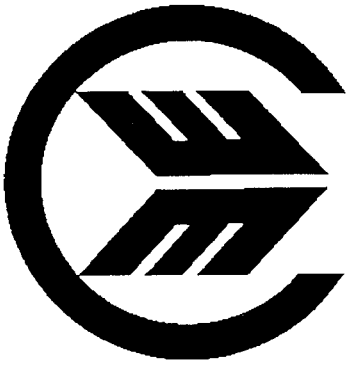
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AIR STRIPPING TOWER ENGINEERING REPORT

VILLAGE OF HARRIMAN MUNICIPAL WELL NO. MH-1



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Princeton, New Jersey

SEC DONOHUE
Environment & Infrastructure

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SEPTEMBER 1992
SEC Donohue Project No. P-1533

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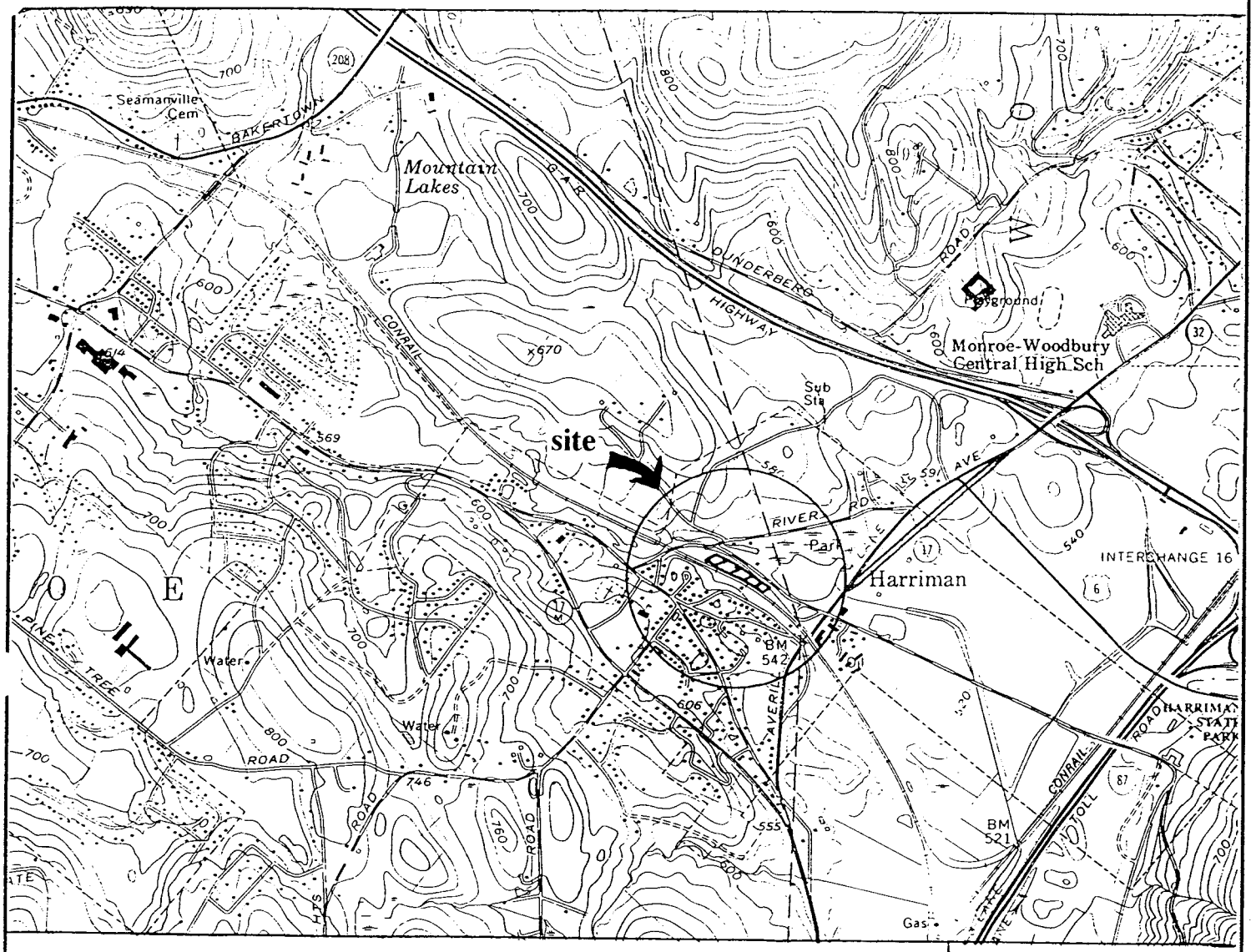
1.0 INTRODUCTION

1.1 Background

The Village of Harriman obtains drinking water from a number of wells at various locations within the limits of the Village. A regional location map is shown in Figure 1. Samples taken from the Village of Harriman Municipal Well MH-1 (Mary Harriman-1) have indicated detectable levels of 1,1,1-trichloroethane (TCA) and trichlorethylene (TCE) which are above the current New York State Department of Environmental Conservation (NYSDEC) Drinking Water Standards. This contamination is believed by the NYSDEC to have originated from a site (designated as the "GAESS Site") on which SCA Chemical Services operated a waste handling operation from 1972 to 1978. Chemical Waste Management, Inc. (CWM) became involved with the site following the acquisition of SCA in 1984.

In November 1990, CWM was contacted by the NYSDEC regarding contamination found in the Village of Harriman wells (Mary Harriman) MH-1 and MH-3. These wells were sampled on a weekly basis by order of a New York State Department of Health (NYSDOH) directive due to the exceedance of N.Y. Drinking Water Standards by the Village of Harriman water supply well. Those analytical results indicated that in the shallow water supply well, designated MH-1, trichloroethylene (TCE) was present at a concentration of 6.7 parts per billion (ppb) and the deep water supply well, designated MH-3, contained TCE at a concentration of .076 ppb. The NYSDEC Drinking Water Standard for Principal Organic Contaminants (POC) is five (5) ppb for TCE.

CWM responded to the NYSDEC notification by performing a Phase I investigation to determine if the Gaess site could be a source of the contamination



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FIGURE 1

Regional Location Map
Gaess Site
Harriman, NY

detected in the Village of Harriman water supply wells. CWM retained SEC Donohue (formerly known as Sirrine Environmental Consultants) to re-sample MH-1 and MH-3 as well as the upgradient Village of Harriman main water supply well (North Main Well) on January 16, 1991. SEC Donohue also collected three surface water samples from the adjacent Ramapo River on the same date. The results of the Phase I investigation were documented in a report dated March 1991. River sediment sample locations are shown on Figure 1. Groundwater sample locations are shown on Figure 2. Analytical results are shown on Table 1.1-1. The analytical results for the samples collected as part of the Phase I investigation indicated the presence of 1,1,1-TCA and TCE above the detection limits of 0.5 ppb in samples collected from MH-1 and MH-3. Using U.S. EPA Methods 502.1 and 503.1, Enviro Test Laboratories determined that MH-1 contained 1.2 ppb of 1,1,1 TCA and 14 ppb (a 16 ppb TCE concentration was detected using U.S. EPA Method 503.1) of TCE and MH-3 contained 0.69 ppb (method 502.01) and 1.6 ppb (method 503.1) of TCE. The results also indicated the presence of 1,1,1-TCA in the upgradient monitoring well (GEI-4) at a concentration of 4.8 ppb.

Table 1.1-1
River Sediment and Groundwater Sampling Results
Phase I and Phase II Investigation

Location	TCE (µg/l)	1,1,1-TCA (µg/l)	Benzene (µg/l)	Toluene (µg/l)	Ethylbenzene (µg/l)	M-xylene (µg/l)
RS-1	ND	ND	ND	14	ND	ND
RS-2	ND	ND	ND	ND	ND	ND
RS-3	ND	ND	ND	ND	ND	ND
MH-1	14	1.2	ND	ND	ND	ND
MH-3	1.6	ND	ND	ND	ND	ND
North Main Well	ND	ND	ND	ND	ND	ND
DG-1T	ND	5.8	ND	ND	ND	ND
UG-2	ND	ND	ND	ND	ND	ND

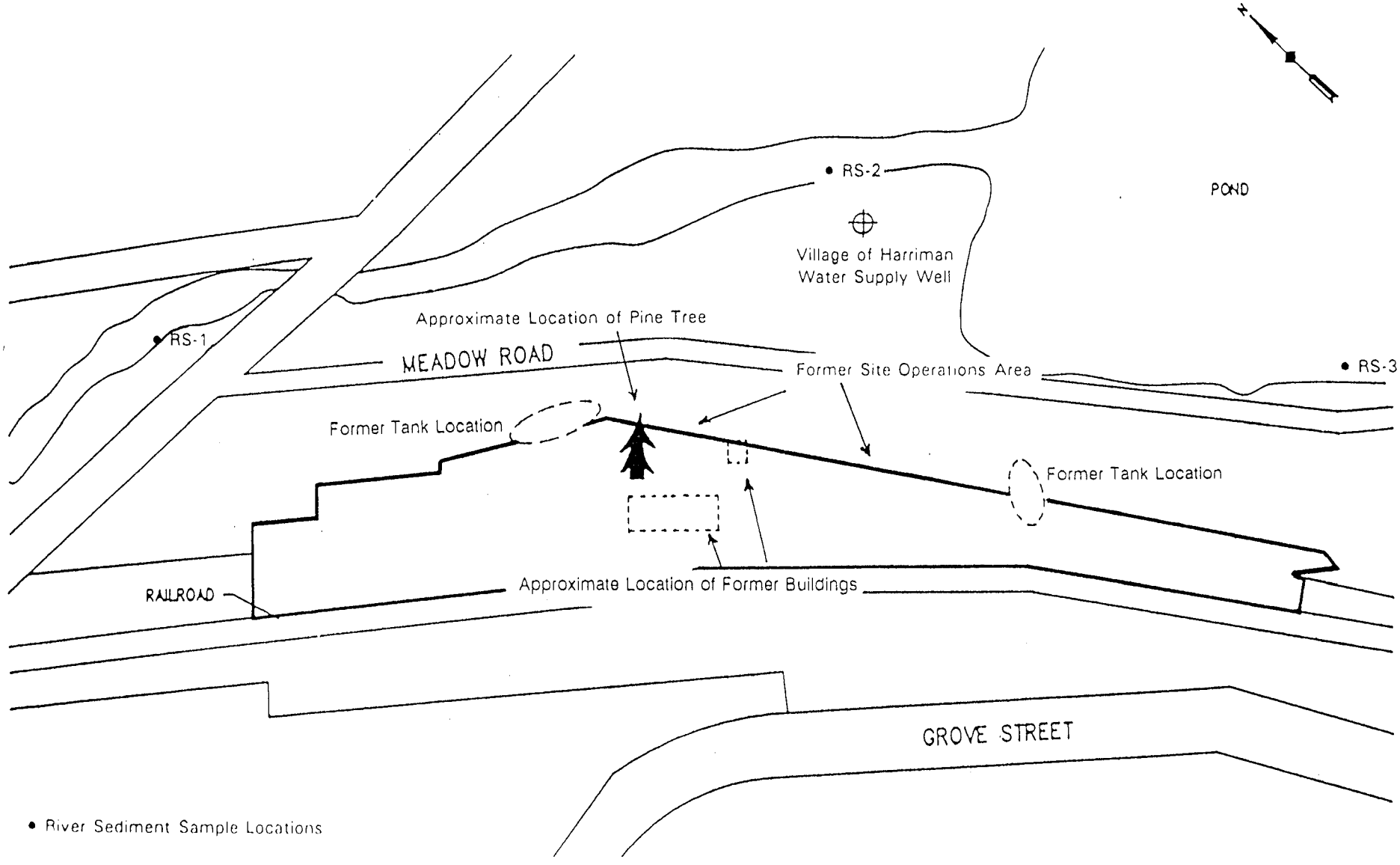
Table 1.1-1 (continued)
River Sediment and Groundwater Sampling Results
Phase I and Phase II Investigation

Location	TCE (µg/l)	1,1,1-TCA (µg/l)	Benzene (µg/l)	Toluene (µg/l)	Ethylbenzene (µg/l)	M-xylene (µg/l)
UG-3	ND	ND	0.53	2	0.54	0.74
UG-4C	ND	ND	ND	ND	ND	ND
GEI-4	ND	4.8	ND	ND	ND	ND
GEI-3	ND	ND	ND	ND	ND	ND
GHP-1S	ND	ND	ND	ND	ND	ND
GHP-1I	ND	ND	ND	ND	ND	ND
GHP-1D	ND	ND	ND	ND	ND	ND
GHP-2S	ND	3.5	ND	ND	ND	ND
GHP-2I	ND	3.2	ND	ND	ND	ND
GHP-2D	ND	8.2	ND	ND	ND	ND
GHP-3S	2.9	ND	ND	ND	ND	ND
GHP-3I	8.9	ND	ND	ND	ND	ND

ND-Not Detected

A Phase II investigation conducted during April, May, and July 1991 found similarly low levels of TCE in the groundwater. The groundwater samples obtained with a hydropunch (samples designated as GHP-1S etc.) at locations downgradient from the Gaess site contained concentrations of TCE and 1,1,1 TCA above the 5 ppb limit for New York State drinking water standards (GHP-2 contained 8.2 ppb of 1,1,1-TCA and GHP-3 contained 8.9 ppb of TCE).

