each side of the mean.

The adjusting ring requires very little effort to establish a reliable locked position. By placing a wrench on the fitting hex to hold switch body in position, grip the serrated jam nut with pliers and turn counterclockwise to loosen or clockwise to tighten. Only a slight snug is required to lock in position.

VACUUM SET POINT ADJUSTMENT - VACUUM MODELS

To lower set point turn electrical switch counterclockwise. To raise set point turn electric switch clockwise.

WIRING INSTRUCTION
MODELS APS & AVS



LIMITATION OF APPLICATION LIABILITY:

Dwyer Instruments, Inc. assumes the buyer to be expert in his intended application of DII products. DII claims no special expertise in the application of its products in the buyer's equipment. DII accepts no responsibility for the buyer's selection and use of DII products. Buyer's interpretation and implementation of application suggestions and recommendations by DII, general or specific, transmitted verbally or in writing, published or unpublished, is strictly at the buyer's own risk.

Limited Warranty: The Seller warrants all Dwyer instruments and equipment to be free from defects in workmanship or material under normal use and service for a period of one year from the date of shipment. Liability under this warranty is limited to repair or replacement F.O.B. factory of any parts which prove to be defective within that time or repayment of the purchase price at the Seller's option provided the instruments have been returned, transportation prepaid, within one year from date of purchase. All technical advice, recommendations and services are based on technical data and information which the Seller believes to be reliable and are intended for use by persons having skill and knowledge of the business, at their own discretion. In no case is Seller liable beyond replacement of equipment F.O.B. factory or the full purchase price. This warranty does not apply if the maximum ratings label is removed or if the instrument or equipment is abused, altered, used at ratings above the maximum specified, or otherwise misused in any way.

THIS EXPRESS LIMITED WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER REPRESENTATIONS MADE BY ADVERTISEMENTS OR BY AGENTS AND ALL OTHER WARRANTIES, BOTH EXPRESS AND IMPLIED. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE FOR GOODS COVERED HEREUNDER.

CAUTIONS

- Warranty may be void if the switch is either disassembled or modified after leaving factory.
- Warranty is void if temperature, pressure and electrical ratings are exceeded in test or in service.
- If switch is to be exercised more than 20 cycles per minute please consult Dwyer Instruments Inc.
- Do not use these pressure switches on OXYGEN service without prior degreasing and proper preparation.
- Customer media and environment must be compatible with construction materials as outlined in general specifications of DII Literature.
- Install pressure switch by utilizing the hex or wrench flats. Do not torque the switch body.



FILTERS PARTS LIST

File Name:

Parts List

Customer:

WHITMAN

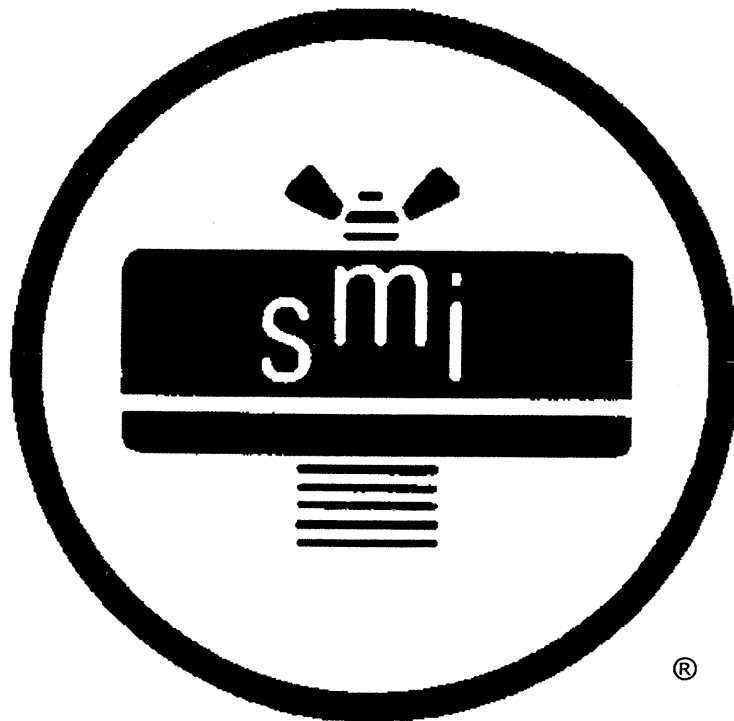
Site Reference:

BRONX

Date:

8/18/2008

Reference	Qty	Units	Description	Material	Part Number
B-100 DILUTION	1	each	FILTER, AIR, INLET SILENCER, DILUTION FILTER SILENCER, 2" MNPT-135SCFM	STEEL/POLY ESTER	SOLBERG-FS-31P-200
B-100 FILTER	1	each	FILTER, AIR, INLINE, 3" FNPT-300SCFM	AL/POLYESTER	SOLBERG-CT-235P-300C
B-200 DILUTION	1	each	FILTER, AIR, INLET SILENCER, DILUTION FILTER SILENCER, 1 1/2" MNPT-85SCFM	STEEL/POLY ESTER	SOLBERG-FS-19P-150
B-200 FILTER	1	each	FILTER, AIR, INLINE, 1 1/2" FNPT WITH QUICK RELEASE LID-115SCFM	STEEL/POLY ESTER	SOLBERG-CSL-849-150HC
BAG FILTERS	4	each	BAG FILTER HOUSING WITH CS TRIPOD LEGS, 2" FNPT SIDE I/ BOTTOM OR SIDE O, SIZE 2 FILTER REQUIRED, BASKET, RATED AT 150 PSI	CS, BUNA N	ROSEDALE-NCO830-2P*-150CB-PB
BAG FILTERS	4	each	BAG FILTER SIZE 2: 50 MICRON	PP/FELT	



SOLBERG

**Inlet Filters and Filter Silencers
Maintenance Manual
F, FS, FT, 2G, QB Series**

www.solbergmfg.com

Maintenance Manual

Solberg Air Inlet Filters and Filter Silencers

F/FS/FT/2G/QB

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****For Further Information Please Call: 630-773-1363***

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Solberg Manufacturing, Inc., 1151 West Ardmore Itasca, IL 60143
Ph: 630/773-1363 Fax: 630/773-0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com
Air Inlet Filters & Filter Silencers March, 2000



SOLBERG

Section A

INTRODUCTION

The purpose of this manual is instruction on the proper assembly and care of Solberg inlet air filters.

! WARNING !

This manual must be read and thoroughly understood before using and caring for this air filter. Failure to comply could result in explosion, product/system contamination or personal injury.

This manual should be used as a supplement to the user's understanding of the proper care needed to maintain a safe and dependable air filter. It is the responsibility of the user to interpret and explain all instructions to persons who do not read or understand English BEFORE they are allowed to maintain and use this filter.

This manual should be readily available to all operators responsible for operation and maintenance of the inlet air filters.

We thank you for selecting products from Solberg Manufacturing, Inc. We are confident that our superior filter designs will meet your application requirements.

Section B

GENERAL INFORMATION

1. Identification of Solberg Inlet Air Filters.

All Solberg inlet air filters should have an identification label/nameplate that gives the following information:

**Assembly Model #
Replacement Element #**

(The exception is OEM supplied units. In this case, please enter the OEM part numbers below.)

Page 3

Solberg Manufacturing, Inc., 1151 West Ardmore Itasca, IL 60143
Ph: 630/773-1363 Fax: 630/773-0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com
Air Inlet Filters & Filter Silencers March, 2000

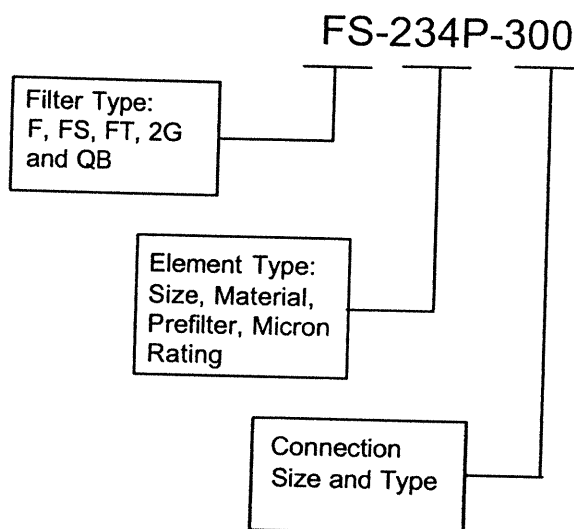


SOLBERG

Fill in the actual nameplate data from your new Solberg inlet filter(s):

No.	Filter Model Number	Replacement Element	Initial Delta P Readings
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

The model number designates the filter type, the original element configuration and housing connection size. For example, the following part number identifies the filter as being a 'FS' design filter with a 234 element with prefilter and 3" NPT connection size:



2. Filtration Rules of Thumb

General: For peak output performance from a compressor, blower, vacuum pump, engine, or any other machine that consumes air, one must have clean, unrestricted air. Proper filtration can help stabilize the working environment within rotating equipment even when the external conditions may be quite severe. A critical component in creating the right working conditions is filter sizing. With the properly sized filter, equipment will run smoothly over its entire expected operating life.

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter efficiency and, conversely, the lower the pressure drop. Therefore, the primary goal in filter sizing is to optimize the velocity of air through the media (sometimes called face velocity).

Rule of Thumb #1: Always begin with the filter cartridge requirements when sizing a filter. Once the appropriate element has been selected then move on to the housing requirements.

Rule of Thumb #2: Always ask or specify a filter based on a micron rating *with filtration efficiencies*. As an example, stating a requirement for a 5-micron filter is misleading because no efficiency rating has been specified. A 5-micron filter at 97-% efficiency can be less efficient than a 10-micron filter at 99.7% efficiency. For proper air system performance in light and industrial duty environments, a filter with a minimum of 99.7% filtration efficiency at 10 microns is required.

Rule of Thumb #3: Size your filter correctly by understanding the impact air velocity through a media has on efficiency and pressure drop. Maintain the suggested Air-to-Media ratios listed below based on the external environment listings and Filtration efficiency needs.



Filtration Efficiency Requirements (99%+ efficiency)	Environmental Conditions	Air to Media Ratio
Industrial Grade 2-micron Paper	Light Duty (clean, office/warehouse-like)	30 CFM/ft ²
	Industrial Duty (workshop, factory-like)	15 CFM/ft ²
	Severe Duty (Foundry, Construction-like)	10 CFM/ft ²
Industrial Grade 5-micron Polyester	Light Duty (clean, office/warehouse-like)	50 CFM/ft ²
	Industrial Duty (workshop, factory-like)	40 CFM/ft ²
	Severe Duty (Foundry, Construction-like)	25 CFM/ft ²
Industrial Grade 4-micron Polyester	Industrial Duty (workshop, factory-like)	25 CFM/ft ²
	Severe Duty (Foundry, Construction-like)	15 CFM/ft ²
Industrial Grade 1-micron Polyester	Severe Duty (Foundry, Construction-like)	10 CFM/ft ²
Industrial Grade 0.3-micron HEPA Glass	Light Duty (Pre-filtered Applications)	10 CFM/ft ²
	Industrial Duty (workshop, factory-like)	7 CFM/ft ²
	Severe Duty (Foundry, Construction-like)	5 CFM/ft ²

Rule of Thumb #4: Pressure drop is also caused by the dirt holding capacity of the element. As the element fills up with dirt, the pressure drop increases. It is important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10" to 15" H₂O above the original reading.

Rule of Thumb #5: The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:



Pipe Size (inches)	Max Airflow	Pipe Size (inches)	Max Airflow	Pipe Size (inches)	Airflow
1/4"	6 CFM	1 1/4"	60 CFM	6"	1,100 CFM
3/8"	8 CFM	1 1/2"	80 CFM	8"	1,800 CFM
1/2"	10 CFM	2"	135 CFM	10"	3,300 CFM
3/4"	20 CFM	2 1/2"	195 CFM	12"	4,700 CFM
1"	35 CFM	3"	300 CFM	14"	6,000 CFM
		4"	520 CFM		
		5"	800 CFM		

**Note: This information is for general use only. A qualified engineer must properly design each system.*

3. Element Specifications

Media	Micron Rating	Temperature Range	Filter Change-Out Differential
Standard Paper	99+% @ 2 micron	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
Standard Polyester	99+% @ 5 micron	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
"N" Series	99+% @ 4 micron	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
"Z" Series	99+% @ 1 micron	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
HEPA "HE" Series	99.97% @ 0.3 microns	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
"U" Series	99+% @ 25 micron	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
"W" Series	99+% @ 100 micron	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
"S2" Series	Stainless Steel Wire Mesh	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
"AC" & "ACP" Series	N/A	-15 to 220 F	Change When Carbon Saturates
"Y" Series Polypropylene	99+% @ 10 micron	-15 to 220 F	10" to 15" H ₂ O Above Initial Delta P
"MX" & "MXD" Series – Nomex Cloth	99+% @ 10 micron	-15 to 385 F	10" to 15" H ₂ O Above Initial Delta P



4. Element Cleaning

Some types of Solberg inlet filter elements can be cleaned and reused. However, damage can occur to an element during cleaning so it is imperative that care is taken during disassembly, cleaning and re-assembly. Damaged elements can allow particulate bypass which will damage rotating equipment.

- A. **Polyester Element:** The polyester element may be washed in warm soapy water, vacuumed, gently blown out or replaced. The element should be dry before reinstallation.
- B. **Paper Element:** The paper element may be lightly blown with low pressure air. It is disposable and in most cases should be replaced with a new element.
- C. **Polyurethane Prefilter:** The prefilter may be washed as a sponge or replaced to give the element a longer service life.
- D. **Stainless Steel Wire Mesh Element:** Cleaning instructions similar to polyester, except mild solvents may be used.
- E. **Activated Carbon Element:** Not cleanable
- F. **Polypropylene Element:** Cleaning instructions similar to polyester
- G. **Nomex Cloth Element:** Cleaning instructions similar to polyester

If you are not confident that the integrity of the element was maintained during cleaning, it is recommended that a new element be installed. Also, spare parts such as gaskets, wingnuts and washers can be supplied upon request.

Section C

PROCEDURES

1. Installation.

- A. Maximum operating temperature for most Solberg inlet air filter products is 220 degrees F. Temperatures in excess of this could cause damage to elements, media and elastomers. High temperature products are available.
- B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on the inlet and outlet ports.
- C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.



2. Disconnecting canister top from canister base.

- A. *FS-04-06-10 (or 05-07-11)*: Twist top housing to open. Use care to support bottom housing while removing top housing. Fitting damage can occur if fitting is torqued in the wrong direction.
- B. *Small F/FS/FT/QB*: Remove weather hood or top plate by loosening hex nut or wing nut and lifting off.
- C. *Large F/FS/FT/2G/QB*: Remove weather hood by loosening hex nut or wing nut and lifting off.

3. Removing element for service/maintenance.

- A. Carefully remove retaining hex head/wing-nut and washer over top plate, and then remove element. Note: Model "04-06-10" elements should be free when housing tops are removed.
- B. Clean sealing surfaces of housing, top plates and element endcaps so that they are free of dirt or any other particulate.

! WARNING !

Failure to comply with these instructions may result in system or equipment contamination.

4. Securing Element.

- A. Place new or cleaned element evenly on base plate. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces. With multiple element stacks place elements in line with base element and ensure elements seat properly.
- B. Place top plate (if necessary) on element by centering on tap bolt.
- C. Secure washer and wing nut to end cap (or top plate) and tap bolt. Element must be tightly secured. Note: Do NOT over tighten!



! WARNING !

Defective installation may cause system or pump contamination. Use only genuine Solberg replacement parts.

5. Securing canister top to canister base.

- A. Make sure all surfaces are free from dust and other particulate.
- B. *Small F/FS/FT/QB*: Replace top plate and/or weather hood if necessary. Feed threaded rod into corresponding bolthole and tighten. Note: Do NOT over tighten!
- C. *Large F/FS/FT/QB/2G*: Replace top plate and/or weather hood. Feed threaded rod into corresponding bolt hole(s) and tighten. Note: Do NOT over tighten!
- D. *FS-04-06-10 (or 05-07-11)*: Reassemble top housing to bottom housing by aligning tabs and turning into place.

Section D

MAINTENANCE RECOMMENDATIONS

- 1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10" to 15" H₂O above drop above the initial reading. Refer to page 4 for initial values.
- 2. Always check replacement cartridge gaskets to insure they are adhered uniformly along the end caps during handling. If not, contact Solberg Manufacturing, Inc. immediately. Do not modify or change!
- 3. Always check inlets/outlets, element base and its components when replacing element to insure cleanliness. Wipe clean if necessary.
- 4. Operate only when a proper seal exists.



SPARE PARTS LIST:

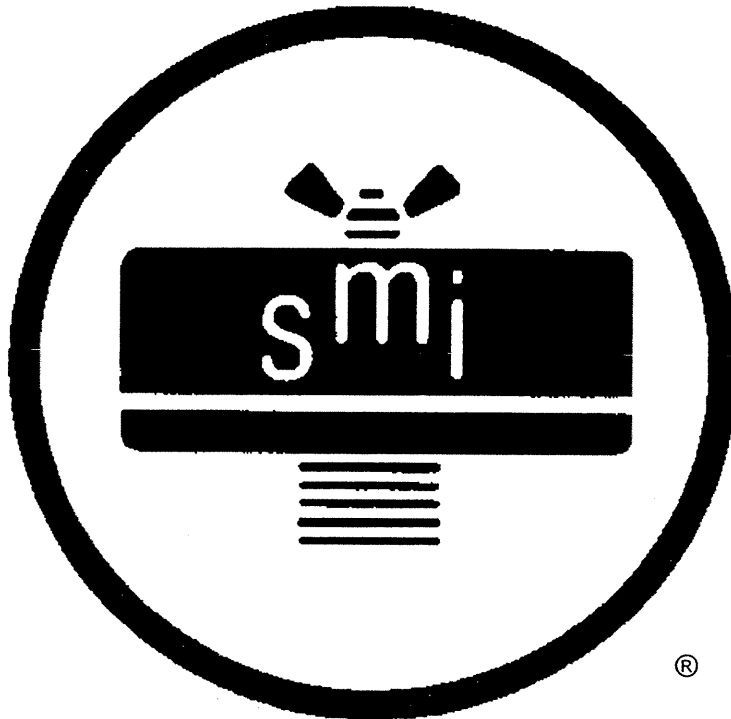
F/FS/FT/2G/QB

Parent Model FS/2G/QB-Element-Connection	Prefilter Model	Housing Weatherhood/Top		Element Top Plate Model No.	Wingnut(s) Model No.	Hex Nut(s) Model No.	Washer(s) Model No.
		for FS Series Model No.	for 2G/QB Series Model No.				
Model-05/04-xxx	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Model-07/06-xxx	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Model-11/10-xxx	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Model-15/14-xxx	PF14	WH6X2	N/A	N/A	WN25X20	N/A	WR25X20
Model-19/18-xxx	PF18	WH6X5	QB6X5	N/A	WN25X20	N/A	WR25X20
Model-31/30-xxx	PF30	WH10X5	QB10X5	N/A	WN25X20	N/A	WR25X20
Model-231/230-xxx	PF230	WH10X10	QB10X10	N/A	WN38X16	N/A	WR38X16
Model-235/234-xxx	PF234	WH16X10	QB16X10	N/A	WN38X16	N/A	WR38X16
Model-245/244-xxx	PF244	WH16X10	QB16X10	N/A	WN38X16	N/A	WR38X16
Model-275/274-xxx	PF274	WH16X10	QB16X10	N/A	WN38X16	N/A	WR38X16
Model-375/374-xxx	PF374	T16000625	T16000625	T12000625	WN50X13	HN50X13	WR50X13
Model-377/376-xxx	PF376	T22000625	T22000625	T14750625	WN50X13	HN50X13	WR50X13
Model-385/384-xxx	PF384	T28000625	T28000625	T19750625	WN50X13	HN50X13	WR50X13
Model-384(2)-xxx	PF384(2)	T28000625	T28000625	T19750625	WN50X13	HN50X13	WR50X13
Model-485/484-xxx	PF484	T28000625	T28000625	T19750625	WN50X13	HN50X13	WR50X13
Model-485(2)/484(2)-xxx	PF484(2)	T28000625	T28000625	T19750625	WN50X13	HN50X13	WR50X13
Model-685-xxx	PF684	T28000625	T28000625	T19750625	WN50X13	HN50X13	WR50X13

Parent Model F/FT-Element-Connection	Prefilter Model	Weatherhood/Top for F Series Model No.	Element Top for F Series Model No.	Top for FT Series Model No.	Wingnut(s) Model No.	Hex Nut(s) Model No.	Washer(s) Model No.
Model-15/14-xxx	PF14	WH6X2	N/A	T4500312	WN25X20	N/A	WR25X20
Model-19/18-xxx	PF18	WH6X5	N/A	T4500312	WN25X20	N/A	WR25X20
Model-31/30-xxx	PF30	WH7.625X5	N/A	T6000312	WN25X20	N/A	WR25X20
Model-231/230-xxx	PF230	WH10X10	N/A	T6000375	WN38X16	N/A	WR38X16
Model-235/234-xxx	PF234	WH10X10	N/A	T8000437	WN38X16	N/A	WR38X16
Model-245/244-xxx	PF244	WH16X10	N/A	T1000437	WN38X16	N/A	WR38X16
Model-275/274-xxx	PF274	WH16X10	N/A	T12000437	WN38X16	N/A	WR38X16
Model-375/374-xxx	PF374	WH16X16	N/A	T12000625	WN50X13	HN50X13	WR50X13
Model-377/376-xxx	PF376	WH22.5X15	N/A	T14750625	WN50X13	HN50X13	WR50X13
Model-385/384-xxx	PF384	WH28X15	N/A	T19750625	WN50X13	HN50X13	WR50X13
Model-384(2)-xxx	PF384(2)	T28000625	T19750625	T19750625	WN50X13	HN50X13	WR50X13
Model-485/484-xxx	PF484	WH28X24	N/A	T19750625	WN50X13	HN50X13	WR50X13
Model-485(2)/484(2)-xxx	PF484(2)	T28000625	T19750625	T19750625	WN50X13	HN50X13	WR50X13
Model-685-xxx	PF684	T28000625	T19750625	T19750625	WN50X13	HN50X13	WR50X13

*Note: Spare parts are for standard products. See page 4 for replacement element.