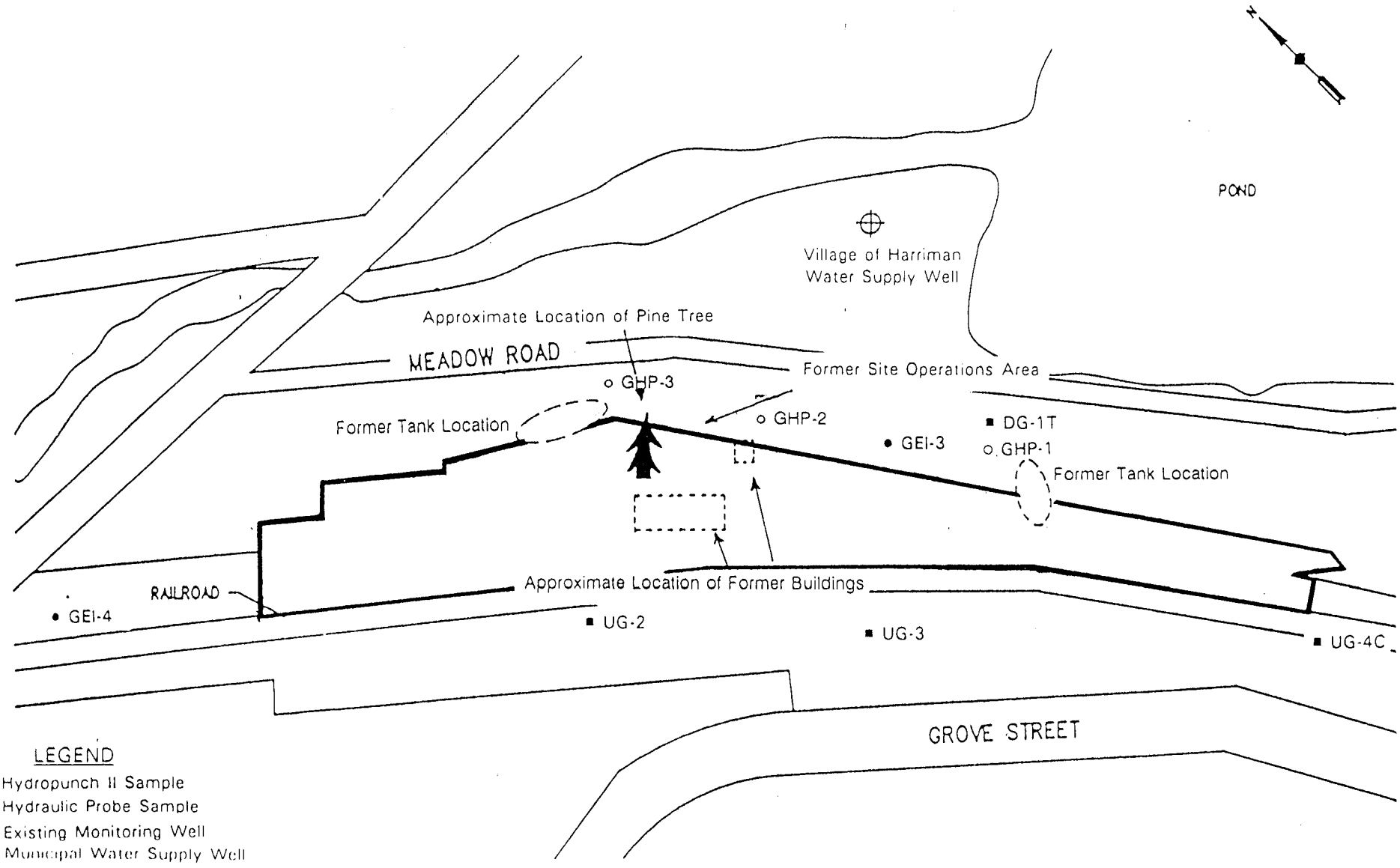
Although the upgradient groundwater sample did not indicate a presence of either TCE or 1,1,1-TCA, UG-2 did indicate the presence of benzene, toluene, ethylbenzene and m-xylene. Benzene was the only contaminant in UG-2 which was present at a concentration above the detection limit of 0.5 ppb (0.53 ppb). SECD believed this contamination was associated with oil staining on the ground surface in the location where sample UG-2 was collected. None of the other



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Figure 2
River Sediment Sample Locations
Gaess Environmental Site
Village of Harriman, New York

DUNCAN-PARNELL, INC., CHARLOTTE 388 800-432-6022



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Figure 3
Groundwater Sample Locations
Gaess Environmental Site
Village of Harriman, New York

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upgradient groundwater samples indicated the presence of volatile organic contamination.

In addition, the on-site "upgradient" monitoring well (GEI-4) installed by Geo-Engineering as part of their 1985 hydrogeologic investigation was resampled as part of the Phase I investigation and indicated the presence of 1,1,1-TCA at a concentration of 4.8 ppb.

Based upon the results of the site investigation, the specific source of the contamination in the Village of Harriman wells remain undetermined. The presence of contamination in the downgradient groundwater samples appears to be related to the Gaess site and levels found are of the same order of magnitude as those found in the Village of Harriman wells. However, those levels should be diluted due to diffusion effects occurring when the Village of Harriman wells are pumping due to inflow from the Ramapo River. The Village of Harriman wells were developed prior to sampling and the dilution effect did not occur. Based on this situation, it can only be concluded that there is another source of contamination, or the constituents from the Gaess site have migrated beyond the downgradient groundwater sampling points. Additionally, GEO-Engineering documented as part of the 1985 hydrogeologic investigation that an upward gradient exists from the bedrock aquifer which would negate the possible migration of contaminants to bedrock.

The NYSDEC has identified CWM as a responsible party with respect to contamination migrating toward and detected at MH-1. As a result, NYSDEC and CWM entered into an Interim Remedial Measures (IRM) Consent Agreement which requires CWM to develop and construct a treatment system for drinking water pumped from MH-1. Similarly CWM entered into a separate agreement with the Village of Harriman on December 4, 1991 which covers installation operation and maintenance of the air stripper unit.

1.2 Topography

The Gaess site consists of approximately 4 acres and is located in the southern highlands of New York State. The Gaess site is situated on a plateau which drops off rapidly to the northeast toward the Ramapo River. The topography rises rapidly to the southwest toward the railroad right-of-way. The right-of-way, owned by Conrail, is located on the northern most extent of the plateau. It is understood, through past documentation, that previous site operations existed entirely on this plateau. The base of the plateau, where the water supply wells (MH-1 and MH-3) are located adjacent to the river, is a floodplain.

1.3 Geology

The geologic conditions of the site were interpreted from borings by Geo-Engineering, well logs by Layne-New York and Jersey Boring and Drilling Co. and approximate depth from the borings completed as part of the Phase II investigation. The site geology can be described as fill underlain by sands and gravels, which in turn are underlain by glacial till. The bedrock underlying the site consists of limestone and dolomite.

The approximate depth to bedrock in the area ranges from 25 to 45 feet below the land surface. The bedrock surface appears to slope to the east as determined by test well drilling results. The bedrock surface was encountered at 37.5 feet in GHP-2, which is located approximately 100 feet to the west of GHP-1, where bedrock was encountered at a depth of 26 feet. In GHP-3, located approximately 110 feet west of GHP-2, bedrock was encountered at 21 feet. Additionally, it was determined by Geo-Engineering that the regional bedrock also slopes downward to the southeast away from the river. The bedrock is overlain by 2 - 7 feet of glacial till. Above the till to the ground surface, granular soils were encountered consisting of inter-layered silt and fine sand to layered fine to coarse

sand and gravel with occasional silt and clay layers. In some areas, 5 to 10 feet of fill overlies the natural materials. The more permeable soils seem to be more prevalent closer to the river.

1.4 Hydrogeology

The groundwater in the natural granular soils above the glacial till adjacent to the Ramapo River appears to exist under unconfined conditions, as determined by Geo-Engineering. The soils show lateral groundwater flow in the stratified layers of coarse and fine grained materials. The horizontal permeability in the coarse grained layers seems to be the controlling factor in the rate of groundwater flow. In this type of hydrogeological environment, groundwater and any associated contamination within the interlayered coarse and fine grained strata tends to flow in a predominantly horizontal direction rather than the vertical due to the hydraulic pressure differential.

A grain size distribution curve was completed by Geo-Engineering on the coarser grained materials to determine their horizontal permeability. It was determined that the horizontal permeability of the coarse grained material was on the order of 1×10^{-3} cm/sec and the porosity on the order of 0.30 (Geo-Engineering, 1985).

Geo-Engineering determined, during the drilling of the Village of Harriman's North Main Well (which is drilled into the bedrock), that the well "produced artisan flow at the rate of 35 gallons per minute". Therefore, there would appear to be an upward vertical flow gradient in the bedrock aquifer. This would severely limit the vertical migration of contaminants to the bedrock aquifer. According to Geo-Engineering in their 1985 hydrogeologic investigation, the general direction of groundwater flow is towards the river or Northeast.

2.0 DESIGN PARAMETERS

2.1 Well Data

The well data for Mary Harriman 1 (MH-1) is contained in Table 2.1-1.

Table 2.1-1
MH-1 - Well Data

Pumping rate	75 gallons per minute
Depth of well	52 feet
Diameter	8 inches
Length of casing	48 feet
Screen Length	10 feet
Aquifer	Sand and Gravel
Date installed	1984

2.2 Water Quality Requirements

The Interim Remedial Measure Consent Order between NYSDEC and CWM requires that the following contaminants be treated to a"non-detectable" level:

- Trichloroethylene
- 1,1,1 Trichloroethane
- and their degradation products

The order further states that "non-detectable" shall mean a concentration for each constituent below 0.5 micrograms per liter (μg/l).

3.0 ENGINEERING DESIGN

CWM selected Terra Vac of West Trenton, New Jersey to provide the air stripper tower and related equipment. Terra Vac provided plans and specifications to CWM for submittal to New York State Department of Health for review.

SECD developed plans and specifications for the related concrete, plumbing and electrical work.

Copies of the specifications are contained in Appendix A. Record of construction drawings are contained in Appendix B. These drawings reflect the design and construction of the tower concrete base and support pads, additional tower structural support and the construction and installation of the treatment system (tower, piping and controls).

3.1 Summary of Field Activities

Field activities on this project were conducted on April 13, 14, 21, 22 and 23, 1992. Concrete work was performed on April 13 and 14. The installation of the air stripper tower was performed on April 21 - 23. Other related work (i.e. plumbing and miscellaneous electrical) was performed on various days between April 23 and May 1. A summary of the major field activities is presented below.

- April 13 - Work performed on this day was for the construction of the tower concrete base pad and two concrete tower support pads. D & J Concrete performed this work. Excavation by hand was performed prior to the installation of the concrete. The proposed location of tower support pad number 2 would have conflicted with the location of an underground utility, therefore, the support was moved approximately 5 feet further from the tower base pad.

- April 14 - Work performed on this day was limited to the installation of reinforcing for the concrete and the pouring of the concrete. Concrete test cylinders were taken for 7 day and 28 day compressive strengths. The 7 day compressive strength was 3,930 pounds per square inch (psi). The 28 day compressive strength was 6,970 psi.

Copies of the field inspection reports for April 13 and 14 are contained in Appendix C and copies of the test results are contained in Appendix D.

- April 21 - Activities on this day were limited to the installation of electrical panels and the replacement of the existing well pump with a smaller pump to be used exclusively to pump water to the top of the air stripper tower. Pump calculations to select the replacement pump are contained in Appendix E. The pump was replaced by A.C. Schulties, Inc.

- April 22 - The tower was erected and temporary guy wires were used to support the tower until steel supports were fabricated. The tower was anchored to the concrete base using 3/4" x 7 " Hilti anchors. A representative from the Orange County Health Department was on-site. At that time it was learned that PVC pipe must be threaded, not glued. Provisions were made to install threaded pipe. Also, at the request of Orange County, the bypass line was installed only for the chlorine disinfection of the well pump. The bypass line is not intended to be used to pump water into the system without being treated. Piping connections to MH-1 were made. Schedule 80 PVC pipe was installed to approximately 3 feet above grade. This is the approximate elevation of the influent connection to the air stripper.

- April 23 - Work performed on this day was limited to final plumbing connections and electrical connections. Insulation and heat tracing was installed at this time.

Structural supports were installed by A.C. Schulties, Inc. on May 26.

3.2 Process Description

A summary of the process flow and a description of the equipment used in this system is presented in the following paragraphs.

Contaminated groundwater is pumped to the air stripper tower using a 3 horsepower, 5 stage submersible pump (Grundfos Model No. 75S30-5) through schedule 80 PVC pipe. A two inch compound meter (low flow and high flow) manufactured by Master Meter is installed on the influent piping. The tower is constructed of a stainless steel alloy 304l and is provided with Jaeger Tri Pac for a nominal packing depth of 29 feet. The water is discharged through a spray nozzle at the top of the tower and a redistribution plate is provided at approximately 15 feet.

A blower assembly (1 hp, 230 volt, 3 phase, 60 cycle) delivering a minimum of 720 cubic feet per minute at a static pressure loss of 2 inches of water blows air up through the tower to carry off the volatiles. A mist eliminator is provided to eliminate water vapor from the exhaust air stream.

The water cascades down the tower and collects in a sump. Level controls installed in the tower control a transfer pump (Meyer's Pump Co., No. I2C10., 10 hp, 230 volt, 3 phase). The level controls located near the base of the tower provide pump up/down control and control the well pump if the sump level reachs a high condition. This allows for positive control of the sump level and for flood

out protection of the air blower. A sail switch in the air blower discharge sends a signal to the control circuitry indicating the status of the blower. If a condition arises which reduces or stops the air flow, the groundwater pump and the transfer pump are immediately shut off. Therefore, water to the Village's water supply is stopped. The Village's existing telemetry system included remote sensing of well pump operations. Therefore the installation of an alarm system was not necessary.

The tower discharge line includes a sample tap for effluent water sampling. The discharge line (schedule 80 PVC) is connected to the existing cast iron pipe below grade and connects with the pipe from well MH-3 in a 6" cast iron pipe and then is pumped into the Village's water supply. See Sheet 2 (SEC Donohue Drawing No. P1533l03).

4.0 OPERATIONS

4.1 Disinfection

In order to begin operation, the new well pump , connecting pipe and the air stripping tower was to have been disinfected with chlorine prior to being placed on-line. This was accomplished by pouring approximately one gallon of hypochlorite solution into the well and pumping the water through the air stripper system to the 1" copper blowoff pipe for approximately 24 to 36 hours. This was performed by the Village's Water Superintendent.

After disinfection, effluent water samples were collected and analyzed for Total Coliform on May 1. Both samples contained less than 1 colony per 100 milliliters. Therefore, the system was disinfected to proper drinking water standards.

4.2 Treatment Efficiency

The Consent Agreement between CWM and NYSDEC contained special conditions detailing monitoring requirements for bacteria and for volatile organics. The Special Conditions are contained in Appendix F.

Prior to placing the system online, it was be tested for treatment efficiency. Influent and effluent water samples were collected on May 1 and analyzed for Volatile Halocarbons (EPA Method 502.1) and Volatile Aromatics (EPA Method 503.1). The preliminary influent sample contained 8.4 μg/l Chloroform, 15 μg/l Trichloroethylene using method 502.1 and 19 μg/l Trichloroethylene using method 503.1. Effluent samples did not detect any volatile compounds. Therefore, the system was put on-line under emergency authorization, by the Orange County Health Department. Analytical results for the treatment efficiency are contained in Table 4.2-1.

5.0 AIR PERMIT

As required in the Consent Agreement, an application for and air emmissions permit was submitted to NYSDEC on March 18, 1992. NYSDEC approved the application and issued a permit on July 7, 1992. A copy of the permit is contained in Appendix G.

6.0 CERTIFICATION

Based upon observations by SEC Donohue, the project was generally completed in accordance with the plans and specifications and the Consent Agreement. Photographs depicting the as-built conditions of the air stripping system are contained in Appendix H. An Operation and Maintenance Manual is contained in Appendix I.

Table 4.2-1
Air Stripper Treatment System Results

DATE	SAMPLE NO.	ANALYTICAL METHOD	TYPE	MDL (UG/L)	RESULT (UG/L)
4/30/92	110755-01	Total Coliform	Effluent	100 ml	<1
5/1/92	110807-03	Total Coliform	Effluent	100 ml	<1
5/1/92	110807-01	V0A-502.1	Influent	0.5 0.5	8.4 Chloroform 15 TCE
5/1/92	110807-01	VOA-503.1	Influent	0.5	19 TCE
5/1/92	110807-02	V0A-502.1	Effluent	0.5	Non-Detected
5/1/92	110807-02	V0A-503.1	Effluent	0.5	Non-Detected
5/13/92	111172-01	V0A-502.1	Influent	0.5 0.5 0.5	2.4 Chloroform 0.8 TCA 14 TCE
5/13/92	111172-01	V0A-503.1	Influent	0.5	14 TCE
5/13/92	111172-02	V0A-502.1	Effluent	0.5	Non-Detected
5/13/92	111172-02	V0A-503.1	Effluent	0.5	Non-Detected
5/14/92	111196-01	V0A-502.1	Influent	0.5 0.5 0.5	1.4 Chloroform 0.59 TCA 11 TCE
5/14/92	111196-01	V0A-503.1	Influent	0.5	11 TCE
5/14/92	111196-02	V0A-502.1	Effluent	0.5	Non-Detected
5/14/92	111196-02	V0A-503.1	Effluent	0.5	Non-Detected
5/15/92	111253-01	V0A-502.1	Influent	0.5 0.5 0.5	0.8 Chloroform 0.71 TCA 8.7 TCE
5/15/92	111253-01	V0A-503.1	Influent	0.5	9.7 TCE
5/15/92	111253-02	V0A-502.1	Effluent	0.5	Non-Detected
5/15/92	111253-02	V0A-503.1	Effluent	0.5	Non-Detected
5/16/92	111318-01	V0A-502.1	Influent	0.5 0.5 0.5	0.82 Chloroform 0.7 TCA 9.1 TCE
5/16/92	111318-01	V0A-503.1	Influent	0.5	9.9 TCE
5/16/92	111318-02	V0A-502.1	Effluent	0.5	Non-Detected
5/16/92	111318-02	V0A-503.1	Effluent	0.5	Non-Detected

Table 4.2-1 (continued)
Air Stripper Treatment System Results

DATE	SAMPLE NO.	ANALYTICAL METHOD	TYPE	MDL (UG/L)	RESULT (UG/L)
5/17/92	111319.01	V0A-502.1	Influent	0.5 0.5 0.5	1.1 Chloroform 1.1 TCA 13 TCE
5/17/92	111319-01	V0A-503.1	Influent	0.5	14 TCE
5/17/92	111319-02	V0A-502.1	Effluent	0.5	Non-Detected
5/17/92	111319-02	V0A-503.1	Effluent	0.5	Non-Detected
5/18/92	111320-01	V0A-502.1	Influent	0.5 0.5 0.5	0.88 Chloroform 0.5 TCA 15 TCE
5/18/92	111320-01	V0A-503.1	Influent	0.5	16 TCE
5/18/92	111320-02	V0A-502.1	Effluent	0.5	Non-Detected
5/18/92	111320-02	V0A-503.1	Effluent	0.5	Non-Detected
5/19/92	111330-01	V0A-502.1	Influent	0.5 0.5 0.5	0.9 Chloroform 1.1 TCA 11 TCE
5/19/92	111330-01	V0A-503.1	Influent	0.5	11 TCE
5/19/92	111330-02	V0A-502.1	Effluent	0.5	Non-Detected
5/19/92	111330-02	V0A-503.1	Effluent	0.5	Non-Detected
5/26/92	111520-01	V0A-502.1	Influent	0.5 0.5	0.64 TCA 6.8 TCE
5/26/91	111520-02	V0A-502.1	Effluent	0.5	Non-Detected
6/3/92	111834-01	V0A-502.1	Influent	0.5 0.5	0.82 TCA 7.8 TCE
6/3/92	111834-02	V0A-502.1	Effluent	0.5	Non-Detected
6/10/92	112064-01	V0A-502.1	Influent	0.5 0.5	0.83 TCA 6.1 TCE
6/10/92	112064-02	V0A-502.1	Effluent	0.5	Non-Detected
6/17/92	112328-01	V0A-502.1	Influent	0.5	1.1 TCA 6.9 TCE
6/17/92	112328-02	V0A-502.1	Effluent	0.5	Non-Detected

APPENDIX A
SPECIFICATIONS

SPECIFICATIONS FOR AIR STRIPPING FACILITY
VILLAGE OF HARRIMAN MUNICIPAL WELL MH-1

GENERAL

A 80 gpm operating capacity air stripping facility shall be provided. The unit shall be designed to achieve 99.7 percent removal of trichloroethylene, and 99.9 percent removal of 1,1,1-trichloroethane. This is based on influent concentrations of 30ug/L for trichloroethlyene and 10ug/L for 1,1,1-trichloroethane. The system shall meet these criteria at the design water flow rate of 80 gpm. The system shall also be capable of handling hydraulic loads as high as 100 gpm. It shall be the responsibility of the tower manufacturer to select and size all components of the column to meet the removal criteria.

AIR STRIPPING TOWER

The tower shall have a minimum effective internal cross sectional area of 7.1 square feet and an overall height of 35 feet. It shall be constructed entirely of stainless steel alloy 304L. Design snow and wind loads shall be as per relevant American National Standard Institute Codes. Earthquake and vibrational effects shall also be considered. The tower shall be completely self-supporting when anchored to a suitable concrete base and supported by guy wires or equivalent. Sufficient anchoring points shall be provided to be compatible with the concrete slab design.

INTERNALS OF AIR STRIPPING TOWER

Sufficient high efficiency packing shall be provided to yield a nominal packing depth of 29 feet. Packing shall be Jaeger Tri Pac. Due to the varying mass-transfer properties of different packings, no substitutes will be accepted. A packing support plate shall be provided which is compatible with the packing furnished. The support plate shall be made of stainless steel. A 90 degree cone nozzle shall be provided to uniformly distribute the water flow over the surface of the packing. The flow nozzle shall be capable of handling a water flow range of zero to 80gpm. The nozzle will be constructed of brass or stainless steel. Liquid redistribution shall be provided at approximately 15 feet on the stripper column to provide for efficient packing performance. One redistributor shall be provided. A moisture separation system shall be provided which will eliminate water droplets in the exhaust air stream. A polypropylene or equivalent mesh type mist eliminator shall be provided for this purpose. All air inlet and outlet openings will be provided with insect screens.

BLOWER ASSEMBLY

A complete blower assembly shall be provided including : one blower, flexible connection, ductwork to tower, and all necessary fasteners and gaskets. The blower shall deliver a minimum of 720

cfm at a static pressure of two inches of water. An open drip proof motor connected by a belt drive to the fan shall be provided. the blower assembly and motor will be mounted on a common base. The blower shall be designed so as to be non-overloading. The motor shall be 230 volts, three phase, 60 cycle, and shall not exceed one hp. The fan assembly shall be as manufactured by Twin City Fan and Blower Company of Minneapolis, Minnesota, or equal. A flexible rubber sleeve will couple the blower discharge to the stripper tower.