SOLBERG

**Vacuum Filters
Maintenance Manual
CSL, CT, VS, VL,
SM-CT, CSS, and CBL Series**

www.solbergmfg.com

Maintenance Manual

SOLBERG Vacuum Filters

CSL, CT, VS, VL, SM-CT, CSS and CBL

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Solberg Manufacturing, Inc., 1151 West Ardmore Itasca, IL 60143
Ph: 630/773-1363 Fax: 630/773-0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com
Vacuum Inlet Filters March, 2000



SOLBERG

Section A

INTRODUCTION

The purpose of this manual is instruction on the proper assembly and care of Solberg vacuum inlet filters.

! WARNING !

This manual must be read and thoroughly understood before using and caring for this air filter. Failure to comply could result in explosion, product/system contamination or personal injury.

This manual should be used as a supplement to the user's understanding of the proper care needed to maintain a safe and dependable air filter. It is the responsibility of the user to interpret and explain all instructions to persons who do not read or understand English BEFORE they are allowed to maintain and use this filter.

This manual should be readily available to all operators responsible for operation and maintenance of the vacuum inlet filters.

We thank you for selecting products from Solberg Manufacturing, Inc. We are confident that our superior filter designs will exceed your application requirements.

Section B

GENERAL INFORMATION

1. Identification of Solberg Vacuum Inlet Filters.

All Solberg vacuum inlet air filters should have an identification label/nameplate that gives the following information:

Assembly Model #
Replacement Element #

(The exception is OEM supplied units. In this case please enter the OEM part numbers below.)

Page 3

Solberg Manufacturing, Inc., 1151 West Ardmore Itasca, IL 60143
Ph: 630/773-1363 Fax: 630/773-0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com
Vacuum Inlet Filters March, 2000

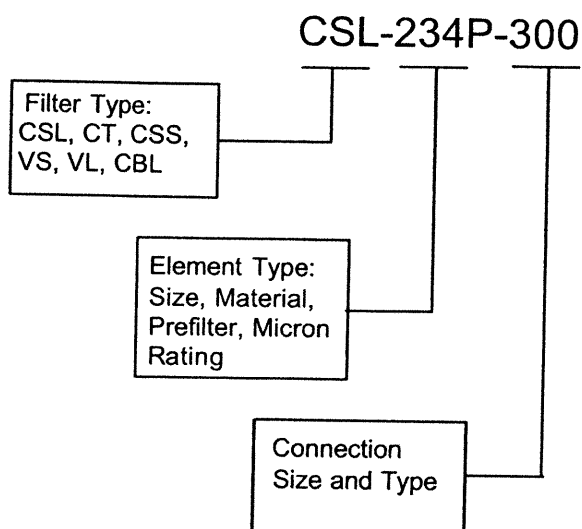


SOLBERG

Fill in the actual nameplate data from your new Solberg inlet filter(s):

No.	Filter Model Number	Replacement Element
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

The model number designates the filter type, the original element configuration and housing connection size. For example, the following part number identifies the filter as being a 'CSL' design filter with a 234 element with prefilter and 3" NPT connection size:



2. Filtration Rules of Thumb

General: For peak output performance from a compressor, blower, vacuum pump, engine, or any other machine that consumes air, one must have clean, unrestricted air. Proper filtration can help stabilize the working environment within rotating equipment even when the external conditions may be quite severe. A critical component in creating the right working conditions is filter sizing. With the properly sized filter, equipment will run smoothly over its entire expected operating life.

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter efficiency and, conversely, the lower the pressure drop. Therefore, the primary goal in filter sizing is to optimize the velocity of air through the media (sometimes called face velocity).

Rule of Thumb #1: Always begin with the filter cartridge requirements when sizing a filter. Once the appropriate element has been selected then move on to the housing requirements.

Rule of Thumb #2: Always ask or specify a filter based on a micron rating **with** filtration efficiencies. As an example, stating a requirement for a 5-micron filter is misleading because no efficiency rating has been specified. A 5-micron filter at 97-% efficiency can be less efficient than a 10-micron filter at 99.7% efficiency. For proper air system performance in light and industrial duty environments, a filter with a minimum of 99.7% filtration efficiency at 10 microns is required.

Rule of Thumb #3: Size your filter correctly by understanding the impact air velocity through a media has on efficiency and pressure drop. Maintain the suggested Air-to-Media ratios listed below based on the external environment listings and Filtration efficiency needs.



Filtration Efficiency Requirements (99+% efficiency)	Environmental Conditions	Air to Media Ratio
Industrial Grade 2-micron Paper	Light Duty (clean, office/warehouse-like)	30 CFM/ft ²
	Industrial Duty (workshop, factory-like)	15 CFM/ft ²
	Severe Duty (Foundry, Construction-like)	10 CFM/ft ²
Industrial Grade 5-micron Polyester	Light Duty (clean, office/warehouse-like)	50 CFM/ft ²
	Industrial Duty (workshop, factory-like)	40 CFM/ft ²
	Severe Duty (Foundry, Construction-like)	25 CFM/ft ²
Industrial Grade 4-micron Polyester	Industrial Duty (workshop, factory-like)	25 CFM/ft ²
	Severe Duty (Foundry, Construction-like)	15 CFM/ft ²
Industrial Grade 1-micron Polyester	Severe Duty (Foundry, Construction-like)	10 CFM/ft ²
Industrial Grade 0.3-micron HEPA Glass	Light Duty (clean office/warehouse-like)	10 CFM/ft ²
	Industrial Duty (workshop, factory-like)	7 CFM/ft ²
	Severe Duty (Foundry, Construction-like)	5 CFM/ft ²

Rule of Thumb #4: Pressure drop is also caused by the dirt holding capacity of the element. As the element fills up with dirt, the pressure drop increases. It is important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10" to 15" H₂O from the original reading.

Rule of Thumb #5: The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:



Pipe Size (inches)	Max Airflow	Pipe Size (inches)	Max Airflow	Pipe Size (inches)	Airflow
1/4"	6 CFM	1 1/4"	60 CFM	6"	1100 CFM
3/8"	8 CFM	1 1/2"	80 CFM	8"	1800 CFM
1/2"	10 CFM	2"	135 CFM	10"	3300 CFM
3/4"	20 CFM	2 1/2"	195 CFM	12"	4700 CFM
1"	35 CFM	3"	300 CFM	14"	6000 CFM
		4"	520 CFM		
		5"	800 CFM		

**Note: This information is for general use only. A qualified engineer must properly design each system.*

3. Element Specifications

Media	Micron Rating	Temperature Range	Filter Change-Out Differential
Standard Paper	99+% @ 5 micron	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
Standard Polyester	99+% @ 2 micron	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
"N" Series	99+% @ 4 micron	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
"Z" Series	99+% @ 1 micron	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
HEPA "HE" Series	99.97% @ 0.3 microns	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
"U" Series	99+% @ 25 micron	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
"W" Series	99+% @ 100 micron	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
"S1" Series	Stainless Steel Wire Mesh	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
"AC" & "ACP" Series	N/A	-15 to 220 F	Change When Carbon Saturates
"Y" Series Polypropylene	99+% @ 10 micron	-15 to 220 F	10"-15" H ₂ O Over Initial Delta P
"MX" & "MXD" Series – Nomex Cloth	99+% @ 10 micron	-15 to 385 F	10"-15" H ₂ O Over Initial Delta P



4. Element Cleaning

Some types of Solberg inlet filter elements can be cleaned and reused. However, damage can occur to an element during cleaning so it is imperative that care is taken during disassembly, cleaning and re-assembly. Damaged elements can allow particulate bypass, which will damage rotating equipment.

- A. **Polyester Element:** The polyester element may be washed in warm soapy water, vacuumed, gently blown out or replaced. The element should be dry before reinstallation.
- B. **Paper Element:** The paper element may be lightly blown with low pressure air. It is disposable and in most cases should be replaced with a new element.
- C. **Polyurethane Prefilter:** The prefilter may be washed as a sponge or replaced to give the element a longer service life.
- D. **Stainless Steel Wire Mesh Element:** Cleaning instructions similar to polyester, except mild solvents may be used.
- E. **Activated Carbon Element:** Not cleanable
- F. **Polypropylene Element:** Cleaning instructions similar to polyester
- G. **Nomex Cloth Element:** Cleaning instructions similar to polyester

If you are not confident that the integrity of the element was maintained during cleaning, it is recommended that a new element be installed. Also, spare parts such as gaskets, wingnuts and washers can be supplied upon request.

Section C

PROCEDURES

1. Installation.

- A. Maximum inlet gas stream temperature for most Solberg inlet vacuum filter products is 220 degrees F. Temperatures in excess of this could cause damage to elements, media and elastomers.
- B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on inlet and outlet ports.
- C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.



2. Disconnecting canister top from canister base.

- A. VS/VL: Remove V-clamp by loosening Hex Nut or T-bolt and releasing.
- B. CT/Small CSL/CBL: Release wire-form clips.
- C. Large CSL: Loosen wingnut or hex head on T-bolts.
- D. CSS: Twist upper housing to release.
- E. Lift off canister top.

3. Removing element for service/maintenance.

- A. Remove retaining hex head/wing-nut and washer carefully, and then remove element. Some elements will have a top plate that should also be removed. Note: Model "CSS" elements should be free when housing tops are removed.
- B. Clean sealing surfaces of housing, top & base plates, and element endcaps so that they are free of dirt or any other particulate.

! WARNING !

Failure to comply with these instructions
may result in system or pump contamination.

4. Securing Element.

- A. Place new or cleaned element evenly on base plate. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces.
- B. Place top plate (if necessary) on element by centering on tap bolt.
- C. Secure washer and wing nut to end cap (or top plate) and tap bolt. Element must be tightly secured. Note: DO NOT over tighten!

! WARNING !

Defective installation may cause system or
pump contamination. Use only genuine
Solberg replacement parts.

Page 9

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Vacuum Inlet Filters March, 2000



SOLBERG

5. Securing canister top to canister base.

- A. Make sure all surfaces are free from dust and other particulate.
- B. Hemisphere o-ring must rest evenly along canister/casting base o-ring groove.
- C. VS/VL: Secure V-clamp by disconnecting hex nut or T-bolt portion and placing V-clamp along the diameter of canister o-ring groove. Fasten T-bolt and secure tightly. V-CLAMP LEGS MUST REST UNIFORMLY ALONG ENTIRE O-RING GROOVE.
- D. CT/Small CSL/CBL: Hold canister housing against o-ring or sealing ring on main filter head. Re-fasten wire-form clips.
- E. Large CSL: Replace housing top plate. Feed T-bolts into corresponding slots and tighten evenly around perimeter. Note: Do NOT over tighten!
- F. CSS: Reassemble top housing to bottom housing by aligning tabs and turning into place.

Section D

MAINTENANCE RECOMMENDATIONS

1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10" to 15" H₂O higher pressure drop above the initial reading. Refer to page 4 for instructions.
2. Always check replacement cartridge gaskets to insure they are adhered uniformly along the end caps during handling. If not, contact Solberg Manufacturing, Inc. immediately. Do not modify or change from Solberg specified parts!
3. Always check inlets/outlets, element base and its components when replacing element to insure cleanliness. Wipe clean if necessary.
4. Operate only when a proper seal exists.
5. VS/VL: Never operate without absolute assurance that V-clamp is secured correctly along entire diameter of canisters. Check along V-clamp for wear. Replace if any distortion occurs due to handling and usage.



SPARE PARTS LIST: CSL, CT, VS, VL, CSS, AND CBL

Parent Model Model-Element-Connection	Prefilter Model	Housing						Element		
		Top Model No.	O-Ring Model No.	Gasket(s)/ Adapter Model No.	Wingnut(s) Model No.	Washer(s) Model No.	Clips/ Bolts Model No.	Top Plate Model No.	Wingnuts/ Bolt Model No.	Washer(s) Model No.
CSS-05/04-xxx	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CSS-07/06-xxx	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CSS-11/10-xxx	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CSL-825/824-xxx	N/A	T824	OR337	BG224	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-843/842-xxx	PF842	T842	OR550	BG268	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-849/848-xxx	PF848	T848	OR675	BG281	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-851/850-xxx	PF850	T850	OR750	BG412	N/A	N/A	CPWF	N/A	N/A	N/A
CSL-239/238-xxx	PF238	TD238	OR1250	N/A	N/A	N/A	CPWF	N/A	WN38X16	WR38X16
CBL-879/878-xxx	PF848	TD848	OR675	N/A	N/A	N/A	CPWF	N/A	WN25X20	WR25X20
CT-235/234-xxx	PF234	N/A	GCT1100	ADCT234	N/A	N/A	CPWF	T8000437	BH38X16	WR38X88
CT-SM3-xxx	N/A	N/A	GCT1100	N/A	N/A	N/A	CPWF	N/A	N/A	N/A
CT-SM4-xxx	N/A	N/A	GCT1100	N/A	N/A	N/A	CPWF	N/A	N/A	N/A
VS-235/234-xxx	PF234	N/A	OR386	N/A	N/A	N/A	N/A	T8000437	WN38X16	WR38X16
VS-245/244-xxx	PF244	N/A	OR386	N/A	N/A	N/A	N/A	T1000437	WN38X16	WR38X16
VS-275/274-xxx	PF274	N/A	OR386	N/A	N/A	N/A	N/A	T12000437	WN38X16	WR38X16
VL-235/234-xxx	PF234	N/A	OR386	N/A	N/A	N/A	N/A	T8000437	WN38X16	WR38X16
VL-245/244-xxx	PF244	N/A	OR386	N/A	N/A	N/A	N/A	T1000437	WN38X16	WR38X16
VL-275/274-xxx	PF274	N/A	OR386	N/A	N/A	N/A	N/A	T12000437	WN38X16	WR38X16
CSL-235/234-xxx	PF234	TC1400	OR1200	N/A	WN38X16	WR38X16	BT38163	T8000437	WN38X16	WR38X16
CSL-335/334-xxx	PF334	TC1400	OR1200	ADEX300	WN38X16	WR38X16	BT38163	T8000437	WN38X16	WR38X16
CSL-245/244-xxx	PF244	TC1850	OR1600	N/A	WN38X16	WR38X16	BT38163	T1000437	WN38X16	WR38X16
CSL-345/344-xxx	PF344	TC1850	OR1600	ADEX300	WN38X16	WR38X16	BT38163	T1000437	WN38X16	WR38X16
CSL-275/274-xxx	PF274	TC1850	OR1600	N/A	WN38X16	WR38X16	BT38163	T12000437	WN38X16	WR38X16
CSL-375/374-xxx	PF374	TC1850	OR1600	ADEX300	WN38X16	WR38X16	BT38163	T12000437	WN38X16	WR38X16
CSL-377/376-xxx	PF376	TC2250	OR2000	N/A	WN38X16	WR38X16	BT38163	T14750625	HN50X13	WR50X13
CSL-384(2)-xxx	PF384(2)	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13
CSL-685-xxx	PF684	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13
CSL-485(2)/484(2)-xxx	PF484(2)	N/A	OR2400	N/A	WN38X16	WR38X16	BT38163	T19750625	HN50X13	WR50X13

*Note: Spare parts are for standard products. See page 4 for replacement element.



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Rosedale Products, Inc.
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Revision: E
Revision Date: 30May2003

Specification No.
7.4.5
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INSTALLATION, OPERATION, & MAINTENANCE MANUAL

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

ROSEDALE PRODUCTS, INC.



MODEL 8

150 PSIG RATED FILTER UNIT

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INSTALLATION, OPERATION, & MAINTENANCE MANUAL

I. Installation

Please remove all shipping and crating materials carefully. Be sure to remove the plugs from the inlet and outlet openings. Dispose of all crating materials safely.

The Model 8 Filter unit is capable of having several different piping variations based upon the outlet style of your unit. The inlet service line should be connected to the inlet flange or NPT coupling located near the top of the unit (above the basket level).

The outlet service line should be connected to the outlet flange or coupling, located near the middle or bottom of the unit depending upon the style of your unit (below basket level).

There are two 1/4" NPT ports on the shell and one 1/4" NPT port on the cover of the Model 8 Filter unit. These ports can remain plugged or used for pressure gauges or special fittings as your application requires.

Some installations require electrical grounding of all equipment, be sure to provide adequate grounding where necessary.

After completing installation be sure to double check connections for integrity. Your Model 8 Filter unit has been factory pressure tested leak free, therefore, any seepage problems usually occur from improper installation connections.

You are now ready to install the filter basket and bag. Remove cover by loosening the cover eyenuts. The eyenuts in the slotted corners should be loosened sufficiently to swing free. Loosen the third eyenut sufficiently to allow the top cover and closure assembly to swing away from the top of the unit.

If your application requires a basket seal, insert the basket seal into the basket collar groove. Refer to Figure 1 or Figure 2 in the Spare Parts Diagram for installation position of your seal.

Place the basket into the filter housing, make sure the basket flange is firmly seated into the basket collar.

Insert bag into the bag basket making sure filter bag ring is firmly seated inside the basket flange. For best results, be sure filter bag is installed fully extended to the bottom of the basket.

Before replacing cover assembly, inspect cover seal gasket (replacing as necessary). Close cover and alternately tighten the three clamp assemblies evenly to ensure a leak proof seal between the cover and housing body. Torque closure assemblies to a maximum of 60-90^{ft-lbs}. Each installation may have different closure bolting torque requirements to effectively seal the filter vessel cover. Many installations require significantly lower closure bolting torque due to the variables explained below. The suggested torque values are for reference only. They are to be used as a guideline by maintenance personnel. These values are meant as a guideline for safe operation of the filter system at its maximum rated pressure. Many variables affect the torque required to operate the filter vessel without leaks. These variables include the diameter of the bolt, type and number of threads, material type and grade, condition of the nut bearing surface and lubrication of bolt threads and nut bearing surfaces. Other factors such as the condition of the o-ring, o-ring material, viscosity of the fluid being filtered, operating pressures, temperature, and the closure assembly tightening procedure must also be considered.

Your Rosedale Model 8 is now ready for operation!

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INSTALLATION, OPERATION, & MAINTENANCE MANUAL

II. Operation

Filter System Start-Up Procedure:

Prior to turning on the flow to the inlet service, please make the following checks:

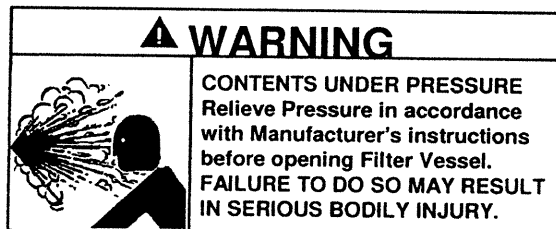
1. Check inside filter unit to be sure basket and filter bag (if applicable) are in housing and do not require cleaning or replacement. If necessary install a clean filter basket and bag (if applicable).
2. Check that filter unit cover is securely fastened to housing. You are now ready to open the flow to the inlet service line. Slowly open the inlet service line approximately 25% of normal operational flow (open slowly as not to displace filter bag inside the housing). After filter unit is pressurized and vented, slowly open outlet service line unit valve until completely open. Complete opening of inlet service line until desired flow rate is reached.