TRANSFER PUMP

One transfer pump assembly shall be installed to pump the effluent of the air stripping tower to the Harriman water supply. The pump will be from the Meyer's Pump Company model number I2C10. The unit shall consist of a two stage centrifugal pump coupled to a 10 hp, 3450 rpm, three phase, 60 cycle, 230 volt TEFC motor, mounted on a structural steel base with coupling and coupling guard. For more details on the transfer pump see attached manufacturer specification sheet.

VALVES

Four two inch brass gate valves will be installed to provide isolation, and bypass capability for the air stripping facility. One two inch check valve will be installed to provide back-leakage protection from the water main system to the air stripping facility.

FLOW METER

One two inch compound type flow meter will be installed in the inlet line to the air stripper tower. The meter will be manufactured by Master Meter Inc.. The meter has a continuous operating range of 1-175 gpm with a low flow threshold of 1/4 gpm and a maximum flow threshold of 285 gpm. The accuracy of the meter in the continuous operating range is +/- 3%. For more details on the flow meter see attached manufacturer specification sheet.

INTERCONNECTING PIPING AND FITTINGS

All interconnecting piping and fittings shall be made of schedule 80 PVC. Piping size shall be two inch. All joints will be threaded.

CONTROL PANEL

One control panel will be installed to provide the following controls:

1. Manual control of the air blower
2. Manual control of the transfer pump
3. /Securing the existing submersible pump should the air blower stop operating
4. | Securing the existing submersible pump should the tower

resevoir become full

5. Securing the transfer pump should the tower resevoir become empty

All components used for the construction of the control panel will be UL rated.

BEX R Series High Capacity Hollow Cone Spray Nozzles

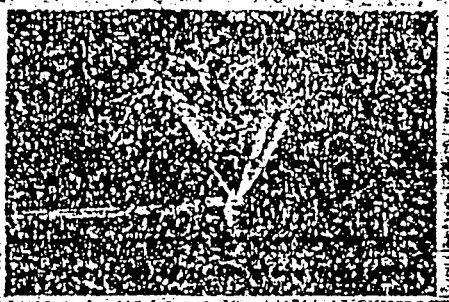
SPRAY CHARACTERISTICS:

A high capacity hollow cone spray pattern with uniform distribution. The large body and orifice diameters minimize clogging.

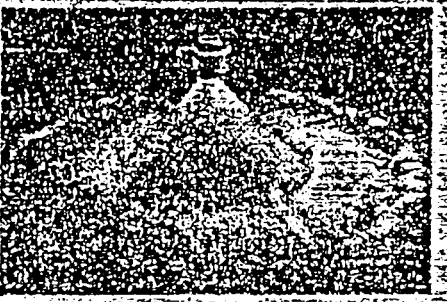
CONSTRUCTION: One piece cast construction. Standard materials are cast iron, bronze and 316 stainless steel. All the R series nozzles have a female N.P.T. pipe connection.

TYPICAL APPLICATIONS:

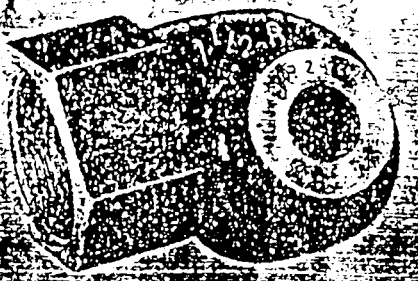
- Aeration & Pollution Control
- Cooling Ponds
- Scrubbing and Washing gases and fumes
- Cooling Coil
- Dust Proofing
- Chemical Processes



At 1 p.s.i.: Wide spray angle with large drop size and minimal misting.



At 15 p.s.i.: Uniform distribution with larger flow rates.



DIMENSIONS



MODEL NUMBER	DIMENSIONS (inches) A	B	C	D	L
1R	2	2 1/8	1/2	1 1/8	2 3/4
1 1/4R	2 1/8	2 1/4	1/2	1 1/4	3 1/8
1 1/2R	2 3/8	2	9/16	1 3/4	3 3/4
2R	2 3/4	3 1/8	3	2 1/4	4 3/4
2 1/2R	3 1/2	4 3/4	1 3/8	2 3/4	5 7/8

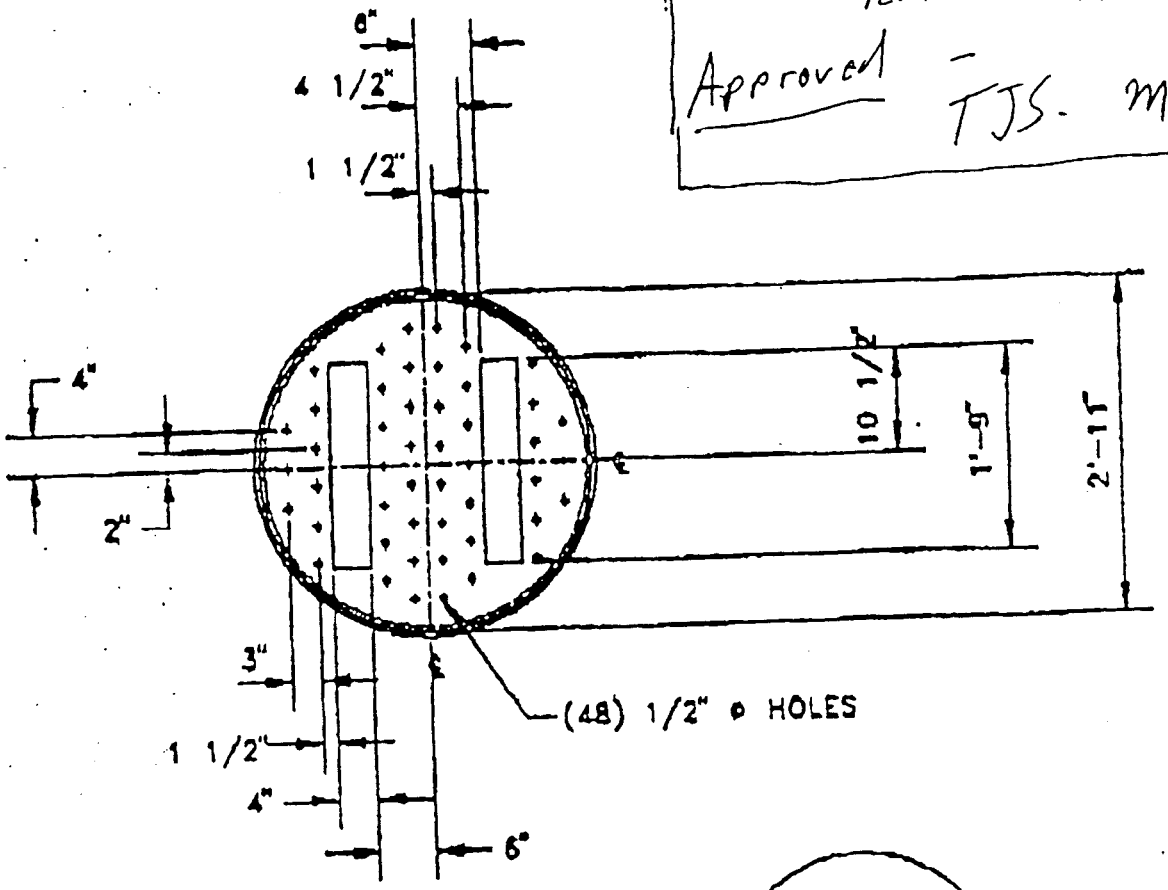
MODEL NUMBER	PIPE SIZE N.P.T. (female)	MAXIMUM PASSAGE (inches)	CAPACITY (G.P.M.) AT VARIOUS PRESSURES (p.s.i.) 2 p.s.i.	3 p.s.i.	5 p.s.i.	7 p.s.i.	10 p.s.i.	15 p.s.i.	20 p.s.i.	30 p.s.i.	40 p.s.i.	50 p.s.i.	60 p.s.i.	100 p.s.i.	SPRAY ANGLE @ 2 p.s.i.	20 p.s.i.	60 p.s.i.
1R10	1/4	1/2	4.5	5.5	7.1	8.4	10	12.2	14.1	17.3	20	24	28	32	65°	72°	73°
1R12		17/32	5.4	6.6	8.5	10.0	12	14.7	17.0	21	24	29	34	38	71°	74°	75°
1R14		9/16	6.3	7.7	9.9	11.7	14	17.1	19.8	24	28	34	40	44	74°	78°	80°
1R16		9/16	7.2	8.8	11.3	13.4	16	19.6	23	28	32	39	45	51	77°	83°	83°
1R18		9/16	8.0	9.9	12.7	15.1	18	22	25	31	36	44	51	57	80°	86°	86°
1 1/4R12	1 1/4	17/32	5.4	6.6	8.5	10.0	12	14.7	17	21	24	29	34	38	64°	68°	69°
1 1/4R14		9/16	6.3	7.7	9.9	11.7	14	17.1	20	24	28	34	40	44	66°	71°	71°
1 1/4R16		5/8	7.2	8.8	11.3	13.4	16	19.6	23	28	32	39	45	51	71°	75°	75°
1 1/4R18		5/8	8.0	9.9	12.7	15.1	18	22	25	31	36	44	51	57	76°	78°	79°
1 1/4R21		5/8	9.4	11.5	14.8	17.6	21	26	30	36	42	51	59	66	79°	82°	82°
1 1/4R24		5/8	10.7	13.1	17.0	20	24	29	34	42	48	59	68	76	81°	86°	85°
1 1/2R18	1 1/2	5/8	8.0	9.9	12.7	15.1	18	22	25	31	36	44	51	57	66°	70°	71°
1 1/2R21		11/16	9.4	11.5	14.8	17.6	21	26	30	36	42	51	59	66	70°	74°	74°
1 1/2R24		3/4	10.7	13.1	17.0	20	24	29	34	42	48	59	68	76	73°	76°	75°
1 1/2R28		3/4	12.5	15.3	19.8	23	28	34	40	48	56	68	79	89	75°	79°	80°
1 1/2R32		3/4	14.3	17.5	23	27	32	39	45	56	64	78	91	101	79°	84°	84°
1 1/2R37		3/4	16.5	20	26	31	37	45	52	64	74	91	105	117	84°	88°	88°
2R37	2	7/8	16.5	20	26	31	37	45	52	64	74	91	105	117	62°	64°	65°
2R43		15/16	19	24	30	36	43	53	61	74	86	105	122	136	66°	70°	72°
2R49		1	22	27	35	41	49	60	69	85	98	120	139	155	70°	72°	73°
2R57		1 1/16	25	31	40	48	57	70	81	99	114	140	161	180	74°	77°	77°
2R68		1 1/16	29	36	46	54	65	80	92	113	130	159	184	200	75°	78°	79°
2R79		1 1/16	34	41	53	63	75	92	106	130	150	184	210	240	78°	81°	81°
2R86		1 1/16	36	47	61	72	86	105	122	149	172	210	240	270	86°	83°	83°
2 1/2R75	2 1/2	1 5/16	34	41	53	63	75	92	106	130	150	184	210	240	67°	72°	72°
2 1/2R86		1 5/16	39	47	61	72	86	105	122	149	172	210	240	270	73°	79°	76°
2 1/2R100		1 5/16	45	55	71	84	100	122	141	173	200	245	280	320	79°	82°	80°
2 1/2R115		1 5/16	51	63	81	96	115	141	163	199	230	280	320	370	80°	84°	80°
2 1/2R132		1 5/16	58	72	93	110	132	161	187	230	265	325	370	420	82°	87°	84°

*Capacities are G.P.M. times 1.5 = L.P.M.

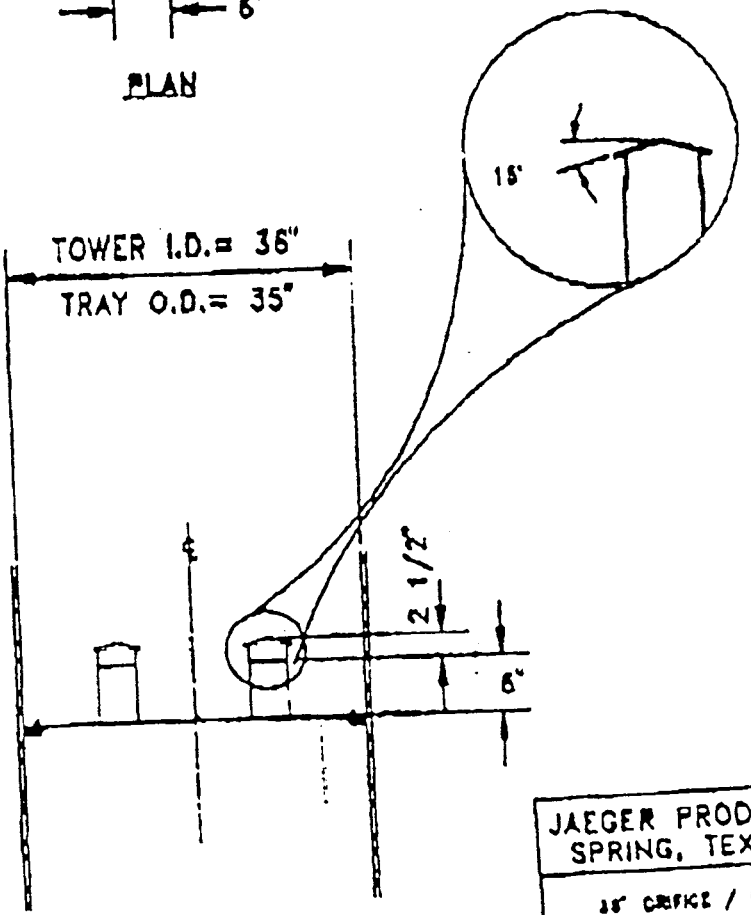
See pages 2 and 3 for engineering data and spray coverage.

Tower - redistribution [illegible]
- Village of Herriman -
- Tank Vac Job

Approved - TJS. March 12 92



PLAN

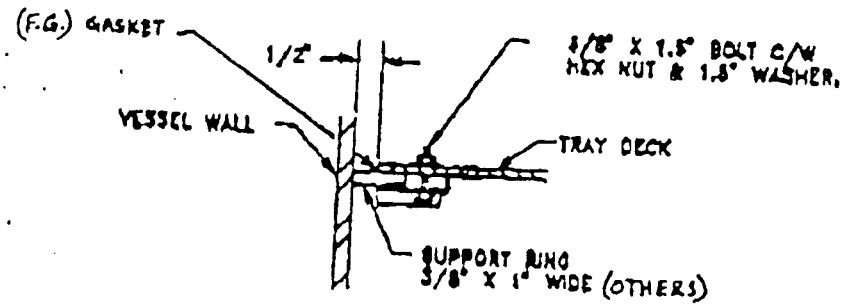


ELEVATION

JAEGER PRODUCTS SPRING, TEXAS	BY	DATE	DESCRIPTION

36" ORIFICE / RIBER LIQUID DISTRIBUTOR/REDISTRIBUTOR

		03/09/92	0392015

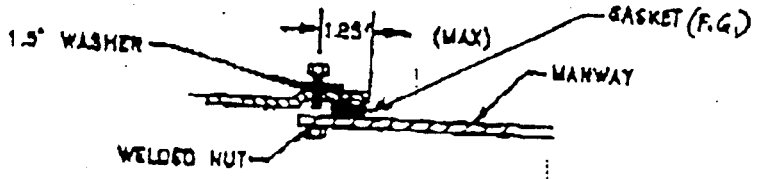


TYP. CLAMP DETAIL
FOR TRAY

BILL OF MATERIALS

ITEM #	QTY	DESCRIPTION	MATL
1	1	14 GAUGE THK. (TY-082)	SA-414 G
2	1	14 GAUGE THK. (TY-818)	SA-414 G
3	4	21" X 6" X 14 GA. PLATE	SA-414 G
4	4	6" X 6" X 14 GA. PLATE	SA-414 G
5	4	2 3/16" X 23" LG. X 14 GA. THK.	SA-414 G
6	18	1" X 2.5" X .120" THK.	SA-414 G
7	18	TRAY CLAMPS (A23-0)	SA-414 G
8	36	WASHER 1.5 ø (J817)	SA-414 G
9	7	3/8" X 1" LG. BOLTS	SA-414 G
10	7	3/8" WELDED NUTS	SA-414 G
11	3'	1/16" X 1" GASKET	FIBERGLAS

Approved TJS
Mar 12 1992



JOINT DET.

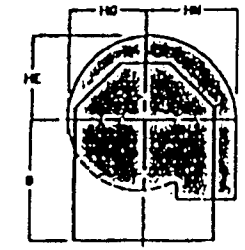
NOTES:
1. (1) TRAY REQUIRED.
2. ALL PARTS TO PASS THRU. 20" I.D. MANWAY.
3. REMOVABLE FROM TOP ONLY.
4. ALL PLATES 14 GAUGE THICK

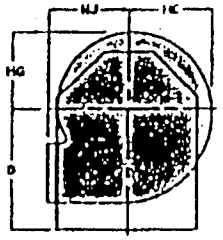
JAEGER PRODUCTS SPRING, TEXAS	REV	BY	DATE	DESCRIPTION
36" ORIFICE / RISER LIQUID DISTRIBUTOR/REDISTRIBUTOR				
PART NO. CUST	VENDOR		01/04/01	0382015	2 of 2	0

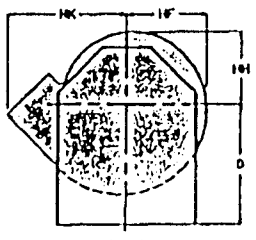
Post-it™ brand fax transmittal memo 7671 | # of pages ▸

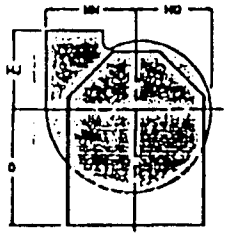
To Wazir	From T. Schmidt
Co. Jaeger Prod.	Co.
Dept.	Phone #
Fax # 713-449-9480	Fax #

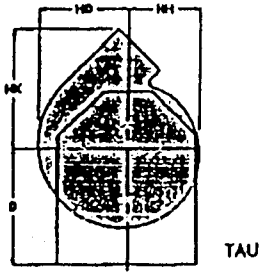
Fan Discharge Options

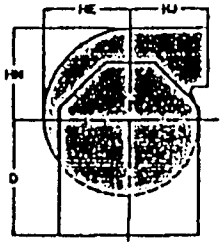


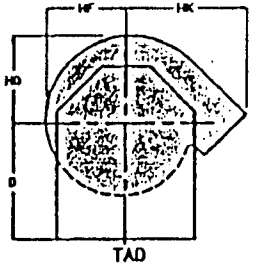












SIZE	UNIT NO.	ROT.	DISCH.	MOTOR H.P.	T.S.
C.F.M.	S.P.	R.P.M.	B.H.P.	Q.V.	

ACCESSORIES REQ'D

JRW INDUSTRIAL FANS ARR 9 OF ROTATABLE

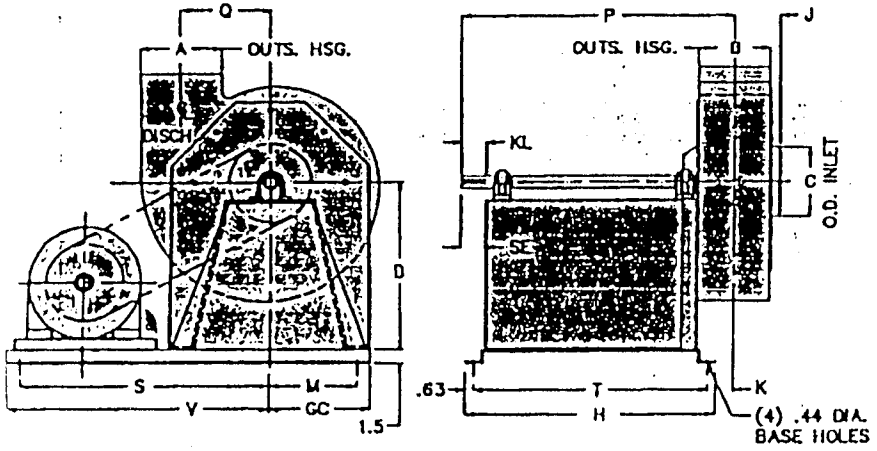
TWIN CITY FAN & BLOWER
MINNEAPOLIS, MINNESOTA 55414

DRAWN 2-25-88
REVISED
DWG. No. AC-13400

JOB Village of Hiawatha

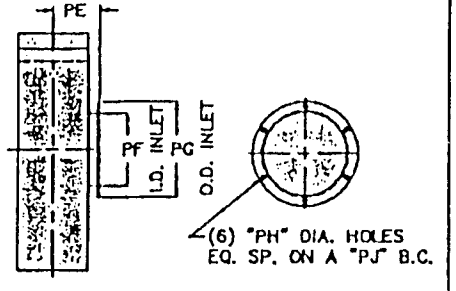
LOC.

S.O. NO.

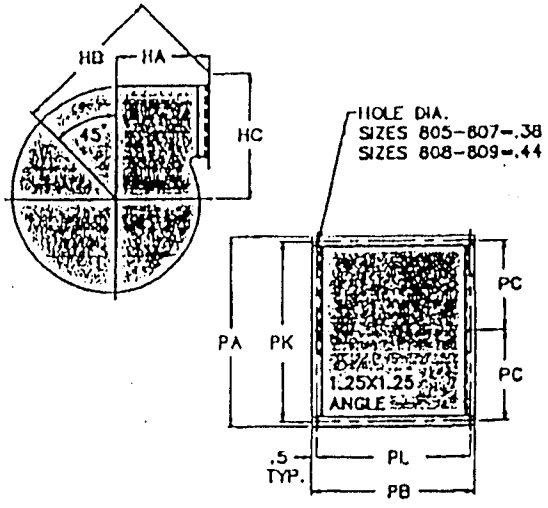


NOTES:

01. CW ROTATION SHOWN, CCW SIMILAR BUT OPPOSITE



OPTIONAL INLET FLANGE

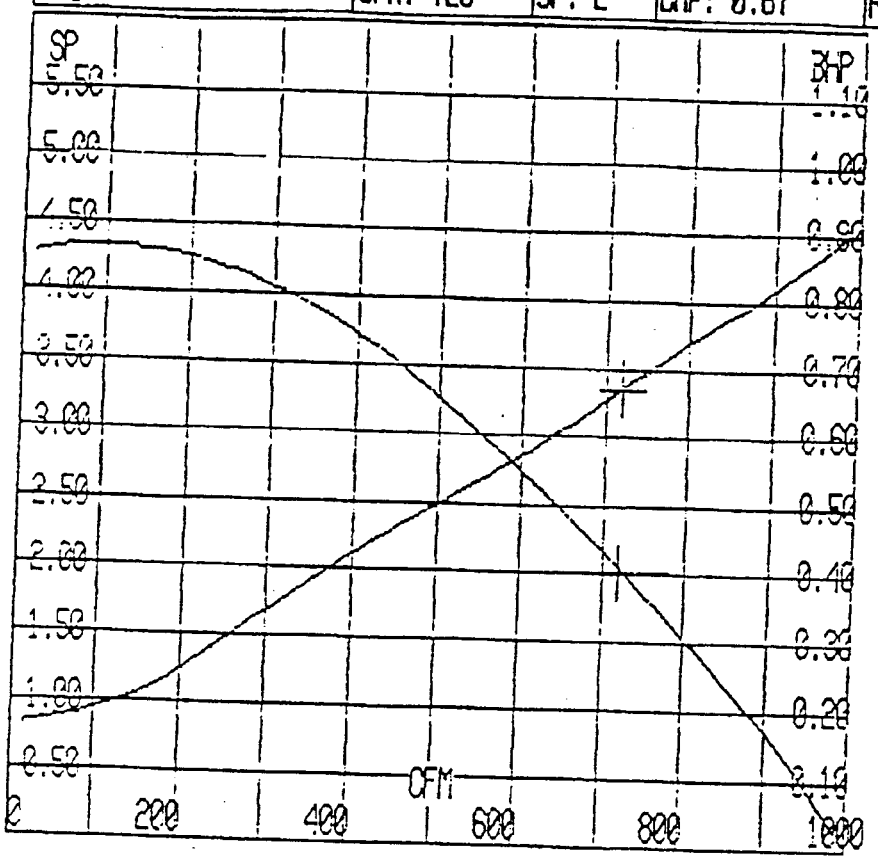


OPTIONAL OUTLET FLANGE

	A	B	C	D	G	H	J	K	L	M	N	P	Q	S	T	V	GC	HA	HB	HC	HD	HE	HF	HG	HH	HJ	HK	HN	SE	KL	WGT. LBS.	WGT. KG	.45 x .13	PA	PB	PC	PE	PF	PG	PH	PJ	PK	PL
5F	4.88	4.5	5	11.25	11.5	17	3.88	1.38	11.5	4.88	1	18.75	5.13	18.25	15.75	19.25	5.75	9.5	13	8.81	7.25	6.94	6.63	6.31	5.38	9	11.75	7.56	2.5	2.25	1431	1		7.38	7	—	4	5.06	7.06	.28	6.31	8.38	8
6H	5.88	4.31	6	13.5	13.5	20.38	3.81	1.31	14.88	5.88	1	22.56	6.13	21.38	19.13	22.38	6.75	9.5	14	10.31	8.69	8.31	7.94	7.56	7.19	9	12.81	9.06	3	2.75	1451	1		8.38	6.81	—	3.94	6.06	8.06	.28	7.31	7.38	5.81
7	5.88	5.25	6	13.5	13.5	20.38	4.25	1.75	14.88	5.88	1	23	6.13	21.38	19.13	22.38	6.75	9.5	14	10.31	8.69	8.31	7.94	7.56	7.19	9	12.81	9.06	3	2.75	1821	1		8.38	7.75	—	4.38	6.09	8.09	.28	7.31	7.38	8.75
7H	6.81	4.31	7	13.5	16	20.38	3.81	1.31	14.88	7.13	1	22.56	7.13	22.63	19.13	23.63	8	9.5	15.13	11.81	10.13	9.69	9.25	8.81	8.38	9	13.88	10.56	3	2.75	1821	1,187		9.31	6.81	—	3.94	7.13	9.38	.38	8.5	8.31	5.81
7F	6.81	6.06	7	13.5	16	20.38	4.69	2.19	14.88	7.13	1	23.44	7.13	22.63	19.13	23.63	8	9.5	15.13	11.81	10.13	9.69	9.25	8.81	8.38	9	13.88	10.56	3	2.75	1841	1,187		9.31	8.56	—	4.81	7.13	9.38	.38	8.5	8.31	7.56
9H	7.75	4.31	8	13.75	19	20.38	3.81	1.31	14.88	8.63	1	22.56	8.19	24.13	19.13	25.13	9.5	11	17.25	13.31	11.56	11.06	10.56	10.06	9.56	10.5	16.0	12.06	3	2.75	1841	1,187		10.75	6.81	4.63	3.94	8.13	10.38	.38	9.56	9.25	5.81
9F	8.63	4.31	9	15.5	19	20	3.81	1.31	15.25	8.63	1	23.56	9.19	27.25	19.38	28.25	9.5	11	18.25	14.75	12.93	12.38	11.81	11.25	10.69	10.5	17.0	13.50	3.63	3.38	2131	1,187		11.13	6.81	5.06	3.94	9.13	11.63	.44	10.63	10.13	5.81

05/11/92 11:22 404 421 8188 TERRA UAC P.1

Twin City Fan & Blower	Fan ID:809N JRW	Customer:TOM SCHMITT		
Tag:	CFM: 728	SP: 2	BHP: 0.67	RPM: 1751



Density: 0.075
Modifiers:

Sound	
OCT	SPL
1	97
2	95
3	94
4	87
5	78
6	70
7	63
8	56
LWA	89

ES-51-A
August 1986

CENTRIFUGAL FANS INSTALLATION & MAINTENANCE GUIDE — GENERAL INSTRUCTIONS

Installation:

All fans should be checked to make sure correct fan was received. The proper function should be provided depending on the operation requirement. Locate proper fan position. Base angles on the fan have holes drilled to mount stationary or resilient base as required, locate and fasten firmly in place. All components should be set level.

Motor and drives are then assembled in their proper positions, if not already assembled on the fan. It is important that motor and blower pulleys be properly aligned so as to allow belts to run true and straight.

Pre-Operation Check:

Check all the set screws and bolts to make sure they have not loosened in transit. If necessary, retighten the set screws and bolts. Rotate the impeller by hand to make sure it has not shifted in transit or been damaged during shipment. If required shift the wheel in position. Check the belt tension which should have approximately ¾" to 1" deflection under 3 pounds pressure based on 2½ to 3 foot centers on drives. Check the belt and pulley alignment. On vent sets — adjustments of belt tension is done with the bolt which adjusts the motor base up and down.

Check to make sure that the fan pulley is on the fan, and motor pulley on the motor, as reversal may cause excessive speed and collapse the wheel.

Start the fan and observe the rotation of the impeller. Normally there is an arrow on the blower indicating proper rotation if impeller is rotating in the wrong direction, reverse rotation. With amp probe or ampmeter, take the amp and volt readings making sure the motor is not being overloaded.

Trouble-Shooting:

Following is a list of possible problems and their causes that may occur on start-up, or develop later during operation.

Noise: May be caused by

(a) Impeller hitting the inlet of the fan or cutoff plate, loose impeller
(b) Drives can cause noise if sheaves are not tight on the shaft, belts are too loose or too tight, wrong belt cross section, or mis-matched belts, also worn belts, oily belts or mis-aligned sheaves.
(c) If couplings are used they may be a source of noise by being unbalanced, misaligned, loose or dry of lubricant.
(d) Bad bearings are a common source of noise when defective, dry of lubricant, loose on the bearing support, loose on the shaft, seals mis-aligned, dirty lubricant, fretting corrosion between inner race and shaft, etc. See separate section on bearing care.
(e) There can be an electrical source of noise such as AC hum in motor or relay, starting relay chatter, noisy motor bearings, single phasing a 3 phase motor, etc.
(f) A bent or undersized shaft may be a noise source. *IF MORE THAN TWO BEARINGS ARE ON THE SAME SHAFT, THEY MUST BE CAREFULLY ALIGNED.*
(g) There may be other noise sources such as obstruction in high velocity air stream causing rattle or pure tone whistle, fan operating at undesirable design point, causing pulsation, cracks or holes in duct work, or whistles in fan housing.

TWIN CITY FAN & BLOWER CO.
550 KASOTA AVE. S.E., MPLS., MN 55414
612/331-4104

amca MEMBER

TCF AXIAL DIVISION, INC.

OHLMAN AND 23RD STREET • R.R. 4 • MITCHELL, SOUTH DAKOTA 57301 • PHONE: (605) 996-8081

IMPORTANT NOTICE

This shipment has been carefully inspected, checked and properly packaged at our company.

When it was delivered to the carrier it was in good condition and technically it became your property at that time. Thus, any damage, whether obvious or hidden, must be reported to the transportation company within five days of receipt of the shipment at your premises to avoid forfeiting claims for damages.

FOR ALL SHIPMENTS DAMAGED IN TRANSIT

Leave the items, packing material and carton "As Is". Notify your carrier's local office and ask for immediate inspection of the carton and the contents.

After inspection has been made by the carrier, and you have received acknowledgement in writing as to the damage, notify our Customer Service Department to make any required repair arrangements.

It is your responsibility to follow the above instructions or the carrier will not honor any claims for damage. Also, if there are any shortages or questions regarding this shipment, please notify us within 10 days.

Please note that we cannot be responsible for any service work or backcharges unless authorized by us in writing, before the work is performed.

W. E. Anderson

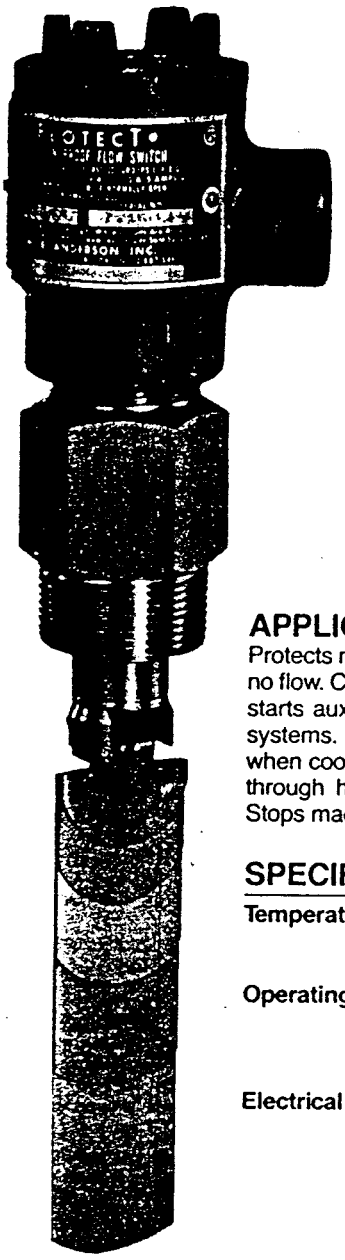
FLOTECT Vane Operated Flow Switch

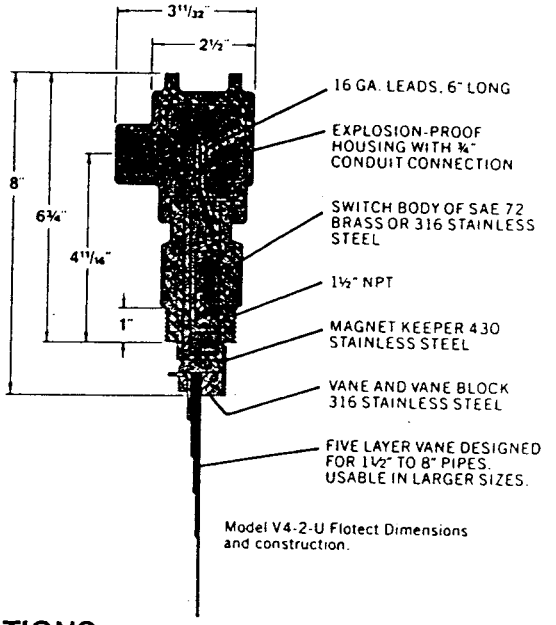
INSTALLATION AND OPERATING INSTRUCTIONS

Explosion-Proof; U.L. and C.S.A. listed – Class I, Groups C, D; Class II, Groups E, F, G.
CENELEC: EExd 11B T6.

Dependable protection against flow variation or stopping in pipelines for fluids, gasses and flowing solids.

Supplied with custom or universal multi-layer vanes for field installation in pipes from 1½".

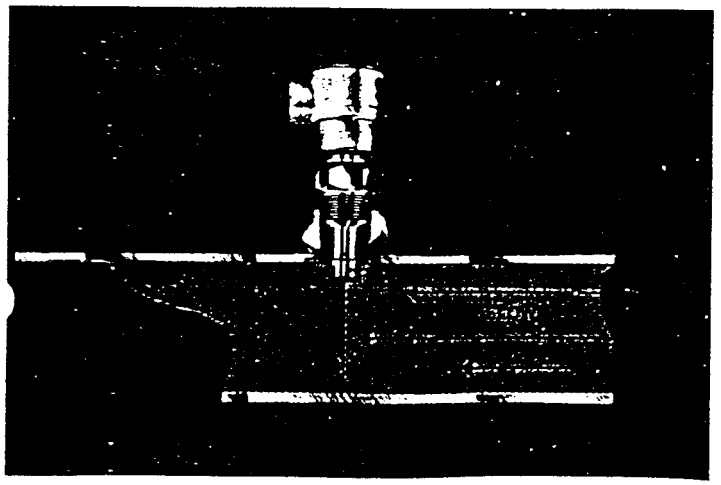




Model V4-2-U Flotect Dimensions and construction.

Compact and reliable, the Flotect V4 Flow switch operates automatically to protect equipment and pipeline systems against damage from reduction or loss of flow. Installed in thousands of pipelines and processing plants around the world, this unique magnetically actuated switching design gives superior performance. Universal multi-layer vane accommodates pipe sizes from 1½" up. Custom vanes are available with factory calibration. There are no bellows, springs, or seals to fail. Instead, the free-swinging vane attracts a magnet within the solid metal switch body above, actuating a snap switch by means of a simple lever arm.