Once the desired service flow has been established, the filter will operate efficiently until dirty. However, under no circumstances should more than *15 PSI Differential Pressure* through the filter be obtained. Operating the filter unit with a high differential may cause filter bags to rupture and/or cause damage to filter system and downstream equipment.

To prevent excessive drop through the filter unit, regular inspection of the filter media is required. Monitoring of differential pressure through the housing can be utilized as a means of determining whether or not the filter media needs cleaning or replacement.

When it becomes necessary to clean or replace filter media, follow the procedure outlined below:

1. First close the flow from the inlet service line.
2. Close the flow to the outlet service line. (In some applications closing flow to outlet is not required.)
3. Relieve the pressure from the filter unit.



4. Drain housing sufficiently to access filter basket.
5. Remove cover by loosening the cover eyenuts. The eyenuts in the slotted corners should be loosened sufficiently to swing free. Loosen the third eyenut sufficiently to allow the top cover and closure assembly to swing away from the top of the unit.
6. Remove filter basket and clean thoroughly, remove the filter bag (if applicable) and throw away. (Cleaning and reusing the filter bag is not recommended.)
7. Remove debris and sludge from inside the inlet portion of housing to avoid interference with cover seal or flow of fluid being filtered.
8. Remove basket seal and inspect, replace if necessary. Clean basket seal groove and replace

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INSTALLATION, OPERATION, & MAINTENANCE MANUAL

- basket seal (see spare parts diagram for location of basket seal).
9. Install clean filter basket and filter bag (if applicable). Place the basket into the filter housing, make sure the basket flange is firmly seated into the basket collar. If applicable, insert bag into the bag basket making sure filter bag ring is firmly seated inside the basket flange. For best results, be sure filter bag is installed fully extended to the bottom of the basket.
 10. Inspect cover gasket for cuts or other signs of failure and make sure it is properly seated.
 11. Move cover back into position, and alternately tighten the three clamp assemblies evenly to ensure a leak proof seal between cover and housing body. Torque closure assemblies to a maximum of 60-90^{ft-lbs}. Many installations require significantly lower closure bolting torque due to the variables previously explained in Section I.

Your Rosedale Model 8 Filter unit is now ready for operation. Refer to filter system start-up procedure.

III. Spare Parts List

Your Rosedale Model 8 Filter unit will give you many years of reliable service provided periodic inspections are made of various components and replacement of worn parts are made promptly. The following is meant to be a recommended spare parts list, these parts are illustrated on the following page.

SPARE PARTS LIST			
Balloon	Description	Part Number	Time-Frame
1	Cover Seal	8150CG-*	as needed
2	Basket Seal	8BG-*	as needed
3	Cover	8*150	as needed
4	Eye Nut	8ENNI	as needed
5	Rod End	8RENI	as needed
6	Clevis Pin Assembly	8CPNI	as needed
7	Filter Bag	(See Order)	as needed
8	Filter Basket	(See Order)	as needed
9	Tripod Legs	8T22*S	as needed

* Select Material Designation:

C=Carbon Steel
S=304 Stainless Steel
S316=316 Stainless Steel

B=Buna N
E=Ethylene Propylene
V=Viton
TEV=Teflon Encapsulated Viton
TSW=Teflon Solid White

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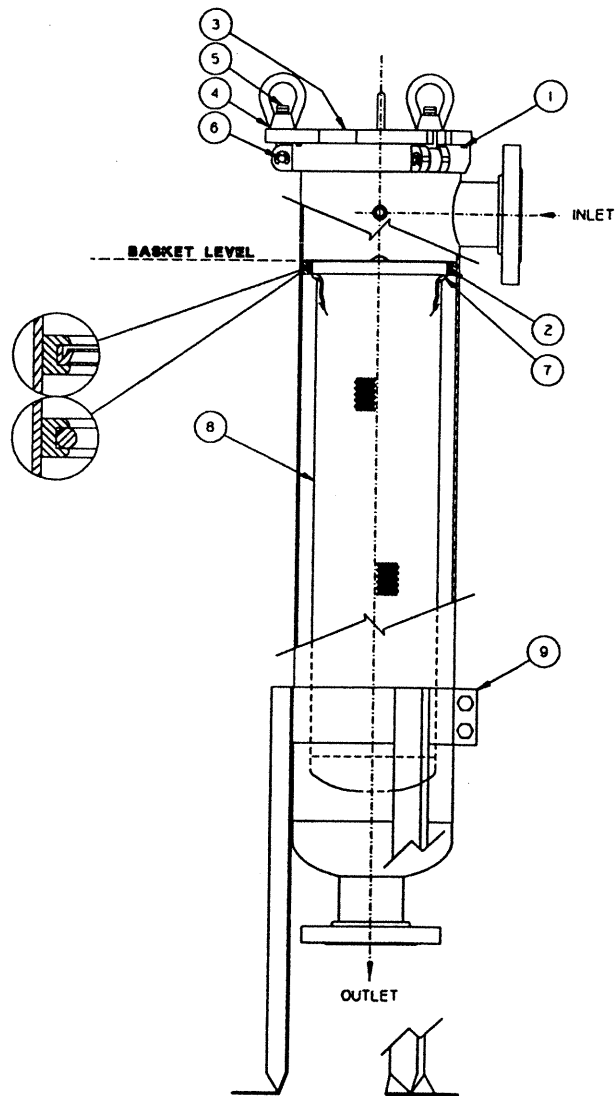
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INSTALLATION, OPERATION, & MAINTENANCE MANUAL

IV. Spare Parts Diagram

Figure 1
V-seal

Figure 2
O-ring



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INSTALLATION, OPERATION, & MAINTENANCE MANUAL

Important Notice

Warranty: In the event any Rosedale Products, Inc. filtration product is found to be defective in material, workmanship, or not in conformance with any express warranty for a specific purpose, Rosedale's only obligation and your exclusive remedy, shall be to repair, replace or refund the purchase price of such parts or products upon timely notification thereof and substantiation that the product has been stored, maintained and used in accordance with Rosedale's written instructions.

EXCLUSIONS TO WARRANTY: THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OF QUALITY, EXCEPT OF TITLE AND AGAINST PATENT INFRINGEMENT.

LIMITATION OF LIABILITY: Except as provided above, Rosedale shall not be liable or responsible for any loss or damage, whether direct, indirect, incidental, special or consequential, arising out of sale, use or misuse of Rosedale filtration products, or the user's inability to use such products.

THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

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<http://www.rosedaleproducts.com>

Reference	Qty	Units	Description	Material	Part Number
P-100, 200	2	each	PUMP END, CENTRIFUGAL, ENCLOSED IMPELLER TYPE, 54GPM @ 30"TDH, 10GPM @ 97"TDH, 1"O X 1 1/4" I X 5 1/16" IMPELLER, LESS 1HP 56C 3600RPM MOTOR	CI/BRASS/ CARBON/ VITON	MYERS-CT10FAB
P-100, 200	2	each	MOTOR, 1HP, 208-230/460V, 3.5-3.2/1.6 AMPS, 3 PHASE EXP, 3450 RPM, 1.0 SF, 56C FOOTLESS FRAME		LEESON 111943.00
P-300	1	each	PUMP END, CENTRIFUGAL, ENCLOSED IMPELLER TYPE, 76GPM @ 50"TDH, 10GPM @ 119"TDH 1 1/4"O X 1 1/2" I, LESS 2HP 56C 3600RPM MOTOR	CI/BRASS/ CARBON/ VITON	MYERS-CT20FAB
P-300	1	each	MOTOR, 2HP, 208-230/460V, 5.6 FLA AT 230V, 3 PHASE TEFC, 3450 RPM, 56C FOOTLESS FRAME		LEESON-111273
WELL PUMP	4	each	5E5 REDI -FLO GRUNDFOS PUMP		QUOTE 208046
WELL PUMP	3	each	10E5 REDI-FLO GRUNDFOS PUMP		QUOTE 208046
WELL PUMP	7	each	1/2 HP 230 VAC 1 PHASE 2 WIRE PRM MOTOR FOR ABOVE PUMP		QUOTE 208046
WELL PUMP	7	each	MOTOR LEAD FOR REDI-FLO3 PUMPS, #12 AWG, 50 FEET LONG	TEFZEL	

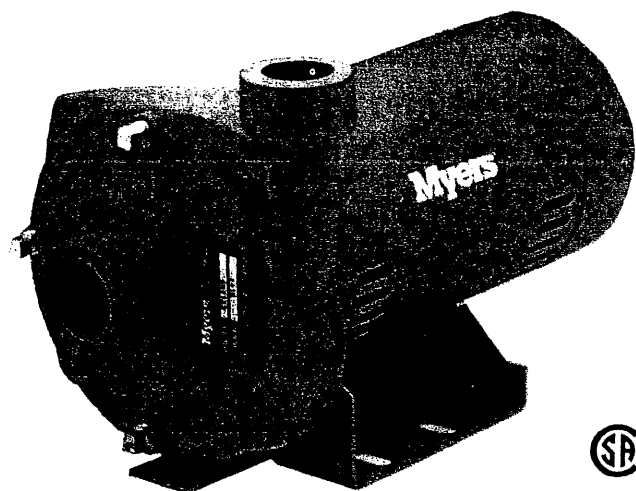
CT Series

High Pressure Centrifugal Pumps

½ - 2½ HP

Heads to 140 Feet

Capacities to 95 GPM



MYERS CT SERIES LINE OF HIGH PRESSURE CENTRIFUGAL PUMPS PROVIDES QUALITY AT A COMPETITIVE PRICE. The complete line of ½ to 2½ HP units provide strong pressures up to 140 feet and flows up to 95 gpm.

The rugged cast iron body construction is available with either a corrosion resistant composite or brass impeller. The brass impeller unit is equipped with a high temperature, viton seal for more demanding applications. The heavy duty motor features a double ball bearing, 50° C ambient, dual voltage design for dependable service. The compact, back pullout design provides easy installation and serviceability.

The quality features of the CT series will provide dependable service for a wide variety of applications.

SPECIFICATIONS

HP	Catalog No.		Pipe Tapping Sizes		Motor Voltage	Phase	Approx. Wt. Lbs.
	Composite Impeller	Brass Impeller	Suction (NPT)	Discharge (NPT)			
½	CT05	CT05B	1¼"	1"	115/230	1	30
	CT053	CT05B3	1¼"	1"	208/230/460	3	30
¾	CT07	CT07B	1¼"	1"	115/230	1	32
	CT073	CT07B3	1¼"	1"	208/230/460	3	32
1	CT10	CT10B	1¼"	1"	115/230	1	35
	CT103	CT10B3	1¼"	1"	208/230/460	3	35
1½	CT15	CT15B	1¼"	1"	115/230	1	40
	CT153	CT15B3	1¼"	1"	208/230/460	3	40
2	CT20	CT20B	1½"	1¼"	115/230	1	57
	CT203	CT20B3	1½"	1¼"	208/230/460	3	57
2½	CT25	CT25B	2"	1½"	115/230	1	62
	CT253	CT25B3	2"	1½"	208/230/460	3	62

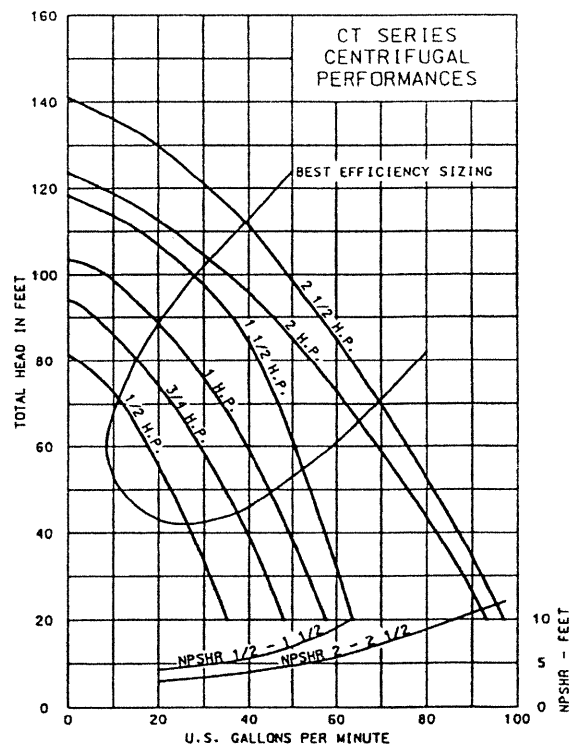
ADVANTAGES BY DESIGN

- Heavy duty cast iron construction.
- Back pull-out design.
- Dependable double ball bearing motor
- Continuous duty rating motor.
- Choice of brass or composite impeller.
- Brass impeller pumps rated 212° F.
- Composite impeller pumps rated 140° F.
- Maximum working pressure of 125 psi.
- CSA listed.

Applications

- Booster service
- Irrigation
- Circulating
- Cooling towers
- Air conditioning
- Liquid transfer
- Sprinkling systems
- General industrial service

PUMP PERFORMANCE



WHERE INNOVATION MEETS TRADITION

Myers®

Pentair Pump Group

CT Series

High Pressure Centrifugal Pumps
 $\frac{1}{2}$ - $2\frac{1}{2}$ HP
 Heads to 140 Feet
 Capacities to 95 GPM

1. MOTOR

- NEMA standard
- Double ball bearing
- Open drip proof
- 60 Hz, 3450 rpm
- Stainless steel shaft
- Single phase with built-in overload protection
- Three phase require overload protection in starter unit
- Non-overloading
- Continuous duty
- Strong capacitor start design

2. SEAL PLATE

- Heavy duty cast iron for dependable service and long life

3. IMPELLER

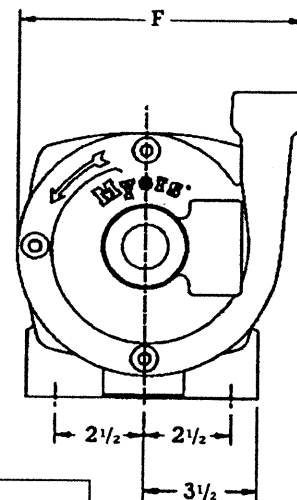
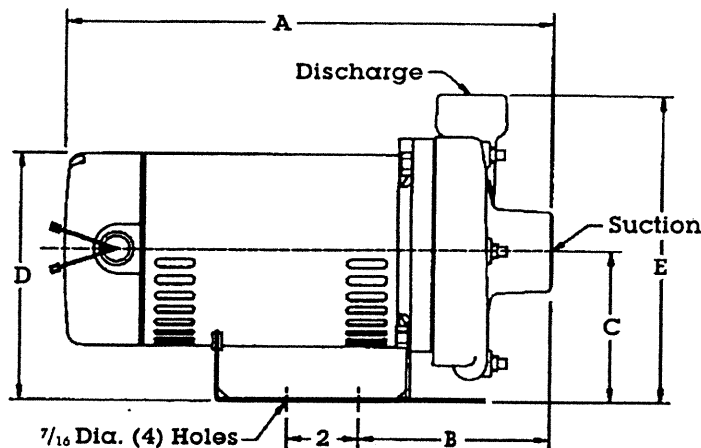
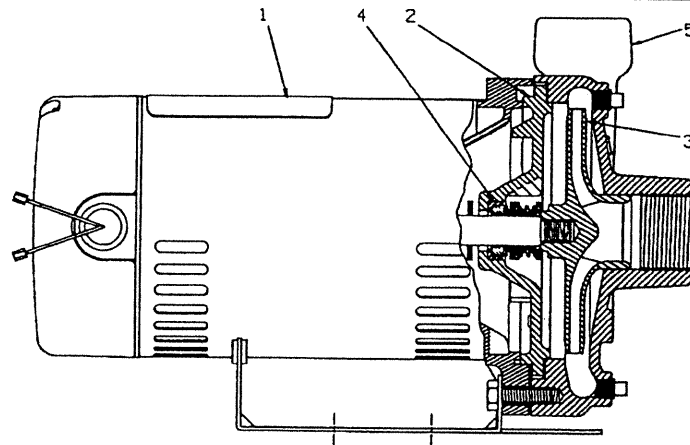
- Reinforced composite for applications to 140° F.
- Threaded SST insert on composite impellers
- Brass for applications to 212° F.
- Enclosed design for high efficiencies
- Balanced for smooth operation

4. MECHANICAL SEAL

- Standard carbon/ceramic faces, Buna elastomers, 300 series SST components (standard for pumps with composite impellers)
- High temperature carbon/ceramic faces, viton elastomers, 300 series SST components (standard for pumps with brass impellers)

5. CASING

- Heavy duty cast iron construction
- Back pull-out design
- Discharge can be rotated in four positions
- Tapped openings for priming, venting and draining.
- Vertical discharge standard



HP	Dimensions, inches							
	A	B	C	D	E	F	Suct.	Disch.
$\frac{1}{2}$	$13\frac{7}{8}$	$5\frac{1}{2}$	$4\frac{3}{8}$	$7\frac{1}{4}$	9	8	$1\frac{1}{4}$	1
$\frac{3}{4}$	$14\frac{5}{8}$	$5\frac{1}{2}$	$4\frac{3}{8}$	$7\frac{1}{4}$	9	8	$1\frac{1}{4}$	1
1	$15\frac{1}{8}$	$5\frac{1}{2}$	$4\frac{3}{8}$	$7\frac{1}{4}$	9	8	$1\frac{1}{4}$	1
$1\frac{1}{2}$	$15\frac{1}{8}$	$5\frac{1}{2}$	$4\frac{3}{8}$	$7\frac{1}{4}$	9	8	$1\frac{1}{4}$	1
2	$16\frac{1}{2}$	$6\frac{1}{4}$	$4\frac{1}{2}$	$7\frac{1}{2}$	$9\frac{1}{2}$	$8\frac{7}{8}$	$1\frac{1}{2}$	$1\frac{1}{4}$
$2\frac{1}{2}$	$16\frac{1}{2}$	$6\frac{1}{4}$	$4\frac{1}{2}$	$7\frac{1}{2}$	$9\frac{1}{2}$	$8\frac{7}{8}$	2	$1\frac{1}{2}$

Myers®

CT Kit Pumps

INSTALLATION

PACKAGE CONTENTS - 1. The catalog lists all parts included with package.
2. Be sure all parts have been furnished and that nothing has been damaged in shipment.
3. OPEN PACKAGES AND MAKE THIS CHECK BEFORE GOING ON JOB.

PIPING - Pipes must line up and not be forced into position by unions. **Piping should be independently supported near the pump so that no strain will be placed on the pump casing.** Where any noise is objectionable, pump should be insulated from the piping with rubber connections. Always keep pipe size as large as possible and use a minimum of fittings to reduce friction losses.

SUCTION PIPING - Suction pipe should be direct and as short as possible. It should be at least one size larger than suction inlet tapping and should have a minimum of elbows and fittings. The piping should be laid out so that it slopes upward to pump without dips or high points so that air pockets are eliminated. The highest point in the suction piping should be the pump inlet except where liquid flows to the pump inlet under pressure. A foot valve must be used to keep pump primed. Where liquid flows to the pump, it may be desirable to use a check valve in the suction line or discharge line to keep pump primed.

To prevent air from being drawn into suction pipe due to a suction whirlpool, the foot valve should be submerged at least three feet below the low water level. The suction pipe must be tight and free of air leaks or pump will not operate properly.

DISCHARGE PIPING - Discharge piping should never be smaller than pump tapping and should preferably be one size larger. A gate valve should always be installed in discharge line for throttling if capacity is not correct. To protect the pump from water hammer and to prevent backflow, a check valve should be installed in the discharge line between the pump and gate valve.

ELECTRICAL CONNECTIONS - Be sure motor wiring is connected for voltage being used. Unit should be connected to a separate circuit, direct from main switch. A fused disconnect switch or circuit breaker must be used in this circuit. Wire of sufficient size should be used to keep voltage drop to a maximum of 5%. All motors, unless provided with built-in overload protection, must be protected with an overload switch, either manual or magnetic.

Never install a pump without proper overload protection. When motor is mounted on a base plate or on slide rails for adjustment, flexible metallic conduit should be used to protect the motor leads.

PRIMING - The pump must be primed before starting. The pump casing and suction piping must be filled with water before starting motor. Remove vent plug in top of casing while pouring in priming water. A hand pump or ejector can be used for priming when desired. When water is poured into pump to prime, use care to remove all air before starting motor.

If pump does not start immediately, stop and reprime.

STARTING - It is good practice to close the discharge valve when starting the pump as it puts less starting load on the motor. When the pump is up to operating speed, open the discharge valve to obtain desired capacity or pressure. Do not allow the pump to run for long periods with the discharge valve tightly closed. If the pump runs for an extended period of time without liquid being discharged, the liquid in the pump case can get extremely hot.

ROTATION - The pump must run in direction of arrow on pump case. All single phase motors are single rotation and leave factory with proper rotation. Three phase motors may run either direction. If rotation is wrong when first starting motor, interchange any two line leads to change rotation.