Features include: Simplicity of design and a leak-proof switch body, machined from bar stock for pressures to 2000 psig, (138 bar), it eliminates the possibility of process fluid entering the switch compartment. The threaded conduit enclosure cover permits easy inspection or replacement of electrical assembly without shutting down the process, or removing electrical conduit. Power must be disconnected. The unit fits directly into pipeline with tee, thredolet or flange for easy installation. Pendulum-like vane action responds accurately to fluid flow rate. The custom vane or multi-layer vane is sensitive to low velocity flows, yet it is rugged enough to withstand high flow surges. If desired, a delay timer can be wired into the installation. All units are explosion-proof and listed with U.L. and C.S.A. for Class I, Groups C and D, Class II, Groups E, F, and G or are flame-proof to CENELEC EExd IIB T6.



APPLICATIONS

Protects motors, pumps and other equipment against low flow and no flow. Controls sequential operation of pumps, etc. Automatically starts auxiliary pumps and engines or actuates alarm and signal systems. Stops water cooled engines, machines and processes when coolant flow is interrupted. Shuts down burner when air flow through heating coil fails. Controls dampers according to flow. Stops machines if cooling oil flow ceases.

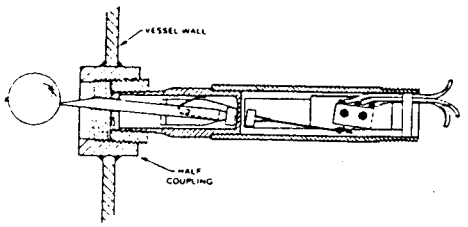
SPECIFICATIONS

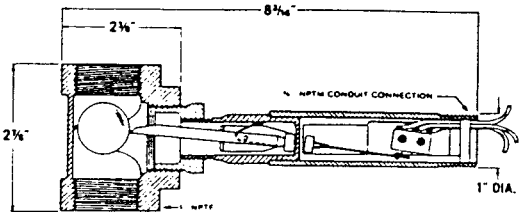
Temperature limits:	Standard 275°F (135°C). High temperature option (not U.L., C.S.A. or CENELEC), 400°F (205°C) max.
Operating Pressure:	Brass 1000psig (69bar) 316S.S. 2000psig(138bar) Ratings to 5000psig(345bar) available (SPDT only).
Electrical Rating:	U.L. and CENELEC: 10A@125/250 Vac C.S.A.; 5A@125/250 Vac, 5A resistive 3A inductive@30Vdc Optional ratings (not UL, CSA or CENELEC); MV option; Gold contacts, 1.0A@125 Vac MT option: 400°F (205°C), 5A@125/250Vac
Wiring:	U.L./C.S.A. unit; 16 gauge copper wire, 6" long, mechanically and solder bonded to switch. CENELEC unit: Terminal board.
Switch body:	One piece milled and bored Brass or 316 SS. Other materials on request.
Vane:	316 SS 1 9/16" (40mm) wide. Std. trim includes 430 SS and silver solder. Other materials on request.
Piping Connection:	1½" NPT std for mounting in 1½" thredolet. For other mounting see back page. Thredolet fittings available.
Installation:	Within 5° of vertical for proper operation. Units for horizontal installation (vertical pipes) on request.
Weight:	4lb.-5oz. (1.96Kg)
Options:	All 316SS wetted parts. Teflon coated wetted parts. DPDT circuits. Cartridge heater to melt paraffin, etc. Time delay relay.

W.E. Anderson
Div. of Dwyer Instr., Inc.

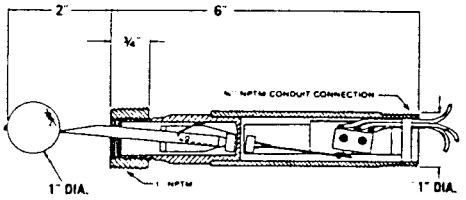
FLOTECT® Model L6 Level Switch

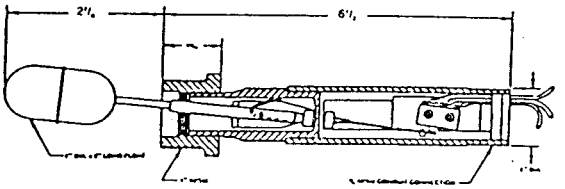
INSTALLATION AND OPERATING INSTRUCTIONS





L-6 WITH EXTERNAL FLOAT CHAMBER





L-6 FOR THRU—WALL INSTALLATION

INSTALLATION

1. Carefully unpack switch, making sure to remove any packing from inside float chamber and/or lower housing.
2. Switch must be indexed during installation, so that the arrow on the side of the switch points down.
3. If switch is installed "thru-wall", a 1" half-coupling must be welded in the vessel wall as shown above. Half-couplings must extend through the wall as shown above. Do not attempt to use thredolets, full couplings or other types of fittings.
4. Pass the connecting wires through external conduit and connect. Switch is deactivated and contacts are in normal condition when level is below switch.

Black - Common
Blue - N. O.
Red - N. C.

Note: Double pole, double throw switches have dual black, blue and red leads. These are connected in tne same manner as single pole double throw switches as described above.

5. Make sure conduit and wiring meet appropriate codes for hazardous areas. Make sure conduit is properly sealed. Care must be taken in hot/cold or outdoor installations to prevent condensation inside conduit. Electrical components must be kept free of moisture at all times. CAUTION: To prevent ignition of hazardous atmosphere, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in operation.
6. Inspect and clean wetted parts at regular intervals.

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 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 the 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.

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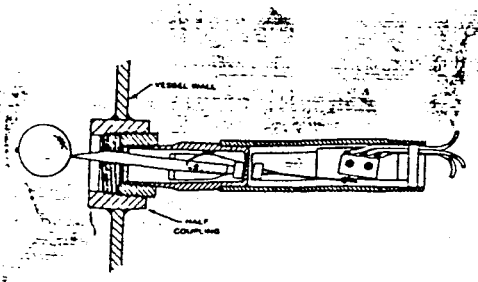
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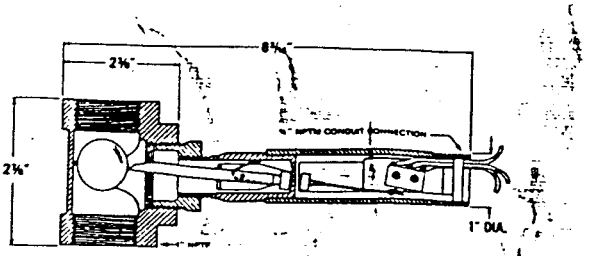
W.E. ANDERSON DIV., DWYER INSTRUMENTS, INC., 320 W. 80th ST., KANSAS CITY, MO 64114 816-333-9882

FLOTECT® Model L6 Level Switch

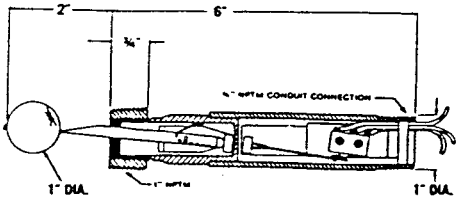
W.E. Anderson
Div. of Dwyer Instr., Inc.

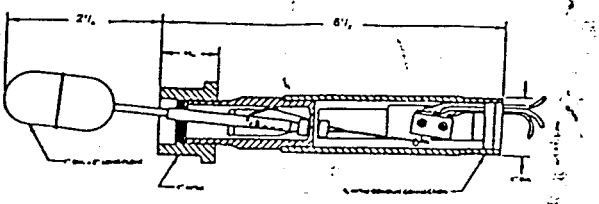
INSTALLATION AND OPERATING INSTRUCTIONS





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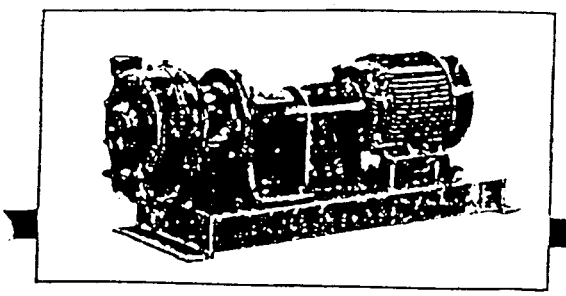
Limited Warranty: The Seller warrants all Dwyer instruments and equipment to be free from defects in workmanship or material under normal use and service for a period of one year from date of shipment. Liability under this warranty is limited to repair or replacement F.O.B. factory of any parts which 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 the 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.

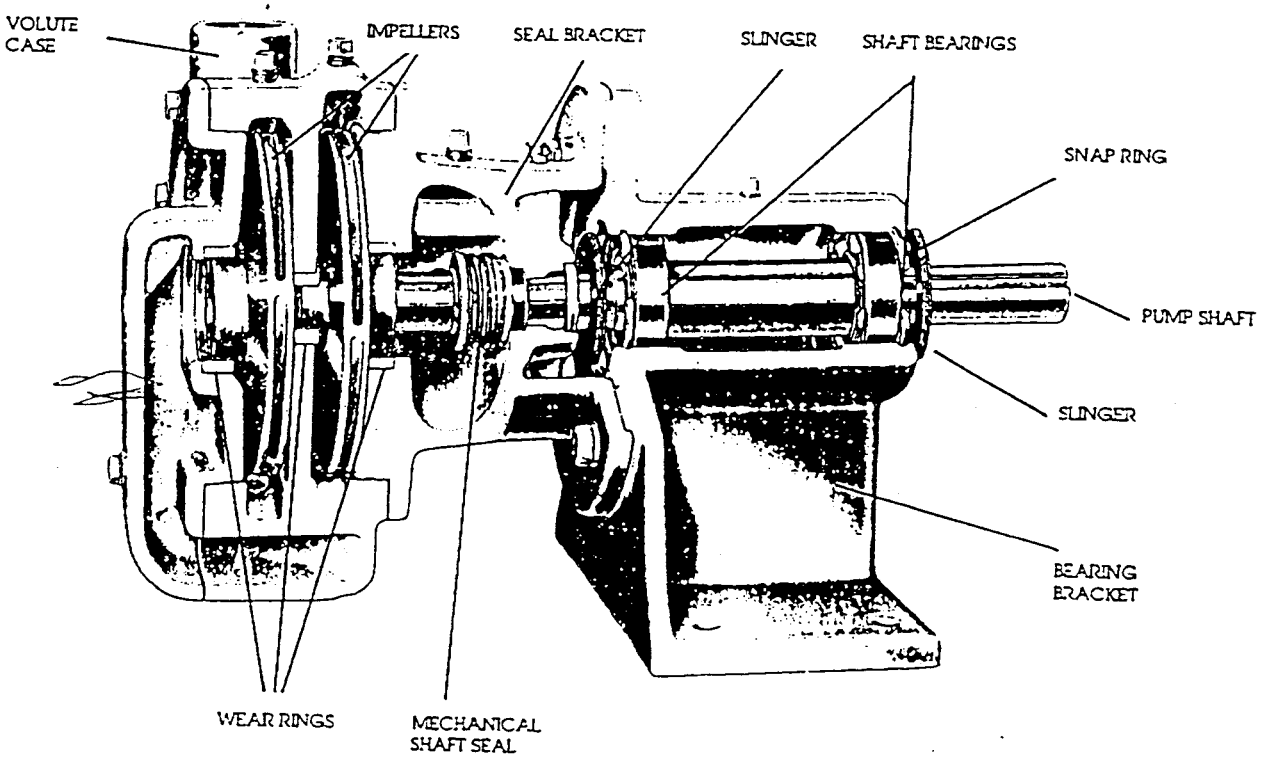
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W.E. ANDERSON DIV., DWYER INSTRUMENTS, INC., 320 W. 80th ST., KANSAS CITY, MO 64114 816-333-9882

XFER PUMP





Construction Materials

VOLUTE CASE
High tensile, gray iron casting with wear rings. Threaded discharge tapping rotates to 8 positions.

SEAL BRACKET
High tensile, gray iron casting with threaded suction tapping. Adjusts to 4 positions at 90° intervals. Seal bracket has oil chamber to lubricate and cool the seal face.