STOPPING - Before stopping pump, close the discharge valve. This will prevent water hammer and is especially important on high head pumps.

FREEZING - Care should be taken to prevent the pump from freezing during cold weather. It may be necessary, when there is any possibility of this, to drain the pump casing when not in operation. Drain by removing the pipe plug in the bottom of the casing.

ROTARY SEAL - CT pumps are fitted only with a rotary seal. This seal is recommended for water free from abrasives. If liquid contains abrasives, the CT pump should not be used.

BEARINGS - The pump motor uses sealed ball bearings that are factory lubricated and do not require further lubrication.

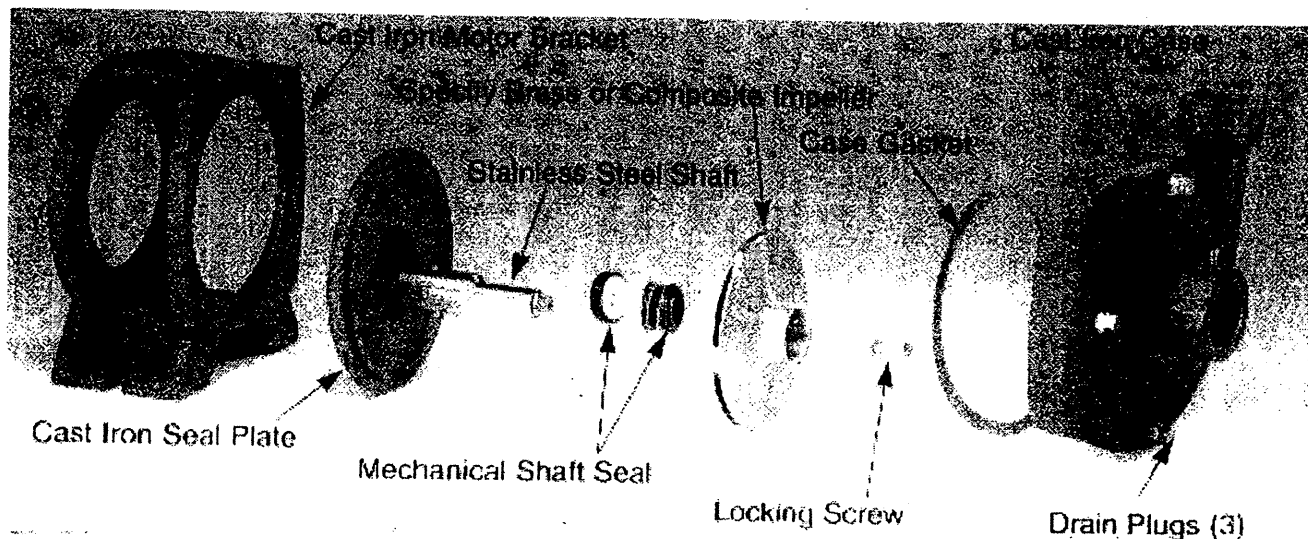
BELT DRIVES - On V-belt drives, if possible, the tight side of the belt should be at the bottom. Adjust belt tension just tight enough to prevent slippage; excess tension unnecessarily loads the bearings. Normally the belt speed should

not exceed 5000 feet per minute and the pulley ratio should not exceed 5 to 1. The distance between the shaft centers should be at least twice the diameter of the larger pulley.

SERVICE

TROUBLE SHOOTING GUIDE

POSSIBLE CAUSE OF PROBLEM				
	D	C	B	A
1. Pump not properly primed; repeat priming operation				X
2. Discharge head too high. Check total head with gauge at pump inlet and discharge. (With no water, the gauge at discharge would show shut-off pressure.)			X	X
3. Excessive volume being discharged. Throttle discharge valve.		X		
4. Speed too low. Check pump drive belts for slippage. If hot, tighten belts. Check motor voltage and speed.		X	X	
5. Rotation wrong. Change shaft rotation.		X	X	X
6. Suction lift too high. Check with vacuum gauge. This should not exceed 15 feet.	X		X	X
7. Air leak in suction line. Check line under pressure to find leak.	X	X	X	X
8. Air pocket in suction line. Check line for proper slope.	X			X
9. Insufficient submergence of suction pipe. Foot valve should be three feet below lowest water level.	X		X	
10. Sediment chamber clogged. Remove and clean thoroughly. Make sure gasket is in good condition and sealing surfaces clean before reassembly of sediment chamber cap.		X		
11. Impeller or suction line plugged.		X	X	X
12. Impeller and volute case badly worn. Disassemble pump; if clearance on diameter is over .030", replace worn impeller and worn volute case.		X	X	
13. Suction strainer plugged. Clean strainer.	X			
14. Impeller diameter too small for condition required.		X	X	
15. Seal leaking - seal is worn or seal face cocked. Replace with new seal and carefully follow directions.				



DISASSEMBLY INSTRUCTIONS

All pumping parts can be removed from case without disturbing the piping.

POWER SUPPLY - Open the power supply switch contacts and remove fuses. Disconnect the electrical wiring from the motor.

VOLUTE CASE

- Drain pump case by removing drain plugs.
- Remove the bolts securing volute case to pump bracket.
- To pry components apart, use two screwdrivers - opposite each other. (Fig. 1)

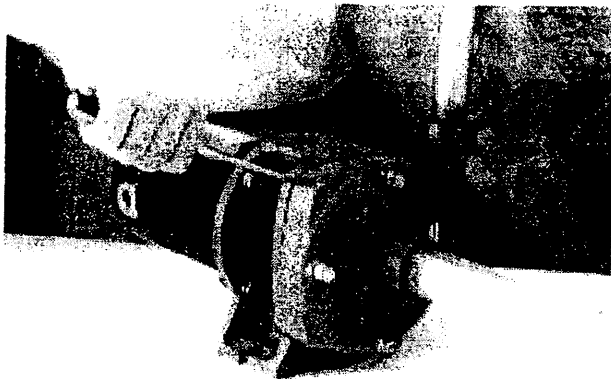


FIG. 1

IMPELLER

- Remove impeller by holding stub shaft with water pump pliers and unscrewing capscrew by hand. (Fig. 2)
- turn impeller counter-clockwise to remove from stub shaft.

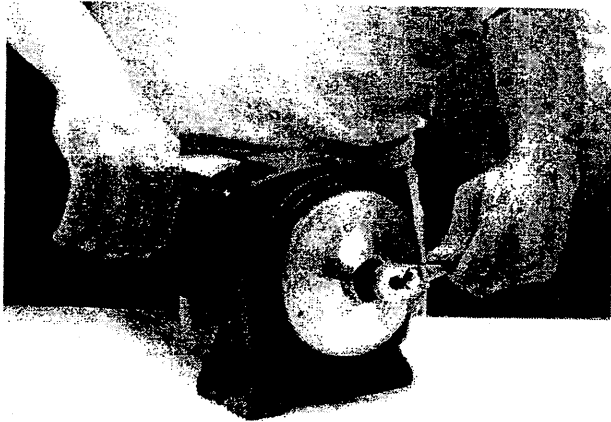


FIG. 2

SEAL

- The seal used is $\frac{5}{8}$ ".
- Always replace both rotating assembly and stationary ceramic seat. **DO NOT USE OLD STATIONARY SEAT WITH NEW ROTATING SEAL ASSEMBLY.**
- Using two screwdrivers, pry out rotating assembly of shaft seal. (Fig. 3)
- The stationary seat can be pressed from the seal plate.

- A new shaft seal should always be used when rebuilding a pump. All pump parts should be cleaned thoroughly before being reassembled.



FIG. 3

MOTOR

- Remove four bolts holding bracket to motor and remove motor. (Fig. 4)
- Remove set screws in stub shaft coupling to disconnect motor pump shaft.

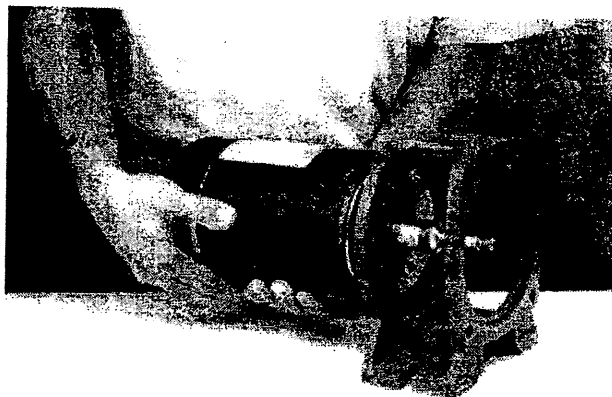


FIG. 4

Model Number	Impeller	HP	Eng. Number	Impeller	
				Number	Diameter
CTFAP	Plastic	$\frac{1}{2}$	26500D100	26441B005	$4\frac{1}{16}$
		$\frac{3}{4}$		26440B005	5
		1		26439B011	5
		$1\frac{1}{2}$		26439B010	$5\frac{5}{16}$
CTFAB	Brass	$\frac{1}{2}$	26500D000	26441B004	$4\frac{1}{16}$
		$\frac{3}{4}$		26440B004	5
		1		26439B009	$5\frac{1}{16}$
		$1\frac{1}{2}$		26439B008	$5\frac{5}{16}$
CT20FAP	Plastic	2	26500D101	26487C009	$5\frac{3}{4}$
CT20FAB	Brass	2	26500D001	26487C007	$5\frac{3}{4}$
CT25FAP	Plastic	$2\frac{1}{2}$	26500D102	26487C008	$6\frac{1}{16}$
CT25FAB	Brass	$2\frac{1}{2}$	26500D002	26487C006	$6\frac{1}{16}$

FIG. 5

ASSEMBLY INSTRUCTIONS

SPOTTING MOTOR SHAFT - Locate "Spotting Position" from motor mounting face to center of spot. A drilling guide and locating fixture is recommended for uniform and accurate spotting. Make two spots with a drill point, at 90 degrees apart - must not be on motor shaft keyway. (Fig 6)

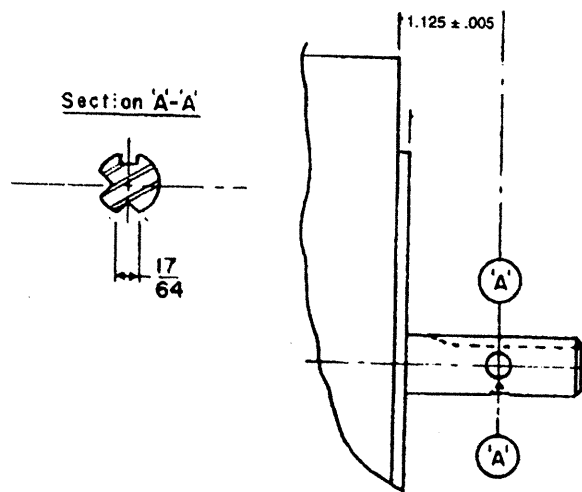


FIG. 6

MOTOR

- Place rubber deflector over motor shaft, slide shaft extension into position and tighten set screws.
- Assemble motor and shaft onto bracket, using (4) $\frac{3}{8}$ -16 UNC Hex Head Cap Screws, $1\frac{1}{8}$ " long.

SEAL INSTALLATION

- Insert seal seat in position by using light pressure on non-abrasive seal installation tool and press firmly and squarely until it bottoms. The use of light oil (SAE10) on the rubber element will facilitate assembly. Care must be taken to keep oil, grease and dirt off face areas of seal. Be sure the seal faces are not damaged during assembly (cracked, scratched or chipped) or the seal will leak during operation.
- Check dimension from face of ceramic seat to shaft shoulder. This distance should be as noted in Figure 7 within a tolerance of $\pm 1/64$.
- Install rotating element of seal on shaft (Fig. 8), be sure the carbon lapped sealing surface is toward seal seat, and assemble impeller. Check diameter of impeller against motor horsepower rating to insure proper performance (Fig. 5).

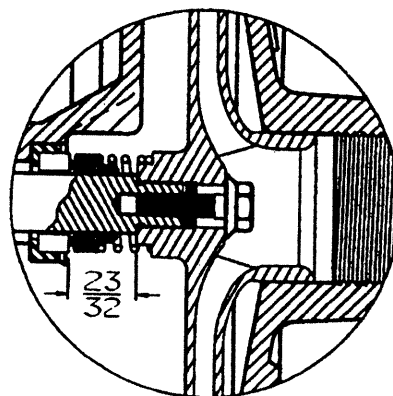


FIG. 7

IMPELLER

- On $\frac{1}{2}$ - $1\frac{1}{2}$ HP units, screw on impeller and secure using special washer and $\frac{1}{4}$ -28UNF socket head cap screw, $\frac{3}{4}$ " long -- must be stainless steel
- On 2- $2\frac{1}{2}$ HP units, screw on impeller and secure using special washer and $\frac{1}{4}$ -28UNF socket head cap screw, $1\frac{1}{8}$ " long -- must be stainless steel.

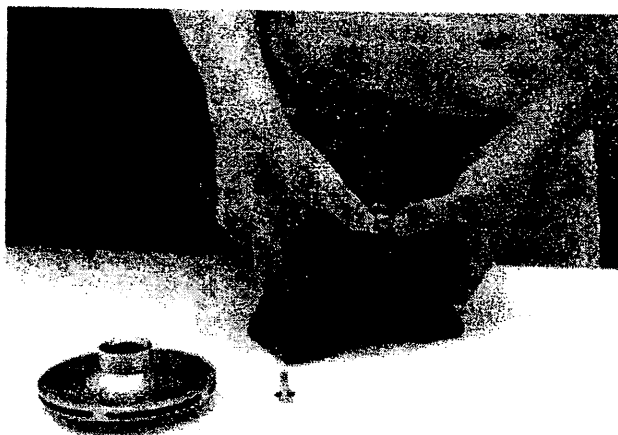


FIG. 8

VOLUTE CASE

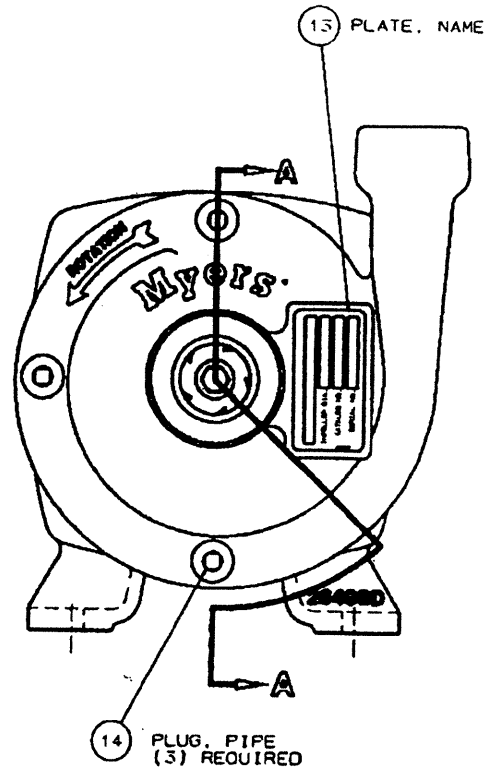
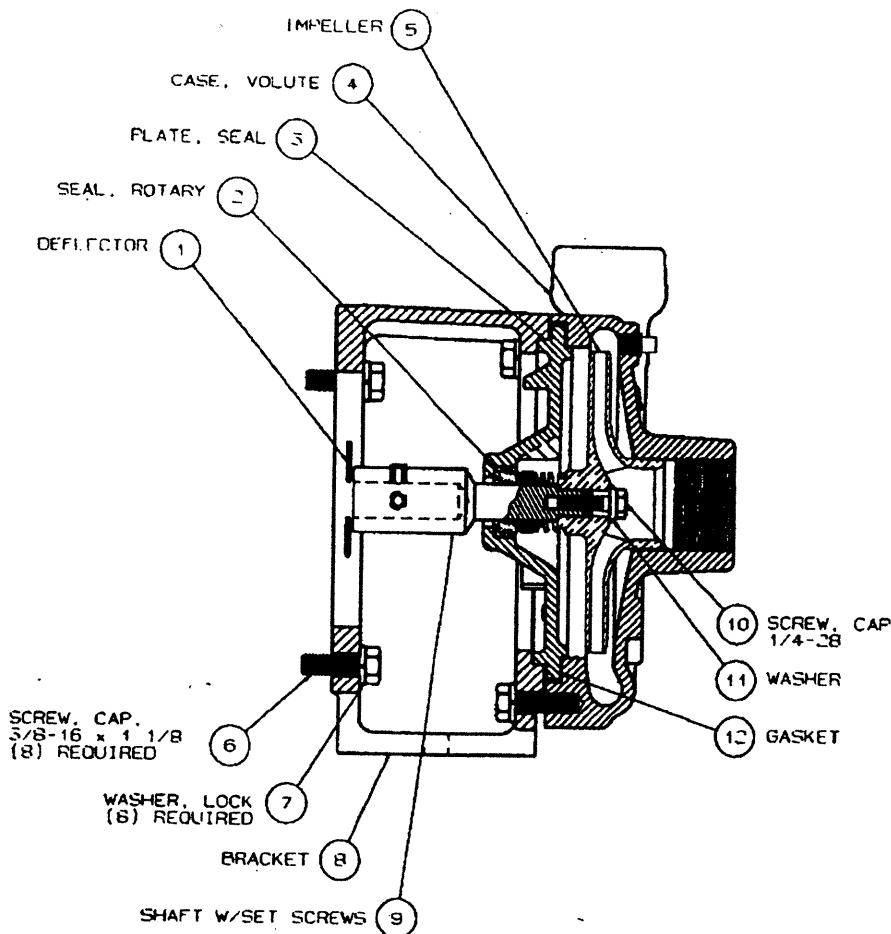
- Worn volute case will cause excessive leakage with a new impeller, thereby reducing the amount of service obtained from a new impeller.
- Assemble gasket and volute case with (4) $\frac{3}{8}$ -16UNC Hex Head Cap Screws $1\frac{1}{8}$ " long. Rotate pump shaft with fingers, being sure that there is no tight spot or binding of assembly. A uniform drag of the seal faces will be present.

Crusader CT Kit Series Parts List
1/2, 3/4, 1 and 1 1/2 HP

Ref. No.	Description	Part No.	Qty. Req'd.
1	Deflector	05059A318	1
2	Seal, Rotary 5/8 Shaft		
	Standard Seal with Polycarbonate Impeller	14525A010	1
	Hi-Temp Seal with Brass Impeller	21181A021	1
3	Plate, Seal (Cast Iron)	26442C000	1
4	Case, Volute (Cast Iron)	26443D001	1
5	Impeller		
	Polycarbonate (1/2 HP)	26441B005	1
	Polycarbonate (3/4 HP)	26440B005	1
	Polycarbonate (1 HP)	26440B011	1
	Polycarbonate (1 1/2 HP)	26439B010	1
	Bronze (1/2 HP)	26441B004	1
	Bronze (3/4 HP)	26440B004	1
	Bronze (1 HP)	26439B009	1
	Bronze (1 1/2 HP)	26439B008	1
6	Cap Screw, 3/8-16 UNC x 1 1/8 Long	19101A016	8
7	Washer, Lock 3/8	05454A007	8
8	Bracket	26498D000	1
9	Shaft with Set Screws	26499B000	1
10	Cap Screw, 1/4-28 UNF x 7/8 Long	19099A032	1
11	Washer, Bronze Special 11/16 O.D.	10186A000	1
12	Gasket, 6 3/8 x 5 19/32 x 1/32 Vell.	05059A446	1
13	Plate, Name	26539A000	1
14	Pipe Plug 1/8 NPT	05022A021	3

Crusader CT Kit Series Parts List
2 and 2 1/2 HP

Ref. No.	Description	Part No.	Qty. Req'd.
1	Deflector	05059A318	1
2	Seal, Rotary 5/8 Shaft		
	Standard Seal with Polycarbonate Impeller	14525A010	1
	Hi-Temp Seal with Brass Impeller	21181A021	1
3	Plate, Seal (Cast Iron)	26485D000	1
4	Case, Volute (Cast Iron)		
	2 HP	26484D003	1
	2 1/2 HP	26484D002	1
5	Impeller		
	Polycarbonate (2 HP)	26487C009	1
	Polycarbonate (2 1/2 HP)	26487C008	1
	Bronze (2 HP)	26487C007	1
	Bronze (2 1/2 HP)	26487C006	1
6	Cap Screw, 3/8-16 UNC x 1 1/8 Long	19101A016	8
7	Washer, Lock 3/8	05454A007	8
8	Bracket	26498D000	1
9	Shaft with Set Screws	26499B000	1
10	Cap Screw, 1/4-28 UNF x 1 1/8 Long	19099A031	1
11	Washer, Bronze Special 11/16 O.D.	10186A000	1
12	Gasket, 6.582 x 6.135 x 1/32 Vell.	05059A447	1
13	Plate, Name	26539A000	1
14	Pipe Plug 1/8 NPT	05022A021	3



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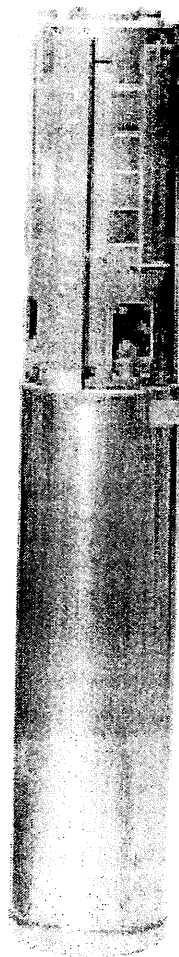
F. E. Myers, 1101 Myers Parkway, Ashland, Ohio 44805-1969
419/289-1144, FAX: 419/289-6658, www.industry.net/fe.myers

Myers (Canada), 269 Trillium Drive, Kitchener, Ontario N2G 4W5
519/748-5470, FAX: 519/748-2553

Redi-Flo4

Stainless Steel Submersible Pumps
for Environmental Applications

Ⓢ Installation and operating instructions



Please leave these instructions with the pump for future reference.

SAFETY WARNING

Grundfos Stainless Steel Submersible Pumps

Your Grundfos Redi-Flo4 Environmental Pump is of the utmost quality. Combined with proper installation, your Grundfos pump will give you many years of reliable service.

To ensure the proper installation of the pump, carefully read the complete manual before attempting to install the pump.

Shipment Inspection

Examine the components carefully to make sure no damage has occurred to the pump-end, motor, cable or control box during shipment.

This Grundfos Redi-Flo4 Environmental Pump should remain in its shipping carton until it is ready to be installed. The carton is specially designed to protect it from damage. During unpacking and prior to installation, **make sure that the pump is not contaminated, dropped or mishandled.**

The motor is equipped with an electrical cable. **Under no circumstance should the cable be used to support the weight of the pump.**

You will find a loose data plate wired to the pump. It should be securely mounted at the well or attached to the control box.

PRE-INSTALLATION CHECKLIST

Before beginning installation, the following checks should be made. They are all critical for the proper installation of this submersible pump.

A. Condition of the Well

If the pump is to be installed in a new well, the well should be fully developed and bailed or blown free of cuttings and sand. Dispose of discharged materials in accordance with the specific job site requirements. The stainless steel construction of the Redi-Flo4 Environmental Pump makes it resistant to abrasion; however, no pump, made of any material, can forever withstand the destructive wear that occurs when constantly pumping sandy groundwater.

Determine the maximum depth of the well, and the drawdown level at the pump's maximum capacity. Pump selection and setting depth should be based on this data.

The inside diameter of the well casing should be checked to ensure that it is not smaller than the size of the pump and motor.

PRE-INSTALLATION CHECKLIST

B. Condition of the Water

Redi-Flo4 pumps are designed for pumping cold groundwater that is free of air or gases. Decreased pump performance and life expectancy can occur if the groundwater is not cold or contains air or gases.

C. Installation Depth

Pumping sand or well sediment can occur when the pump motor is installed lower than the top of the well screen or within five feet of the well bottom. This can reduce the performance and life expectancy of the pump and should be avoided.

If the pump is to be installed in a lake, containment pond, tank or large diameter well, the water velocity passing over the motor must be sufficient to ensure proper motor cooling. The minimum recommended water flow rates which ensure proper cooling are listed in Table A.

D. Electrical Supply

The motor voltage, phase and frequency indicated on the motor nameplate should be checked against the actual electrical supply.

WIRE CABLE TYPE

The wire cable used between the pump and control box or panel should be approved for submersible pump applications. The conductor insulation should have a continuous Teflon® jacket with no splices and must be suitable for use with submersible pumps.

INSTALLATION

The riser pipe or hose should be properly sized and selected based on estimated flow rates and friction-loss factors.

A back-up wrench should be used when the riser pipe is attaching a riser pipe or metallic nipple to the pump. The pump should only be gripped by the flats on the top of the discharge chamber. **The body of the pump, cable guard or motor should not be gripped under any circumstance.**

If Steel Riser Pipe Is Used:

An approved pipe thread compound should be used on all joints. Make sure the joints are adequately tightened in order to resist the tendency of the motor to loosen the joints when stopping and starting.

When tightened, the first section of the riser pipe must not come in contact with the check valve retainer in the discharge chamber of the pump.

INSTALLATION

After the first section of the riser pipe has been attached to the pump, the lifting cable or elevator should be clamped to the pipe. **Do not clamp the pump.** When raising the pump and riser section, be careful not to place bending stress on the pump by picking it up by the pump-end only.

Make sure that the electrical cables are not cut or damaged in any way when the pump is being lowered in the well.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping or possible cable damage.

If Plastic or Flexible Riser Pipe Is Used:

Use the correct compound recommended by the pipe manufacturer or specific job specifications. Besides making sure that joints are securely fastened, the use of a torque arrester is recommended when using these types of pipe.

Do not connect the first plastic or flexible riser section directly to the pump. Always attach a metallic nipple or adapter into the discharge chamber of the pump. When tightened, the threaded end of the nipple or adapter must not come in contact with the check valve retainer in the discharge chamber of the pump.

The drop cable should be secured to the riser pipe at frequent intervals using an approved clip or tape to prevent sagging, looping and possible cable damage.

IMPORTANT - Plastic and flexible pipe tend to stretch under load. This stretching must be taken into account when securing the cable to the riser pipe.

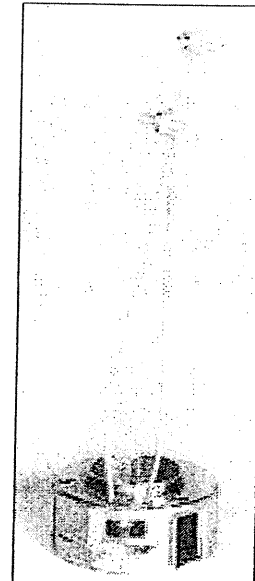
Leave enough slack between clips or taped points to allow for this stretching. This tendency for plastic and flexible pipe to stretch will also affect the calculation of the pump setting depth. If the depth setting is critical, check with the manufacturer of the pipe to determine how to compensate for pipe stretch.

When these types of pipe are used, it is recommended that a safety cable be attached to the pump to lower and raise it. The discharge piece of Redi-Flo4 submersibles is designed to accommodate this cable (Figure 4).

Protect the Well from Contamination

While installing the pump, proper care should be used not to introduce foreign objects or contaminants into the well. The well should be finished off above grade to protect against surface water from entering the well, causing contamination.

FIGURE 4



NOTE: Teflon® is a registered trademark of DuPont.

ELECTRICAL

WARNING: To reduce the risk of electrical shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit supplying the pump, to the grounding screw provided within the wiring compartment.

All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

Verification of the electrical supply should be made to ensure the voltage, phase and frequency match that of the motor. Motor voltage, phase, frequency and full-load current information can be found on the nameplate attached to the motor. Motor electrical data can be found in Table C.

If voltage variations are larger than $\pm 10\%$, do not operate the pump.

Direct on-line starting is used due to the extremely fast run-up time of the motor (0.1 second maximum), and the low moment of inertia of the pump and motor. Direct on-line starting current (locked rotor amp) is between 4 and 6.5 times the full-load current.

Engine-Driven Generators

If the Redi-Flo4 pump is going to be operated using an engine driven generator, we suggest the manufacturer of the generator be contracted to ensure the proper generator is selected and used. See Table B for generator sizing guide.

Control Box/Panel Wiring

Single-phase motors must be connected as indicated in the motor control box. A typical single-phase wiring diagram using a Grundfos control box is shown (Figure 5-A).

High Voltage Surge Arresters

A high voltage surge arrester should be used to protect the motor against lightning and switching surges. The correct voltage-rated surge arrester should be installed on the supply(line) side of the control box (Figure 5-B). **The arrester must be grounded in accordance with the National Electric Code, local codes and regulations.**

FIGURE 5-A

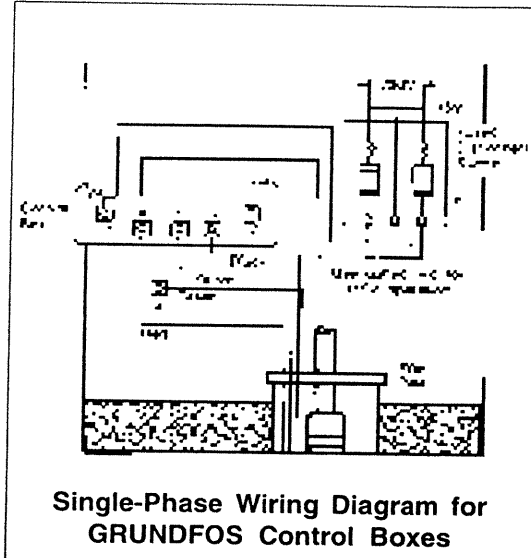
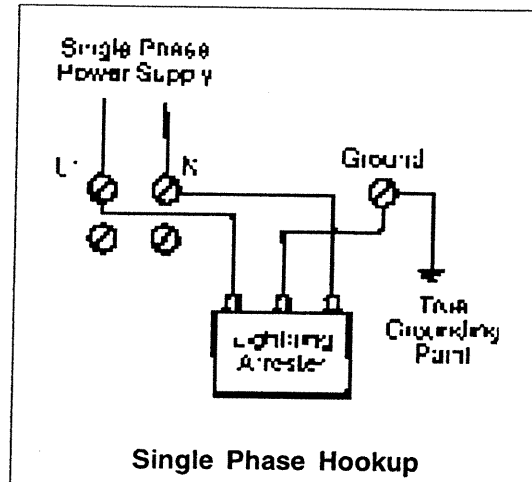


FIGURE 5-B



ELECTRICAL

Control Box and Surge Arrester Grounding

The control box shall be permanently grounded in accordance with the National Electrical Code and local codes or regulations. The ground wire should be a bare copper conductor at least the same size as the drop cable wire size. The ground wire should be run as short a distance as possible and be securely fastened to a true grounding point.

True grounding points are considered to be: a grounding rod driven into the water strata, steel well casing submerged into the water lower than the pump setting level, and steel discharge pipes without insulating couplings. If plastic discharge pipe and well casing are used, a properly sized bare copper wire should be connected to a stud on the motor and run to the control panel. Do not ground to a gas supply line. Connect the grounding wire to the ground point first and then to the terminal in the control box or panel.

Wiring Checks

Before making the final wiring connections of the drop cable to the control box terminal, it is a good practice to check the insulation resistance to ensure that the cable is good. Measurements for a new installation must be at least 1,000,000 ohm. Do not start the pump if the measurement is less than this. If it is higher, finish wiring and verify that all electrical connections are made in accordance with the wiring diagram. Check to ensure the control box and high voltage surge arrester have been grounded.

START-UP

After the pump has been set into the well and the wiring connections have been made, the following procedures should be performed:

- A. Attach a temporary horizontal length of pipe with installed gate valve to the riser pipe.
- B. If required, make provisions to capture discharged fluids for disposal.
- C. Adjust the gate valve one-third open.
- D. Start the pump and let it operate until the water runs clear of sand and silt.
- E. As the water clears, slowly open the gate valve in small increments until the desired flow rate of clear water is reached. The pump should not be operated beyond its maximum flow rating and should not be stopped until the groundwater runs clear.
- F. If the groundwater is clean and clear when the pump is first started, the valve should still be opened until the desired flow rate is reached.
- G. Disconnect the temporary piping arrangements and complete the final piping connections.
- H. **Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed.** This can result in motor damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.
- I. Start the pump and test the system. Check and record the voltage and current draw on each motor lead.

OPERATION

- A. The pump and system should be periodically checked for water quantity, pressure, drawdown, periods of cycling, and operation of controls. **Under no circumstances should be the pump be operated for any prolonged periods of time with the discharge valve closed.** This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.
- B. If the pump fails to operate, or there is a loss of performance, refer to Troubleshooting, Section 7.

TROUBLESHOOTING

The majority of problems that develop with submersible pumps are electrical, and most of these problems can be corrected without pulling the pump from the well. The following charts cover most of the submersible service work. As with any troubleshooting procedure, start with the simplest solution first; always make all the above-ground checks before pulling the pump from the well.

Usually only two instruments are needed – a combination voltmeter/ammeter, and an ohmmeter. These are relatively inexpensive and can be obtained from most water systems suppliers.

WHEN WORKING WITH ELECTRICAL CIRCUITS, USE CAUTION TO AVOID ELECTRICAL SHOCK. It is recommended that rubber gloves and boots be worn and that care is taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well. **WARNING:** Submersible motors are intended for operation in a well. When not operated in a well, failure to connect motor frame to power supply ground may result in serious electrical shock.

TROUBLESHOOTING

Preliminary Tests

SUPPLY VOLTAGE



How to Measure

By means of a voltmeter, which has been set to the proper scale, measure the voltage at the control box. On single-phase units, measure between line and neutral.

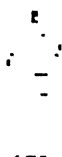
What it Means

When the motor is under load, the voltage should be within $\pm 10\%$ of the nameplate voltage. Larger voltage variation may cause winding damage.

Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected.

If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.

CURRENT MEASUREMENT



How to Measure

By use of an ammeter, set on the proper scale, measure the current on each power lead at the control box. See the Electrical Data, Table C, for motor amp draw information.

Current should be measured when the pump is operating at a constant discharge pressure with the motor fully loaded.

What it Means

If the amp draw exceeds the listed service factor amps (SFA), check for the following:

1. Loose terminals in control box or possible cable defect. Check winding and insulation resistances.
3. Too high or low supply voltage.
4. Motor windings are shorted.
5. Pump is damaged causing a motor overload.

WINDING RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box. Using an ohmmeter, set the scale selectors to Rx1 for values under 10 ohms and Rx10 for values over 10 ohms.

Zero-adjust the meter and measure the resistance between leads. Record the values.

Motor resistance values can be found in Electrical Data, Table C. Cable resistance values are in Table D.

What it Means

If all the ohm values are normal, and the cable colors correct, the windings are not damaged. If any one ohm value is less than normal, the motor may be shorted. If any one ohm value is greater than normal, there is a poor cable connection or joint. The windings or cable may also be open. If some of the ohm values are greater than normal and some less, the drop cable leads are mixed. To verify lead colors, see resistance values in Electrical Data, Table C.

INSULATION RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box. Using an ohm or mega ohmmeter, set the scale selector to Rx 100K and zero-adjust the meter.

Measure the resistance between the lead and ground (discharge pipe or well casing, if steel).

What it Means

For ohm values, refer to table below. Motors of all Hp, voltage, phase and cycle duties have the same value of insulation resistance.

TROUBLESHOOTING CHART

OHM VALUE	MEGAOHM VALUE	CONDITION OF MOTOR AND LEADS
2,000,000 (or more)	2.0	Motor not yet installed: New Motor.
1,000,000 (or more)	1.0	Used motor which can be reinstalled in the well.
500,000 - 1,000,000	0.5 - 1.0	Motor in well (Ohm readings are for drop cable plus motor): A motor in reasonably good condition.
20,000 - 500,000	0.02 - 0.5	A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason.
10,000 - 20,000	0.01 - 0.02	A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will still operate, but probably not for long.
less than 10,000	0 - 0.01	A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.

A. Pump Does Not Run

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. No power at pump panel.	Check for voltage at panel.	If no voltage at panel, check feeder panel for tripped circuits.
2. Fuses are blown or circuit breakers are tripped.	Remove fuses and check for continuity with ohmmeter.	Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation and motor must be checked.
3. Defective controls.	Check all safety and pressure switches for operation. Inspect contacts in control devices.	Replace worn or defective parts.
4. Motor and/or cable are defective.	Turn off power. Disconnect motor leads from control box. Measure the lead to lead resistances with the ohmmeter (Rx1). Measure lead to ground values with ohmmeter (Rx100K). Record measured values.	If open motor winding or ground is found, remove pump and recheck values at the surface. Repair or replace motor or cable.
5. Defective capacitor.	Turn off the power, then discharge capacitor. Disconnect leads and check with an ohmmeter (Rx100K). When meter is connected, the needle should jump forward and slowly drift back.	If there is no needle movement, replace the capacitor.

TROUBLESHOOTING CHART

B. Pump Runs But Does Not Deliver Water

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Groundwater level in well is too low or well is collapsed.	Check well draw-down.	Lower pump if possible. If not, throttle discharge valve and install water level control.
2. Integral pump check valve is blocked.	Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shut-off. After taking reading, open valve to its previous position. Convert PSI to feet. (For water: $\text{PSI} \times 2.31 \text{ ft/PSI} = \text{ft.}$), and add this to the total vertical distance from the pressure gauge to the water level in the well while the pump is running. Refer to the specific pump curve for the shut-off head for that pump model. If the measured head is close to the curve, pump is probably OK.	If not close to the pump curve, remove pump and inspect discharge section. Remove blockage, repair valve and valve seat if necessary. Check for other damage. Rinse out pump and reinstall.
3. Inlet strainer is clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and reinstall.
4. Pump is damaged.	Same as B.2 above.	If damaged, repair as necessary. Rinse out pump and re-install.

C. Pump Runs But at Reduced Capacity

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Draw-down is larger than anticipated.	Check drawdown during pump operation.	Lower pump if possible. If not, throttle discharge valve and install water level control.
2. Discharge piping or valve leaking.	Examine system for leaks.	Repair leaks.
3. Pump strainer or check valve are clogged.	Remove pump and inspect.	Clean, repair, rinse out pump and reinstall.
4. Pump worn.	Same as B.2 above.	If not close to pump curve, remove pump and inspect.

D. Pump Cycles Too Much

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Pressure switch is not properly adjusted or is defective.	Check pressure setting on switch and operation. Check voltage across closed contacts.	Re-adjust switch or replace if defective.
2. Level control is not properly set or is defective.	Check setting and operation.	Re-adjust setting (refer to manufacturer data.) Replace if defective.
3. Plugged snifter valve or bleed orifice.	Examine valve and orifice for dirt or corrosion.	Clean and/or replace if defective.

TROUBLESHOOTING CHART

E. Fuses Blow or Circuit Breakers Trip

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. High or low voltage.	Check voltage at pump panel. If not within $\pm 10\%$, check wire size and length of run to pump panel.	If wire size is correct, contact power company. If not, correct and/or replace as necessary.
2. Control box wiring and components.	Check that control box parts match the parts list. Check to see that wiring matches wiring diagram. Check for loose or broken wires or terminals.	Correct as required.
3. Defective capacitor.	Turn off power and discharge capacitor. Check using an ohmmeter (Rx100K). When the meter is connected, the needle should jump forward and slowly drift back.	If no meter movement, replace the capacitor.
4. Starting relay (Franklin single-phase motors only).	Check resistance of relay coil with an ohmmeter (Rx1000K). Check contacts for wear.	Replace defective relay.

TECHNICAL DATA

Table A

Minimum Water Flow Requirements for Submersible Pump Motors

MOTOR DIAMETER	CASING OR SLEEVE I.D. IN INCHES	MIN. FLOW PAST THE MOTOR (GPM)
4"	4	1.2
	5	7
	6	13
	7	21
	8	30

NOTES:

1. A flow inducer or sleeve must be used if the water enters the well above the motor or if there is insufficient water flow past the motor.
2. The minimum recommended water velocity over 4" motors is 0.25 feet per second.

Table B

Guide for Engine-Driven Generators in Submersible Pump Applications

MOTOR HP	MINIMUM KILOWATT RATING OF GENERATOR FOR THREE-WIRE SUBMERSIBLE PUMP MOTORS	
	EXTERNALLY REGULATED GENERATOR	INTERNALLY REGULATED GENERATOR
0.33 HP	1.5 KW	1.2 KW
0.50	2.0	1.5
0.75	3.0	2.0
1.0	4.0	2.5
1.5	5.0	3.0

NOTES:

1. Table is based on typical 80°C rise continuous duty generators with 35% maximum voltage dip during start-up of single phase motors.
2. Contact the manufacturer of the generator to assure the unit has adequate capacity to run the submersible motor.
3. If the generator rating is in KVA instead of kilowatts, multiply the above ratings by 1.25 to obtain KVA.

TECHNICAL DATA

Table C

Electrical Data – 60 Hz Submersible Pump Motors

GRUNDFOS MOTORS

HP	PH	VOLT	SER. FACT.	CIRC. BRK. OR STD. FUSE	DUAL ELEMENT FUSE	AMPERAGE			FULL LOAD		LINE-TO-LINE RESISTANCE (OHMS)	KVA CODE	MAX. THRUST (LBS)	GRUNDFOS PART NO.	
						FULL LOAD	LOCK ROTOR	S.F. AMPS	EFF.	POWER FACTOR					
											Blk-Yel	Red-Yel	**		
Delta															

4-Inch, Single Phase, 2-Wire Motors (control box not required)

1/3	1	230	1.75	15	5	3.4	25.7	4.6	59.0	77.0	6.8-8.2		S	770	79.952301
1/2	1	230	1.60	15	7	4.5	34.5	6.0	62.0	76.0	5.2-6.3		R	770	79.952302
3/4	1	230	1.50	20	9	6.9	40.5	8.4	62.0	75.0	3.2-3.8		N	770	79.952303
1	1	230	1.40	25	12	8.0	48.4	9.8	63.0	82.0	2.5-3.1		M	770	79.952304
1-1/2	1	230	1.30	35	15	10.0	62.0	13.1	64.0	85.0	1.9-2.3		L	770	79.952305

4-Inch, Single Phase, 3-Wire Motors

1/3	1	230	1.75	15	5	3.4	14.0	4.6	59.0	77.0	6.8-8.3	17.3-21.1	L	770	79.453301
1/2	1	230	1.60	15	7	4.5	21.5	6.0	62.0	76.0	4.7-5.7	15.8-19.6	L	770	79.453302
3/4	1	230	1.50	20	9	6.9	31.4	8.4	62.0	75.0	3.2-3.9	14-17.2	L	770	79.453303
1	1	230	1.40	25	12	8.0	38.0	9.8	63.0	82.0	2.6-3.1	10.3-12.5	K	770	79.453304
1-1/2	1	230	1.30	35	15	9.4	45.9	11.6	69.0	89.0	1.9-2.3	7.8-9.6	H	770	79.453305

FRANKLIN MOTORS

(refer to the Franklin Submersible Motors Application Maintenance Manual)

TECHNICAL DATA

Table D

Total Resistance of Drop Cable (OHMS)

The values shown in this table are for copper conductors. Values are for the total resistance of drop cable from the **control box to the motor and back**.

To determine the resistance:

1. Disconnect the drop cable leads from the control box.
2. Record the size and length of drop cable.
3. Determine the cable resistance from the table.
4. Add drop cable resistance to motor resistance. Motor resistances can be found in the Electrical Data Chart, Table C.
5. Measure the resistance between each drop cable lead using an ohmmeter. Meter should be set on Rx1 and zero-balanced for this measurement.
6. The measured values should be approximately equal to the calculated values.

Wire Resistances

DISTANCE FROM CONTROL BOX TO PUMP MOTOR (FT.)	12 AWG WIRE RESISTANCE (OHMS)	14 AWG WIRE RESISTANCE (OHMS)
10	0.03	0.05
20	0.06	0.10
30	0.10	0.15
40	0.13	0.21
50	0.16	0.26
60	0.19	0.31
70	0.23	0.36
80	0.26	0.41
90	0.29	0.46
100	0.32	0.51
110	0.36	0.57
120	0.39	0.62
130	0.42	0.67
140	0.45	0.72
150	0.49	0.77
160	0.52	0.82
170	0.55	0.87
180	0.58	0.93
190	0.62	0.98
200	0.65	1.03

NOTES

NOTES

LIMITED WARRANTY

Redi-Flo4 Environmental Pumps manufactured by GRUNDFOS PUMPS CORPORATION (GRUNDFOS) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS' manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

Grundfos Pumps Corporation
17100 W. 118th Terrace
Olathe, Kansas 66061
Telephone: (913) 227-3400
Fax: (913) 227-3500

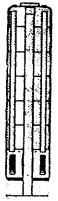
Grundfos Canada, Inc.
2941 Brighton Rd.
Oakville, Ontario L6H 6C9
Telephone: (905) 829-9533
Fax: (905) 829-9512

Bombas Grundfos de Mexico, S.A. de C.V.
Boulevard TLC #15, Parque Industrial Stiva Aeropuerto
C.P. 66600 Apodaca, N.L. Mexico
Telephone: 52-8-144-4000
Fax: 52-8-144-4010

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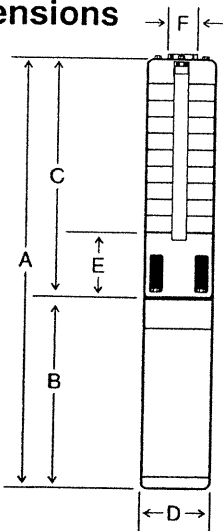
Submittal Data

3450 RPM
60 Hertz

	JOB or CUSTOMER:	
	ENGINEER:	
	CONTRACTOR:	
	SUBMITTED BY:	DATE:
	APPROVED BY:	DATE:
	ORDER NO:	DATE:
	SPECIFICATION REF:	

QUANTITY	TAG NO.	MODEL NO.	GPM	FEET	VOLT	PHASE	COMMENTS

Dimensions



Technical Data

FLOW RANGE: 1.2 to 7 U.S. GPM

MOTORS: Grundfos MS402E Environmental Submersible Motor (Standard)
 Maximum Operating Temperature: 104°F (40°C)
 Maximum Submergence Pressure: 220 PSI
 Maximum Number of Starts Per Hour: 100
 Minimum Recommended Flow Past Motor: 0.25 ft./sec.

(NOTE: Franklin Pollution Recovery motor is optional.)

DISCHARGE SIZE: 1" NPT

MATERIALS OF CONSTRUCTION: See reverse side.

INSTALLATION: Unit to be installed vertically for submerged operation.

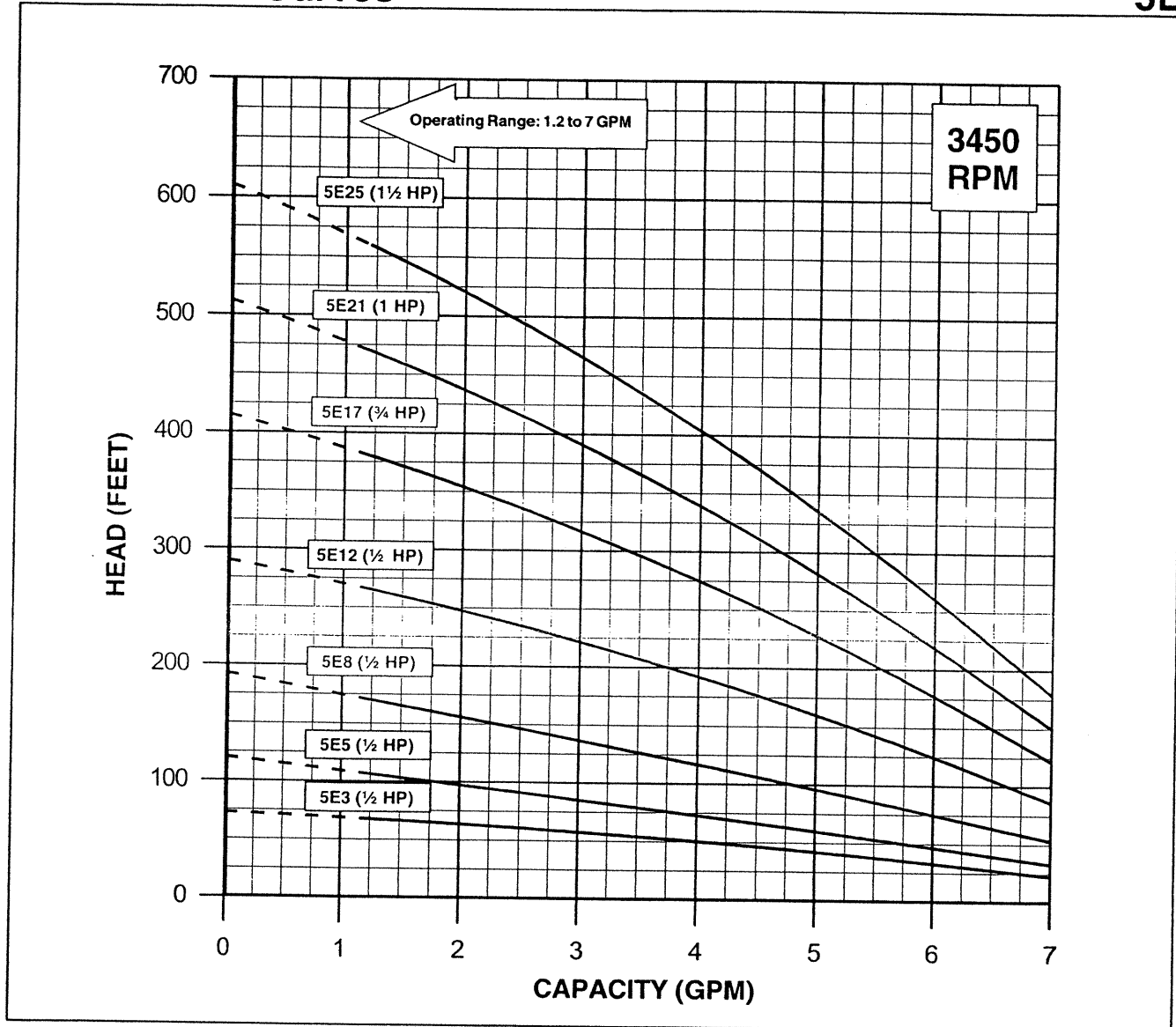
Electrical Data, Dimensions, and Weights ①

Pump Type	Motors				DIMENSIONS IN INCHES							
	HP	SF	PH	Volts	Overall Length A	Motor Length B	Pump End Length C	Max. Dia. D	Inlet E	Disch. Pipe Size (NPT) F	Net Weight (Lbs.) ^②	Ship. Weight (Lbs.) ^②
5E3	½	1.60	1	230	19 ⅞	10 ⅜	8 ⅞	3 ⅜	3 ¼	1	24	26
5E5	½	1.60	1	230	21 ⅞	10 ⅜	10 ⅞	3 ⅜	3 ¼	1	25	27
5E8	½	1.60	1	230	23 ⅞	10 ⅜	12 ¾	3 ⅜	3 ¼	1	27	28
5E12	½	1.60	1	230	26 ⅜	10 ⅜	16	3 ⅜	3 ¼	1	28	29
5E17	¾	1.50	1	230	31 ⅞	11 ⅞	20 ⅜	3 ⅜	3 ¼	1	31	32
5E21	1	1.40	1	230	35 ⅞	12	23 ⅞	3 ⅜	3 ¼	1	33	35
5E25	1 ½	1.30	1	230	40 ⅞	13 ⅞	26 ¾	3 ⅜	3 ¼	1	35	37

① Data for Grundfos MS402E motors. ② Does not include motor leads.

Performance Curves

5E



Materials of Construction

REDI-FLO4 PUMP END

Description	Material
Check Valve Housing, Check Valve, Diffuser Chamber, Impeller, Suction Interconnector, Inlet Screen, Pump Shaft, Straps, Cable Guard, Priming Inducer	304 SS
Check Valve Seat	304 SS & Teflon®
Impeller Seal Ring	Teflon®
Coupling	316/431 SS
Intermediate Bearings	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR LEADS

Description	Material
Connector Sleeve	304 SS
Connector Potting	Scotch Cast #4® Epoxy w/FPM Cap
Connector Plug	FPM
Lead Insulation	Teflon®
Conductor	Stranded Copper, 12 AWG

NOTES: Specifications are subject to change without notice.
Teflon® is a registered trademark of DuPont.
Scotch Cast #4® is a registered trademark of 3M Company.

GRUNDFOS ENVIRONMENTAL MOTOR

Description	Material
NEMA Top, Studs & Fasteners, Stator Housing, Fill Plug Screw	304 SS
Nuts	316 SS
Sand Slinger	FPM
Shaft Extension	431 SS
Diaphragm	FPM
Fill Plug Washer	Teflon®

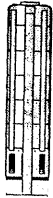
GRUNDFOS®

GRUNDFOS Pumps Corporation • 3131 N. Business Park Ave. Fresno, CA 93727
Customer Service Centers: Allentown, PA • Fresno, CA
Phone: (800)333-1366 • Fax: (800)333-1363
Canada: Oakville, Ontario • Mexico: Apodaca, N.L.

Submittal Data

3450 RPM

60 Hertz



JOB or CUSTOMER:

ENGINEER:

CONTRACTOR:

SUBMITTED BY:

DATE:

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DATE:

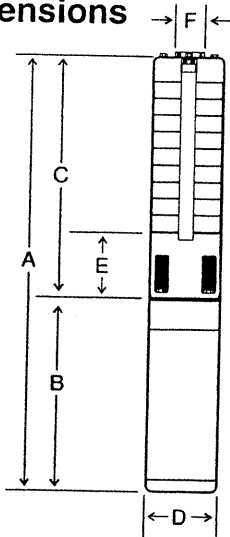
ORDER NO:

DATE:

SPECIFICATION REF:

QUANTITY	TAG NO.	MODEL NO.	GPM	FEET	VOLT	PHASE	COMMENTS

Dimensions



Technical Data

FLOW RANGE: 5 to 14 U.S. GPM

MOTORS: Grundfos MS402E Environmental Submersible Motor (Standard)
 Maximum Operating Temperature: 104°F (40°C)
 Maximum Submergence Pressure: 220 PSI
 Maximum Number of Starts Per Hour: 100
 Minimum Recommended Flow Past Motor: 0.25 ft./sec.

(NOTE: Franklin Pollution Recovery motor is optional.)

DISCHARGE SIZE: 1 1/4" NPT

MATERIALS OF CONSTRUCTION: See reverse side.

INSTALLATION: Unit to be installed vertically for submerged operation.

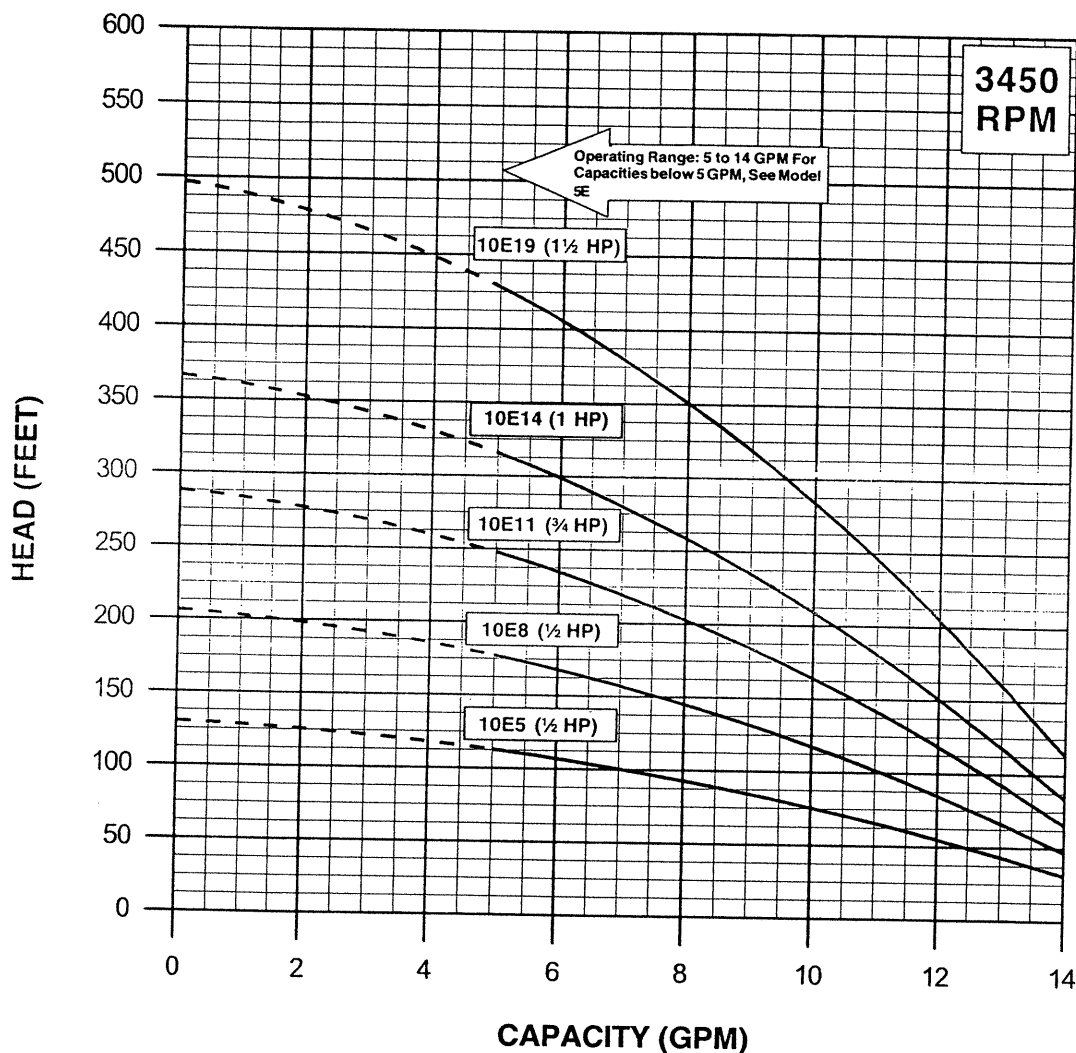
Electrical Data, Dimensions, and Weights †

Pump Type	Motors				DIMENSIONS IN INCHES							
	HP	SF	PH	Volts	Overall Length A	Motor Length B	Pump End Length C	Max. Dia. D	Inlet E	Disch. Pipe Size (NPT) F	Net Weight (Lbs.)¹	Ship. Weight (Lbs.)¹
10E5	1/2	1.60	1	230	21 1/8	10 13/16	10 5/16	3 31/32	3 1/4	1 1/4	25	26
10E8	1/2	1.60	1	230	23 5/16	10 13/16	12 3/4	3 31/32	3 1/4	1 1/4	26	28
10E11	3/4	1.50	1	230	26 5/16	11 3/8	15 3/16	3 31/32	3 1/4	1 1/4	28	30
10E14	1	1.40	1	230	29 11/16	12	17 11/16	3 31/32	3 1/4	1 1/4	31	32
10E19	1 1/2	1.30	1	230	35 3/8	13 5/16	21 13/16	3 31/32	3 1/4	1 1/4	35	37

† Data for Grundfos MS402E motors. † Does not include motor leads.

Performance Curves

10E



Materials of Construction

REDI-FLO4 PUMP END

Description	Material
Check Valve Housing, Check Valve, Diffuser Chamber, Impeller, Suction Interconnector, Inlet Screen, Pump Shaft, Straps, Cable Guard, Priming Inducer	304 SS
Check Valve Seat	304 SS & Teflon®
Impeller Seal Ring	Teflon®
Coupling	316/431 SS
Intermediate Bearings	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR

Description	Material
NEMA Top, Studs & Fasteners, Stator Housing, Fill Plug Screw	304 SS
Nuts	316 SS
Sand Slinger	FPM
Shaft Extension	431 SS
Diaphragm	FPM
Fill Plug Washer	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR LEADS

Description	Material
Connector Sleeve	304 SS
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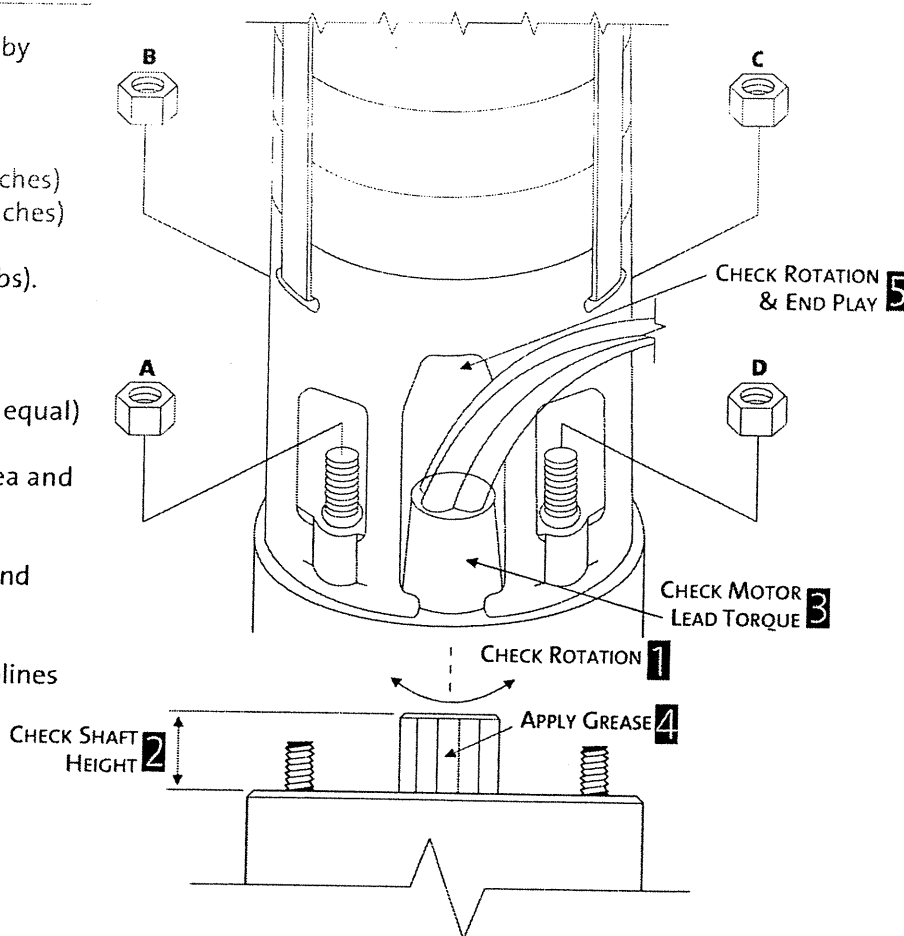
FIELD INSTALLATION INSTRUCTIONS

Submersible 4-inch Motor Attachment Procedure for Franklin Electric

IMPORTANT

Perform procedure with the motor and pump in the vertical, shaft-up position.

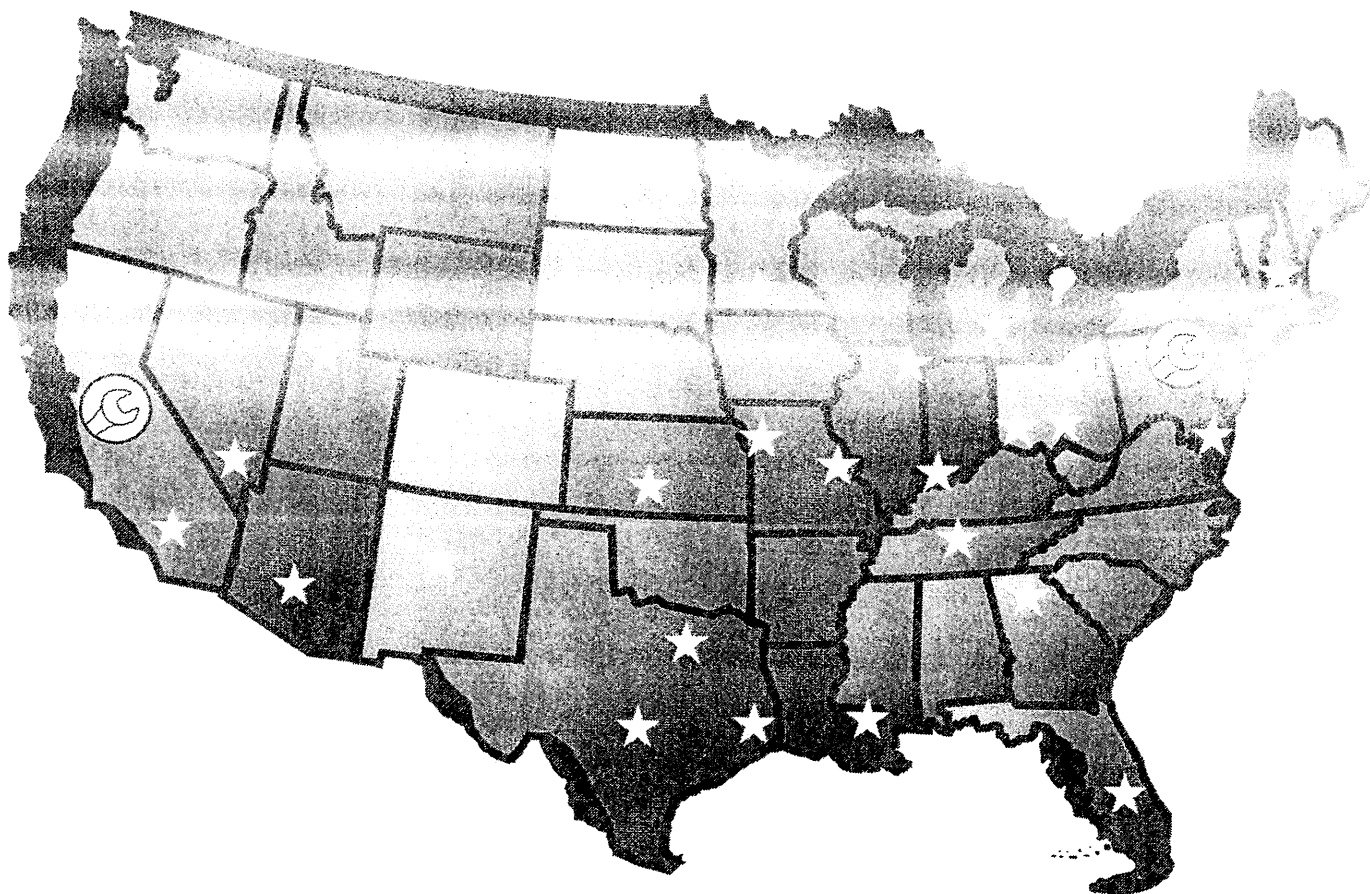
1. Check motor shaft rotation (spin by hand to ensure free rotation).
2. Check motor shaft height.
 - Minimum: 38.05 mm (1.498 inches)
 - Maximum: 38.30 mm (1.508 inches)
3. Check motor lead torque (17.5 ft-lbs).
4. Apply non-toxic FDA approved waterproof grease (Mobil FM102, Texaco CYGNUS2661 or approved equal) to motor shaft splines to prevent abrasives from entering spline area and to prolong spline life.
5. Check pump shaft rotates freely and end play is free.
6. Place pump on motor and align splines for proper engagement.
7. Put nuts on motor studs. Tighten slowly and evenly in a diagonal pattern for proper shaft engagement. Torque to 13 ft-lbs. Tightening sequence B-D-C-A.
8. Pull motor lead to end of pump and install cable guard.





GRUNDFOS
AUTHORIZED
SERVICE CENTERS

When it comes to **SERVICE...**
We've got you covered!



AUTHORIZED
SERVICE CENTERS

BE > THINK > INNOVATE >

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GRUNDFOS AUTHORIZED SERVICE CENTERS

ARIZONA

Pioneer Equipment, Inc.
3738 E. Miami
Phoenix, AZ 85040
Phone: 602.437.4312
Fax: 602.437.0174
Products Serviced: C/I, HVAC, WS

CALIFORNIA

Barrett Engineered Pumps
1695 National Avenue
San Diego, CA 92170
Phone: 619.232.7867
Fax: 619.232.3029
Products Serviced: C/I, HVAC, WS/WW

CONNECTICUT

F. J. Smith/Blake Equip. Co., Inc.
41 Commerce Way
South Windsor, CT 06074
Phone: 860.528.6523
Fax: 860.528.8057
Products Serviced: C/I, HVAC, WW

FLORIDA (Orlando Area)

The Blumenauer Corporation
2708 Rew Circle
Ocoee, FL 34761
Phone: 407.555.7575
Fax: 407.656.8589
Products Serviced: C/I, HVAC, WS/WW

GEORGIA

Mayland Southern Pump & Pro.
1461 Ventura Dr.
Cumming, GA 30130
Phone: 770.888.6886
Fax: 770.888.6260
Products Serviced: C/I, HVAC, WS/WW

IDAHO

R.C. Worst Co.
625 Best Avenue
Coeur d'Alene, ID 83814
Phone: 208.664.2133
Fax: 208.667.8775
Products Serviced: C/I, HVAC, WS/WW

ILLINOIS

Metropolitan Industries, Inc.
37 Forestwood Drive
Romeoville, IL 60446-1343
Phone: 815.886.9200
Fax: 815.886.6369
Products Serviced: C/I, HVAC, WS/WW

TRAMCO Pump Co.

1500 W. Adams St.
Chicago, IL 60607
Phone: 312.243.5800
Fax: 312.243.0702
Products Serviced: C/I, HVAC

INDIANA

D & F Distributors
1144 Indy Court
Evansville, IN 47711
Phone: 812.867.2441
Fax: 812.867.6822
Products Serviced: C/I, HVAC, WS/WW

KANSAS

Lee Mathews Equipment, Inc.
633 E. Harry
Wichita, KS 67211
Phone: 316.267.4700
Fax: 316.267.4774
Products Serviced: C/I, HVAC, WS/WW

LOUISIANA

Thomas Pump & Machinery, Inc.
120 Industrial Dr.
Slidell, LA 70460
Phone: 504.649.3000
Fax: 504.649.4300
Products Serviced: C/I, HVAC

MASSACHUSETTS

Hayes Pump, Inc.
66 Old Powder Mill Rd.
West Concord, MA 01742
Phone: 978.369.5800
Fax: 978.369.8461
Products Serviced: C/I, HVAC

MARYLAND

Tate Engineering Systems, Inc.
1850 Carbon Center Ct.
Baltimore, MD 21227
Phone: 410.242.8600
Fax: 410.242.7777
Products Serviced: C/I, HVAC

MAINE

D. L. Thurrott, Inc.
84 Eastern Avenue
Waterville, ME 04901
Phone: 207.873.0860
Fax: 207.872.6069
Products Serviced: C/I, HVAC

MICHIGAN

HS/Buy Van Assoc., Inc.
56 S. Squirrel Rd.
Auburn Hills, MI 48326
Phone: 248.852.7610
Fax: 248.852.6657
Products Serviced: C/I, HVAC

MINNESOTA

PFC Equipment, Inc.
9366 Deerwood Lane
Maple Grove, MN 55369
Phone: 763.425.7890
Fax: 763.425.1132
Products Serviced: C/I, HVAC

MISSOURI

Industrial Process Equipment Co.
2800 Locust St.
St. Louis, MO 63103
Phone: 314.534.3100
Fax: 314.533.0022
Products Serviced: C/I, HVAC

Lee Mathews Equipment, Inc.
318 Broadway
Kansas City, MO 64105
Phone: 816.221.0650
Fax: 816.221.1998
Products Serviced: C/I, HVAC, WS/WW

NEW JERSEY

Hayes Pump, Inc.
295 Fairfield Avenue
Fairfield, NJ 07004
Phone: 973.808.0606
Fax: 973.808.7311
Products Serviced: C/I, HVAC

NEVADA

Precision Pump
4214 Bertson Dr.
Las Vegas, NV 89103
Phone: 702.873.1178
Fax: 702.873.1190
Products Serviced: C/I, HVAC, WS/WW

NEW MEXICO

TP Pump & Pipe Company
1824 Second St., NW
Albuquerque, N.M. 87125
Phone: 505.247.4036
Fax: 505.243.0308
Products Serviced: C/I, HVAC, WS/WW

NEW YORK

Quimby Equipment Co., Inc.
35 Central Ave.
E. Farmingdale, NY 11735
Phone: 516.454.8411
Fax: 516.454.8417
Products Serviced: C/I, HVAC, WW

OHIO

Ohio Transmission & Pump Co.
6500 Davis Ind Pkwy
Cleveland, OH 44139
Phone: 216.349.3900
Fax: 216.349.1031
Products Serviced: C/I, HVAC, WS

Ohio Transmission & Pump Co.
666 Parsons Avenue
Columbus, OH 43206
Phone: 614.445.9651
Fax: 614.445.8887
Products Serviced: C/I, HVAC, WS

Ohio Transmission & Pump Co.
Park 63, 400 Wright Dr.
Middletown, OH 45044
Phone: 513.539.8411
Fax: 513.539.6040
Products Serviced: C/I, HVAC, WS

RHODE ISLAND

D. L. Thurrott, Inc.
17 Powder Hill Rd.
Lincoln, RI 02865
Phone: 401.334.6880
Fax: 401.334.6881
Products Serviced: C/I, HVAC

TENNESSEE

D & F Distributors
2317 Cruzen St.
Nashville, TN 37211
Phone: 615.259.9090
Fax: 615.259.9095
Products Serviced: C/I, HVAC, WS

TEXAS

Automatic Pump & Equipment
7280 College St.
Beaumont, TX 77707
Phone: 409.866.2314
Fax: 409.886.6501
Products Serviced: C/I, HVAC, WS

Pierce Pump Company
3300 Dilido Rd.
Dallas, TX 75228
Phone: 214.320.3604
Fax: 214.328.5665
Products Serviced: C/I, HVAC

Vantage Pump & Compressor, Inc.
4712 Broom St.
San Antonio, TX 78217
Phone: 210.654.4501
Fax: 210.669.7032
Products Serviced: C/I, HVAC, WS/WW

UTAH

Delco Western
2559 S. 1935 W
Salt Lake City, UT 84119-2023
Phone: 801.972.0900
Fax: 801.972.1171
Products Serviced: C/I, HVAC, WS

NOTE:

Contact Authorized Service
Center for Pricing.

LEGEND:

C/I = Commercial/Industrial

HVAC = Heating, Ventilating, & Air
Conditioning

WS/WW = Water Services/Waste
Water

L-SR-TL-001 Rev. 4/04
PRINTED IN USA

GRUNDFOS Pumps Corporation
17100 W. 118th Terrace
Olathe, KS 66061
Telephone: 913.227.3400
Fax: 913.227.3500
www.grundfos.com

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Oakville, Ontario
L6H 6C9
Telephone: 905.829.9533
Fax: 905.829.9512

Bombas GRUNDFOS de Mexico S.A. de CV.
Boulevard TLC No. 15
Poligono Industrial Strva Aeropuerto
C.P. 66600 Apodilca, N.L. Mexico
Telephone: 01152918014-4000
Fax: 01152818144-4010

GRUNDFOS 



AIR WATER SEPARATOR PARTS LIST

File Name:

Parts List

Customer:

WHITMAN

Site Reference:

BRONX

Date:

8/18/2008

Reference	Qty	Units	Description	Material	Part Number
T-100, 200	2	each	55 GALLON EXTRA HIGH EFFICIENCY SEPARATOR WITH MANUAL DRAIN VALVE, 20" Hg MAX, LINED	16 GA STEEL	PLC-MDXX-WSD55-XXM
LS 100, LS 200	2	each	LEVEL SWITCH, VERTICAL, TRILEVEL SWITCHING, 2" FNPT TOP MOUNT, 25' SJOW CORD, BUNA-N FLOATS, STEEL BODY, 304SS SHAFT, WIRE CODE: GREEN = COMMON, RED = HHL (NC), WHITE = HL (NO), BLACK = LL (NO)	SS/STEEL/BU NA N	PLC-SDA0-MLS1N5-XXE1311- 15-25

Air/Water Separator Operation and Maintenance

SECTION INCLUDES

- 1.1 Application
- 1.2 Receiving and Unpacking
- 1.3 Tools required
- 1.4 Installation
- 1.5 Operation
- 1.6 Maintenance
- 1.7 Troubleshooting

1.1 APPLICATION

- a) Product Level Control's air/water separators are designed to remove water from moisture-laden air streams. Proper selection and sizing of your air/water separator will ensure effective operation and longevity
- b) Appurtenances required in addition to an air/water separator include:
 - i) High water level switch. The high level switch will shut down the airflow when the separator becomes full of water.
 - ii) Vacuum relief valve. The vacuum relief valve protects the separator from over pressurization.
 - iii) Inline filter. The inline filter protects downstream equipment from foreign particles.
- c) Air/water separator model number description:

	Vessel Type D-Low Vacuum Rated, flat head [up to 20" Hg vacuum use] R-High Vacuum Rated, flat head [rated for full vacuum] A-Air Receiver Tank, domed head [rated for full vacuum]
	Vessel Size, Nominal Gallons [Low Vacuum = 30, 55, 85, 110] [High Vacuum = 30 - 200] <i>custom sizes available for High Vacuum models only</i>
	Separation Technology S-Standard, Cyclonic C-High Efficiency, Cyclonic [99% efficient for 150 micron & larger droplets] M-Extra High Efficiency, Mist Eliminator [99.9% efficient for 50 micron & larger droplets]
	Flow, ICFM or ACFM <i>please request PLC's assistance if conversion is required</i>
	Operational Vacuum, Inches of Mercury Vacuum
	Options [Available to all models] GA-Gauge ST-Sight Tube TF-Tank Full Switch PC-Pump Control Level Switches XC-Protective Internal Coating BC-Ball Float Check Valve
MDXX-WS ____ -XX ____ - ____ - ____	

1.2 RECEIVING AND UNPACKING

- a) Upon receiving the unit, inspect carefully for any damage that may have occurred during shipment.
- b) Shipping damage claims must be filed with the carrier at time of delivery.

1.3 TOOLS REQUIRED

- i) No special tools are required to install the unit. Some separators can be heavy. Make sure you have appropriate equipment to place the separator in position.

1.4 INSTALLATION

- a) Secure separator to floor. Separator must be mounted vertically and secured to prevent movement during operation.
- b) Connect inlet and discharge piping to the separator. Inlet is horizontal while the outlet is on top. Use flexible couplings to avoid transferring vibration and stress to separator. Inlet and discharge piping must be secured such that the separator does not support the weight of the piping. Note: Keep in mind the weight of the pipe and its contents (air and water) when installing pipe supports.
- c) Install water level switch (es). This switch is either installed in a sight tube or directly through the wall of the separator. Install and wire switch according to manufacturer's instructions and local codes. Typically this switch is wired to a control panel to control either a transfer pump or shut the system down when the separator becomes full of water.
- d) Install and adjust vacuum relief valve according to manufacturer's instructions. Set the vacuum relief valve at the lowest of the following values: maximum vacuum rating of the vacuum blower, or maximum vacuum that can be applied to the separator. For separator models MDXX-WSR and MDXX-WSA, the vacuum relief valve can be set at full vacuum, or 28" mercury vacuum. For separator models MDXX-WSD (drum type), set the vacuum relief valve at 20" mercury vacuum. Note these are the maximum vacuum levels the separators can handle.
- e) In cold climates, prevent the separator from freezing. Catastrophic failures can occur if water in the separator or water in transmission piping freezes.

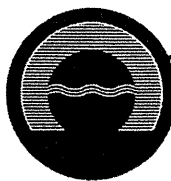
1.5 OPERATION

- a) Moisture-laden air enters the air/water separator through the horizontal inlet. After entering the separator, tangential forces created by cyclonic motion remove free moisture contained in the air stream. This separated moisture falls to the bottom of the separator as a liquid due to gravity. Air continues to swirl around the separator until it reaches the discharge at the top.
- b) Manually drain the separator by opening the drain valve. It may be necessary to turn off the vacuum blower in order to allow the water to drain from the separator. This water may be considered hazardous waste. Be sure to wear appropriate safety clothing and follow proper procedures for disposal. Some locations require this water to be treated before discharge.

- c) For systems with automatic water pump out: Water level switches will automatically operate the water transfer pump to empty the separator. Be sure the transfer pump is primed before operation. Also consult the transfer pump's literature for specific operating instructions. As stated above, this water may be hazardous. Follow above guidelines for disposal.

1.6 MAINTENANCE

- a) Product Level Control's air/water separators require minimal maintenance.
- b) Gain access to the interior of the separator through the removable lid or the clean out port. Lids are removed by removing the bolt and band at the top of the separator, remove discharge piping, and then remove the lid while being careful to prevent damage to the gasket. When reinstalling the lid, carefully place the gasket, ring, and tighten the bolt until the ends of the ring are $\frac{1}{4}$ " apart. While tightening the bolt, tap the band horizontally with a hammer on the side opposite the bolt. If lid leaks, bolt may be tightened slightly more and silicone can be applied to gasket.
- c) Periodically, a layer of sludge may form on the bottom of the separator. Remove the top lid of the separator and remove the sludge with water. Remember this sludge may be considered hazardous so be sure to wear appropriate safety clothing. If the separator does not contain a removable lid, gain access through the clean out port located on the side of the separator and remove the sludge as indicated above.
- d) If your separator contains a high efficiency demister, periodically check the pressure drop across the separator. If the pressure drop increases to an unacceptable value, or when the separator's performance decreases, remove the demister and clean with an appropriate solution. Do not unwrap the demister. If the demister is unwrapped and then rewrapped, performance will be sacrificed.
- e) Periodically, consult the maintenance instructions for the vacuum relief valve. Also, verify the vacuum setting in order to protect the separator.



Product Level Control

Instrumentation Multi-Level Switch

Product Level Control manufactures our own line of treatment sensors, custom-equipped for optimal on-site performance. By offering flexible product designs with a wide range of available options, we meet your individual project goals for the best possible value.

FEATURES

Constructed to meet client specifications

Design allows up to 5 level points on a single assembly — float intervals defined by customer

Various materials of construction allow for chemical resistance to contaminants

Delivered fully assembled

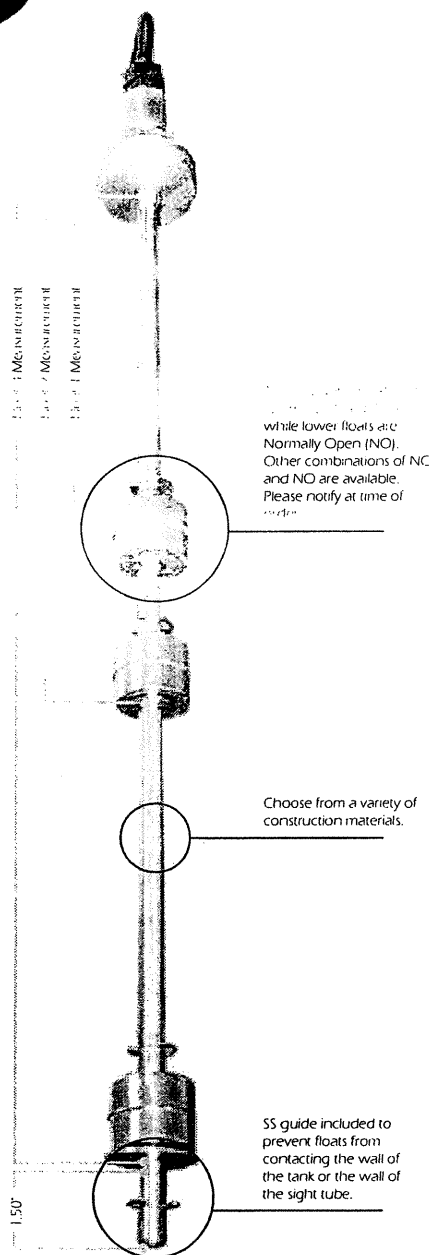
1-year warranty

ELECTRICAL SPECIFICATIONS

- Maximum contact rating of 15 watts
- Maximum switching voltage of 250 VDC
- Maximum switching current of 3 amps
- Typical life of 10⁶
- Single pole, single throw switch (SPST)
- 18 gauge stranded copper conductors
- Wire coding: Green (Common), Red (HHL, NC), White (HL, NO), Black (LL, NO)

MECHANICAL SPECIFICATIONS

- Maximum pressure rating of 50 PSI
- Minimum specific gravity rating of 0.61
- Length up to 72"
- Diameter equals 1.78"



PROCESS OF OPERATION

Used in conjunction with a control panel, three floats set at different intervals on a single rod operate together to control a transfer pump. When liquid levels reach the high float, the pump activates until liquid is pumped below the low float. The uppermost float acts as a tank full sensor to prevent overflow.

PLC PERSONALIZED ORDERING NUMBER

Cord Length 0-N/A 1-25' 2-50' 3-75' 4-100'	Body Type 3-PVC 4-CPVC 5-Brass 6-Steel	Mounting Thread E-2" MNPT F-3" MNPT G-4" MNPT	Float Quantity 1-1 2-2 3-3 4-4 5-5
Cord Type 0-NEMA 4 JBox S-SJOW	Float Type 2-316SS N-Buna N	Rod Type 1-304SS 2-316SS 5-Brass	Float Location(s)* (in inches) *required for each float

SDXX-A0 - - - - -XX

ATTACHMENT 3

SITE SPECIFIC SVE OFF-GAS AIR DISCHARGE LIMITS PER AG-1/DAR-1

97-09-10
Dexter Contaminant List
DAR 1 - Site Specific Limits for Compounds Identified/Detected

Based on PPB shown should be < or = to standard				Based on PPB shown should be < or = to standard				Based on PPB shown should be < or = to standard			
Site Limit (except those in Green see below)				Site Limit (except those in Green see below)				Site Limit (except those in Green see below)			
Possible Contaminants	SGC Limit (ppb)	SGC Limit (ppm)	SGC Limit (ug/m ³)	SGC Standard (ug/m ³)	AGC Limit (ppb)	AGC Limit (ppm)	AGC Limit (ug/m ³)	AGC Standard (ug/m ³)	AGC Results (lb/hr) @ 300 scfm	AGC Results (lb/day) @ 300 cfm	AGC Results (lb/yr) @ 300 cfm
Benzene	405	0.405	1297.017	1300.00	0.04	0.00004	0.128	0.13	0.00000015	0.000003	0.0013
Methylene chloride	4,000	4	13951.480	14000.00	0.6	0.0006	2.093	2.10	0.00000237	0.000007	0.0208
1,4-Dichlorobenzene*	75,000	75	452025.000	452025.00	0.0140	0.000014	0.0844	0.09	0.00000010	0.000002	0.0008
1,2-Dichlorobenzene	4,900	4.9	29532.300	30000.00	59.0000	0.059	355.5930	360.00	0.00040340	0.009681	3.5337
1,3-Dichlorobenzene	4,900	4.9	29532.300	30000.00	59.0000	0.059	355.5930	360.00	0.00040340	0.009681	3.5337
Vinyl chloride	70,000	70	179977.700	180000.00	0.0400	0.00004	0.1028	0.11	0.00000012	0.000003	0.0010
1,2-Dichloroethane*	4.80	0.0048	19.530	20.00	0.0090	0.000009	0.0366	0.038	0.00000004	0.000001	0.0004
Chrysene*	10.5	0.0105	98.275	100.00	0.002	0.000002	0.018	0.02	0.00000002	0.000001	0.0002
Carbon Disulfide	1987.12	1.99	6200.000	6200.00	224.35	0.224351784	700.000	700.00	0.00079410	0.019058	6.9563
Chloroform	30.64	0.03	150.000	150.00	0.01	8.78376E-06	0.043	0.0430	0.00000005	0.000001	0.0004
cyclohexane*	304153.87	304.15	1050000.000	1050000.00	1738.02	1.738022131	6000.000	6000.00	0.00680658	0.163358	59.6256
n-dodecane*	142.63	0.14	1000.000	1000.00	142.63	0.142633005	1000.000	1000.00	0.00113443	0.027226	9.9376
n-hexane*	50930.90	50.93	180000.000	180000.00	198.06	0.198064626	700.000	700.00	0.00079410	0.019058	6.9563
4-Methyl-2-pentanone (MIBK)	49900.20	49.90	205000.000	205000.00	49900.20	49.9001996	205000.000	205000.00	0.23265814	5.581395	2037.2093
Trichloroethylene	2598.66	2.60	14000.000	14000.00	0.09	9.28091E-05	0.500	0.50	0.00000057	0.000014	0.0050
Pentane*	118235.25	118.24	350000.000	350000.00	1418.82	1.418823052	4200.000	4200.00	0.00476461	0.114351	41.7379
Tetrachloroethylene	147.11	0.15	1000.000	1000.00	0.15	0.000147106	1.000	1.00	0.00000113	0.000027	0.0009
n-Undecane*	155.35	0.16	1000.000	1000.00	155.35	0.155351872	1000.000	1000.00	0.00113443	0.027226	9.9376
Naphthalene	1,503	1.503	7898.220	7900.00	0.56	0.00056	2.94	3.00	0.00000334	0.000080	0.0292
1,2,4-Trichlorobenzene**	497	0.497	3697.610	3700.00	497	0.497	3698	3700.00	0.00419468	0.100872	36.7454
1-Butanol*	49,300	49.3	149818.756	150000.00	493	0.493	1498	1500.00	0.00169959	0.040790	14.8884
Acetone	75,500	75.5	179786.640	180000.00	11.700	11.7	27861	28000.00	0.03160633	0.758552	276.8714
n-Butane*	796,000	796	1895804.320	1900000.00	23.900	23.9	56952	57000.00	0.06460781	1.550588	565.9645
2-Butanone (MEK)*	199,000	199	588345.490	590000.00	199.000	199	588345	590000.00	0.66743674	16.018482	5846.7459
Chlorobenzene*	75,500	75.5	348429.480	350000.00	23	0.023	106	110.00	0.00012041	0.002890	1.0548
Chlorodifluoromethane*	1,000,000	1000	3463270.000	3500000.00	14.300	14.3	49525	50000.00	0.05618237	1.348377	492.1576
Chloroethane*	970000	970	2565960.400	2600000.00	3750	3.75	9920	10000.00	0.01125349	0.270084	98.5806
n-Decane*	120	0.12	700.018	700.00	120	0.12	700	700.00	0.00079412	0.019059	6.9565
cis-1,2-Dichloroethene*	195000	195	775035.300	790000.00	15	0.015	60	63.00	0.00006763	0.001623	0.5925
1,2-Dichloropropane*	75000	75	347444.250	347444.25	75000	75	347444	347444.00	0.39415116	9.459628	3452.7642
Ethylbenzene*	12400	12.4	53976.828	54000.00	229	0.229	997	1000.00	0.00113083	0.027140	9.9061
n-Heptane*	50000	50	205410.000	210000.00	949	0.949	3899	3900.00	0.00442278	0.106147	38.7436
Cumene*	49000	49	241461.710	245000.00	81	0.081	399	400.00	0.00045281	0.010867	3.9666
Methanol	25000	25	32841.000	33000.00	3000	3	3941	4000.00	0.00447070	0.107297	39.1633
Nonane*	198000	198	1041214.680	1050000.00	4750	4.75	24979	25000.00	0.02833651	0.680076	248.2278
n-Octane*	74000	74	346573.820	350000.00	700	0.7	3278	3300.00	0.00371912	0.089259	32.5795
n-Propylbenzene*	202	0.202	995.414	1000.00	202	0.202	995.414	1000.00	0.00112923	0.027101	9.8920
Toluene	9700	9.7	36644.078	37000.00	1300	1.3	4911	5000.00	0.00557126	0.133710	48.8042
1,2,4-Trimethylbenzene*	25000	25	123194.750	125000.00	58	0.058	288	290.00	0.00032423	0.007782	2.8403
1,3,5-Trimethylbenzene*	25000	25	123194.750	125000.00	58	0.058	288	290.00	0.00032423	0.007782	2.8403
m-Xylene & p-Xylene	987	0.987	4296.381	4300.00	22	0.022	96	100.00	0.00010864	0.002607	0.9517
Benzyl chloride	46.24	0.046	240.000	240.00	0.0039	3.85312E-06	0.020	0.02	0.00000002	0.000001	0.0002
o-Xylene	987	0.987	4296.381	4300.00	22	0.022	96	100.00	0.00010864	0.002607	0.9517
Total	4595244.272	4595.244272			394065.9636	394.0659636					

* - No SGC and/or AGC standard listed, as per DAR-1, derived from lower of TLV, MEL, TWA or STEL, or assumed default of 1 mg/m3 if no data available

** - TVL is greater than SGC, so default AGC=SGC

Building height is assumed at 30 feet

ug/M3 = ppbv X Mol weight / X 0.041

At STP

Basic Building cavity Impact Model used

Cc= Annual building cavity impact - (1.72 X lbs per year) / building height*2

Ccst= Short term building cavity impact = 90,400 X lbs per hour) / building height*2

No cavity impacts above SGC standards when SGC limits are used, however, impacts are identified above AGC where colored red when SGC limits are used
Therefore, SGC levels cannot be used for them (benzene, 1,4-dichlorobenzene, vinyl chloride, TCE and n-propylbenzene)

SGC levels can be used for all others

The below table lists calculated levels to be used for those constituents

Site limits for these constituents are below (SGC Limit)				Site limits for these constituents are below (SGC Limit)				Site limits for these constituents are below (SGC Limit)			
Possible Contaminants	SGC Limit (ppb)	SGC Limit (ppm)	SGC Limit (ug/m ³)	SGC Standard (ug/m ³)	AGC Limit (ppb)	AGC Limit (ppm)	AGC Limit (ug/m ³)	AGC Standard (ug/m ³)	AGC Results (lb/hr) @ 300 scfm	AGC Results (lb/day) @ 300 cfm	AGC Results (lb/yr) @ 300 cfm
Benzene	355	0.355	1136.891	1300.00	0.04	0.00004	0.128	0.13	0.00000015	0.000003	0.0013
1,4-Dichlorobenzene*	131	0.131	789.537	452025.00	0.0140	0.000014	0.0844	0.09	0.00000010	0.000002	0.0008
Vinyl chloride	375	0.375	964.166	180000.00	0.0400	0.00004	0.1028	0.11	0.00000012	0.000003	0.0010
n-Propylbenzene*	177	0.177	872.219	1000.00	202	0.202	995.414	1000.00	0.00112923	0.027101	9.8920
Trichloroethylene	811	0.811	4369.181	14000.00	0.09	9.28091E-05	0.500	0.50	0.00000057	0.000014	0.0050

97-09-10
Dexter Contaminant List
DAR 1 - Site Specific Limits for Compounds Identified/Detected

							Building height is 27-29 feet, 30 feet is assumed (conservative)		Building Cavity Impact Analysis (Based on AGC)		Building Cavity Impact Analysis (based on SGC)	
							Compare to AGC Limit (Should be less than AGC Limit)		Compare to AGC Limit (Should be less than AGC Limit)		Compare to SGC Limit (Should be less than SGC Limit)	
							No cavity impacts above AGC standards when AGC limit is used					
SGC Results (lb/hr) @ 300 scfm	SGC Results (lb/day) @ 300 cfm	SGC Results (lb/yr) @ 300 cfm	SGC Standard (ug/m3)	AGC Standard (ug/m ³)	Molecular Weight	Stack Height (ft) - Min.	Cc (ug/m ³)	Ccst (ug/m ³)	Cc (ug/m ³)	Ccst (ug/m ³)	Cc (ug/m ³)	Ccst (ug/m ³)
0.00147137	0.035313	12.8892	1300.00	0.13	78.11	32	0.000002	0.000015	0.024633	0.147731	0.024633	0.147731
0.01582698	0.379847	138.6443	14000.00	2.10	85.07	32	0.000040	0.000238	0.264965	1.589732	0.264965	1.589732
0.51279070	12.306977	4492.0465	452025.00	0.09	147	32	0.000002	0.000010	8.584800	51.506977	8.584800	51.506977
0.03350233	0.804056	293.4804	30000.00	360.00	147	32	0.006753	0.040519	0.560874	3.365122	0.560874	3.365122
0.03350233	0.804056	293.4804	30000.00	360.00	147	32	0.006753	0.040519	0.560874	3.365122	0.560874	3.365122
0.20417209	4.900130	1788.5475	180000.00	0.11	62.71	32	0.000002	0.000012	3.418113	20.507952	3.418113	20.507952
0.00002216	0.000532	0.1941	20.00	0.038	99.24	32	0.000001	0.000004	0.000371	0.002225	0.000371	0.002225
0.00011149	0.002676	0.9766	100.00	0.02	228.28	32	0.0000038	0.000002	0.001865	0.011198	0.001865	0.011198
0.00703347	0.168803	61.6132	6200.00	700.00	76.1	32	0.013294	0.079763	0.117750	0.706473	0.117750	0.706473
0.00017016	0.004084	1.4906	150.00	0.0430	119.4	32	0.000001	0.000005	0.002849	0.017092	0.002849	0.017092
1.19115145	28.587635	10434.4867	1050000.00	6000.00	84.2	32	0.113951	0.683683	19.541483	119.644545	19.541483	119.644545
0.00113443	0.027226	9.9376	1000.00	1000.00	171	32	0.018992	0.113947	0.018992	0.113947	0.018992	0.113947
0.20419739	4.900737	1788.7691	180000.00	700.00	86.2	32	0.013294	0.079763	3.418537	20.510493	3.418537	20.510493
0.23255814	5.581395	2037.2093	205000.00	205000.00	100.2	32	3.893333	23.359173	3.893333	23.359173	3.893333	23.359173
0.01588202	0.381168	139.1265	14000.00	0.50	131.4	32	0.000009	0.000057	0.265886	1.593261	0.265886	1.593261
0.39705048	9.529212	3478.1622	350000.00	4200.00	72.2	32	0.079765	0.478578	6.647154	39.881515	6.647154	39.881515
0.00113443	0.027226	9.9376	1000.00	1.00	165.8	32	0.000019	0.000114	0.018992	0.113947	0.018992	0.113947
0.00113443	0.027226	9.9376	1000.00	1000.00	157	32	0.018992	0.113947	0.018992	0.113947	0.018992	0.113947
0.00895998	0.215039	78.4894	7900.00	3.00	128.17	32	0.000456	0.000335	0.150002	0.899980	0.150002	0.899980
0.00419468	0.100672	36.7454	3700.00	3700.00	74.12	32	0.070225	0.421332	0.070225	0.421332	0.070225	0.421332
0.16995888	4.079013	1488.8398	150000.00	1500.00	181.46	32	0.026453	0.170714	2.845338	17.071426	2.845338	17.071426
0.20395535	4.894928	1786.6489	180000.00	28000.00	58.12	32	0.529132	3.174680	3.414484	20.486182	3.414484	20.486182
2.15179163	51.642999	18849.6947	1900000.00	45000.00	58.12	32	1.081621	6.489495	38.023861	218.135515	38.023861	218.135515
0.86743674	16.018492	5846.7459	590000.00	5000.00	72.11	32	11.173781	67.040313	11.173781	67.040313	11.173781	67.040313
0.39526884	9.486452	3462.5550	350000.00	110.00	112.56	32	0.002018	0.012095	6.617327	39.702659	6.617327	39.702659
3.92883721	94.292093	34416.6140	3500000.00	50000.00	84.47	32	0.940568	5.643207	65.773973	394.629871	65.773973	394.629871
2.91090233	69.861656	25499.5044	2600000.00	10000.00	64.52	32	0.188398	1.130350	48.732366	292.363967	48.732366	292.363967
0.00079412	0.019059	6.9565	700.00	200.00	142.28	32	0.013295	0.079765	0.013295	0.079765	0.013295	0.079765
0.87922326	21.101358	7701.9957	790000.00	1900.00	96.94	32	0.001132	0.006793	14.719370	88.313091	14.719370	88.313091
0.39415116	9.459628	3452.7642	347444.25	347444.00	112.99	32	6.598616	39.590295	6.598616	39.590295	6.598616	39.590295
0.06123293	1.469590	536.4005	54000.00	1000.00	106.17	32	0.018932	0.113586	1.025121	6.150508	1.025121	6.150508
0.23302326	5.592558	2041.2837	210000.00	3900.00	100.2	32	0.074043	0.444244	3.901120	23.403891	3.901120	23.403891
0.27392140	6.574113	2399.5514	245000.00	400.00	120.19	32	0.007581	0.045482	4.585809	27.513882	4.585809	27.513882
0.03725581	0.894140	326.3609	33000.00	4000.00	32.04	32	0.074845	0.449057	0.623712	3.742140	0.623712	3.742140
1.18118512	28.348443	10347.1816	1050000.00	25000.00	128.26	32	0.474391	2.846245	19.774914	118.643483	19.774914	118.643483
0.39316372	9.435929	3444.1142	350000.00	3300.00	114.23	32	0.062263	0.373585	6.582085	39.491112	6.582085	39.491112
0.00112923	0.027101	9.8920	1000.00	0.10	120.19	32	0.018905	0.113425	0.018905	0.113425	0.018905	0.113425
0.04157014	0.997683	364.1544	37000.00	400.00	92.14	32	0.093270	0.589602	0.695940	4.175490	0.695940	4.175490
0.13975581	3.354140	1224.2609	125000.00	290.00	120.19	32	0.005428	0.032587	2.336699	14.037895	2.336699	14.037895
0.13975581	3.354140	1224.2609	125000.00	290.00	120.19	32	0.005428	0.032587	2.336699	14.037895	2.336699	14.037895
0.00487394	0.116975	42.6957	4300.00	100.00	106.17	32	0.001819	0.010912	0.081596	0.489561	0.081596	0.489561
0.00027226	0.006534	2.3850	240.00	0.02	126.6	32	0.0000038	0.000002	0.004558	0.027347	0.004558	0.027347
0.00487394	0.116975	42.6957	4300.00	100.00	106.17	32	0.001819	0.010912	0.081596	0.489561	0.081596	0.489561

All results now comply for both AGC and SGC limits
for building cavity impacts

SGC Results (lb/hr) @ 300 scfm	SGC Results (lb/day) @ 300 cfm	SGC Results (lb/yr) @ 300 cfm	SGC Standard (ug/m3)	AGC Standard (ug/m ³)	Molecular Weight	Stack Height (ft) - Min.	Cc (ug/m ³)	Ccst (ug/m ³)	Cc (ug/m ³)	Ccst (ug/m ³)
0.00128972	0.030953	11.2980	1300.00	0.13	78.11	32	0.000002	0.000015	0.021582	0.129546
0.00089567	0.021496	7.8461	452025.00	0.09	147	32	0.000002	0.000010	0.014995	0.089966
0.00109378	0.026251	9.5815	180000.00	0.11	62.71	32	0.000002	0.000012	0.018311	0.109864
0.00098947	0.023747	8.6678	1000.00	0.10	120.19	32	0.018905	0.113425	0.016565	0.099387
0.00495653	0.118957	43.4192	14000.00	0.50	131.4	32	0.000009	0.000057	0.082979	0.497856