DRAIN PLUGS
Plugs are conveniently located so case can be completely drained in any discharge position.

BEARING BRACKET
Heavy duty bracket provides rigid support for liquid end. Holds shaft bearings in perfect alignment with pump case for quiet operation.

SHAFT BEARINGS
Regreasable heavy duty ball bearings, sealed on outboard side, lubricated at the factory.

IMPELLERS
Dual enclosed impellers are hydraulically and dynamically balanced. Mounted back-to-back for reduced axial thrust, results in vibration free operation and minimum bearing load. 12C has bronze impellers. 12CI has epoxy coated, high tensile gray iron impellers

WEAR RINGS
Replaceable wear rings and interstage bushings help to eliminate wear of the casting in the impeller hub and ring area. Bronze in 12C. Ni-Resist in 12CI.

MECHANICAL SHAFT SEAL
Located on suction side to provide lower pressure differential and longer seal life and maximum positive inlet pressure of 75 PSI. Standard seal will accomodate 220°F. Please consult factory for special seal applications.

PUMP SHAFT
Manufactured from tough, corrosion resistant stainless steel.

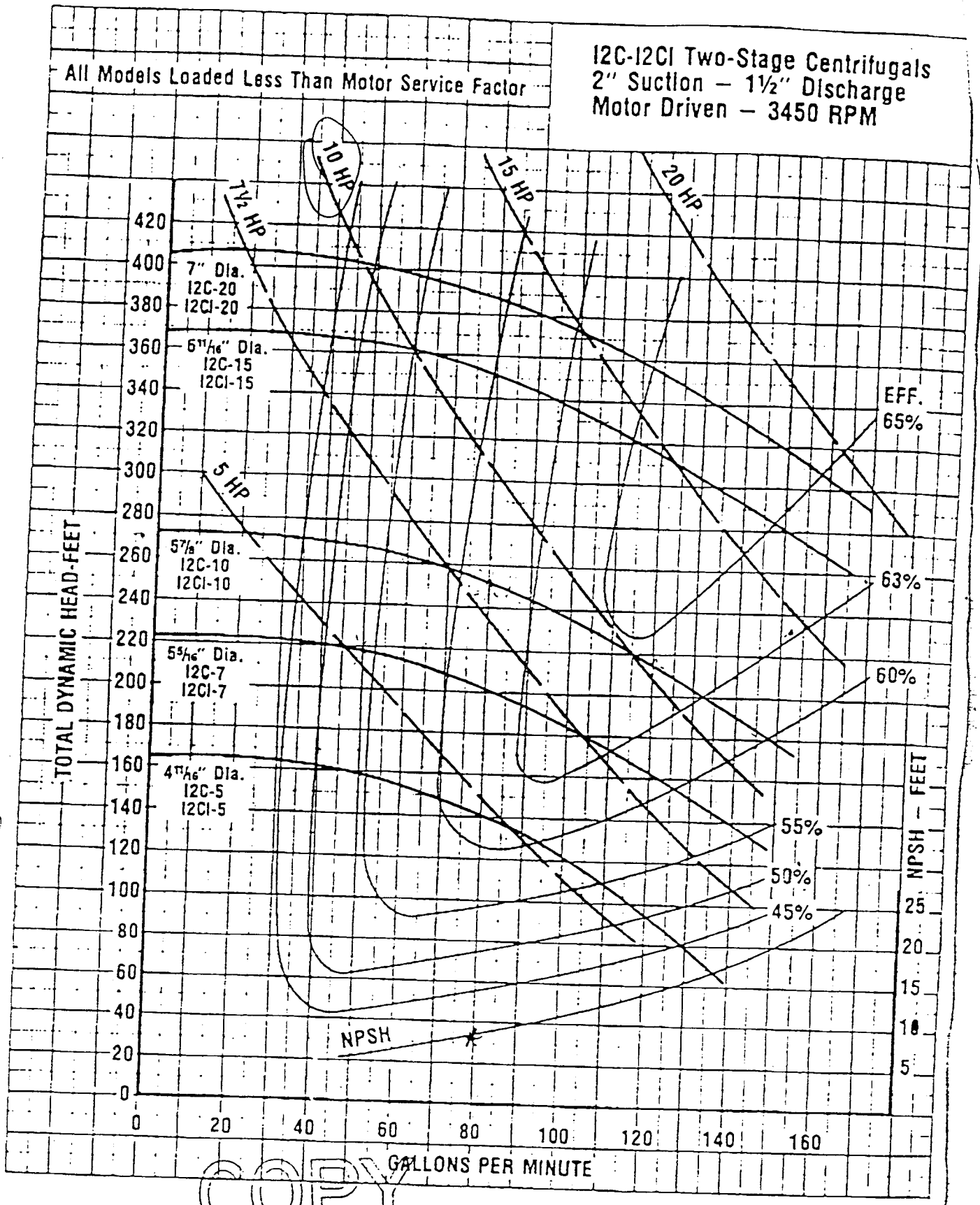
SLINGER
Molded rubber slinger protects bearings from moisture and dirt

SNAP RING
Carbon steel ring holds each bearing in place, prevents axial movement of the bearings and shaft.

MOTOR (FRAME MOUNTED UNITS)
General purpose, 3450 RPM, open drip proof, 230/460 volt motor is standard. Special motors on request. Frame mounted units use a flexible coupling for easy motor or pump replacement. Mounted on a heavy duty welded steel base.

Weight 125#

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COPY

Myers®

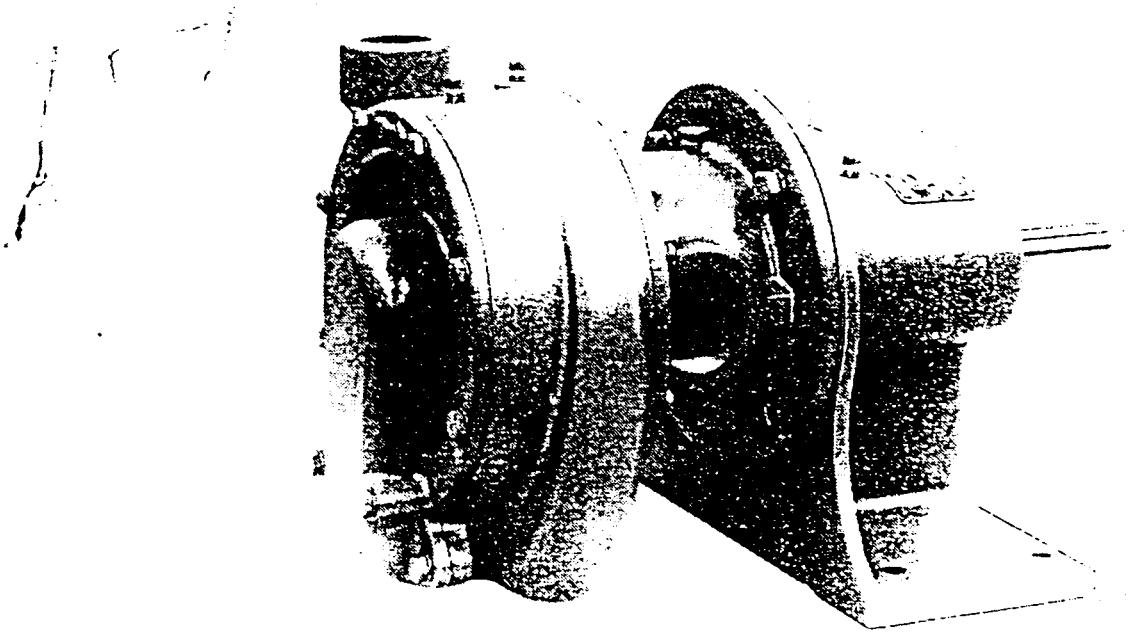
F.E.Myers, A Pentair Company
1101 Myers Parkway
Ashland, Ohio 44805-1923

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Transfer pump

I2C & I2CI/2C95 Two-Stage Centrifugal Pump Installation, Servicing and Parts List



Myers®

13600A429

INDUSTRIAL HIGH CAPACITY – HIGH PRESSURE TWO STAGE CENTRIFUGAL PUMP
"I2C" – PUMP UNIT ONLY – "I2CB" – BASE MOUNTED, DIRECT CONNECTED
"I2CB-M" – BASE MOUNTED, DIRECT CONNECTED, COMPLETE WITH MOTOR

Location

The pump should be located in an easily accessible place as close to the liquid source as possible. It should be installed in a clean, dry, well ventilated place, allowing room to inspect and service pump and driver.

Foundation

The pump should be bolted securely to a rigid foundation, either concrete or steel. The **2" N.P.T. Suction** can be rotated at 90° intervals to 4 different positions. As standard, the suction will be on the right side when facing the pump end. The **1½" N.P.T. Discharge** can be rotated at 45° intervals to 8 different positions. As standard, the discharge will point up.

Direct connected pumps should always be mounted in a horizontal position on a level foundation. It is the best practice on permanent installations to grout the baseplate in place, this is particularly important with the larger motors. The unit should be set in place with wedges under each corner, near the foundation bolts. Adjust wedges and foundation bolts until the baseplate is level, in proper relation to the piping so the flexible coupling halves are aligned. About ¾" should be allowed under the baseplate for grouting. The foundation bolts should be drawn up evenly until snug. When the alignment is correct grout the unit in place. Do not tighten foundation bolts or connect piping until grout is thoroughly set.

Alignment

Direct connected units are accurately aligned at the factory but all baseplates are flexible to some extent and, therefore, must not be relied upon to maintain the factory alignment. A flexible coupling is intended to take care of only slight misalignment. Therefore the pump and driver must be carefully aligned at the installation. Parallel alignment can be checked by placing a straight edge across the coupling halves. It must rest evenly on both halves at four positions spaced at approximately 90° intervals around the coupling. Angular alignment can be checked with a feeler gauge between the coupling halves at four points at approximately 90° intervals around the coupling. The coupling halves are positioned on the shafts so there is a gap of 1/32" between the jaw of one half and the body of the other half.

On belt driven units the pump and driver shafts should be parallel; the pulleys or sheaves must be aligned also. This can be checked by placing a long straight edge or tight string across the edges of the pulley or sheaves. The pulley or sheave on both pump and driver should be mounted as close to the bearing housing as possible to minimize the overhang, allowing sufficient clearance for rotor end play.

Belt Drives

Avoid a vertical drive on flat belt drives; an angle of 45° or less between the line of shaft centers and the horizontal is desirable. Normaliy 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. Wide, single ply flat belts are preferable to double ply belts due to the lower bearing pressures that result. Adjust belt tension just tight enough to prevent slippage; excess tension unnecessarily loads the bearings. V-belts do not require as much tension as flat belts.

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 pump tappings or larger 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, which would make it 2½" minimum. It 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 can 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 to serve as a shut-off or throttling valve if capacity is not correct. To protect the pump and foot valve 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 correct for voltage being used. Always use separate fused switch for pump, and wire of sufficient size 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. This switch to be supplied by customer. Never install a pump without proper overload protection. Check local code requirements.

When the motor is mounted on a baseplate 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. Be sure pump case is filled with water before operating. The mechanical shaft seal must never be run dry. Remove the three top ¼" pipe plugs while priming (one in each chamber) to assure that all air is evacuated. The three individual chambers of the pump and the suction piping must be completely filled before starting motor.

If pump does not start immediately, stop and reprime.

Rotation

The pump must run in direction of arrow on pump case. Three phase motors may run either direction so if rotation is wrong when first starting motor, interchange any two line leads to change rotation.

Starting

With all piping connected to the pump and the unit tightened down in place, check the alignment. If misalignment is apparent after grout has set, it must be corrected by placing shims under pump or driver. If the alignment is correct and the pump turns freely by hand, the unit is ready to start after it is primed.

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.

Stopping

Before stopping pump, close the discharge valve. This will prevent water hammer and is especially important on high head pumps.

Mechanical Seal Lubrication

The pump is provided with an oil chamber which lubricates the seal face of the mechanical seal. The oil level should be checked every 50 hours. Fill cavity through the oil cup (item 30) with S.A.E. No. 30 oil.

NOTE: Warning tag is attached to the oil cup, which reads "If the suction bracket is rotated to a different position, this oil cup must be removed and rotated so it will remain in a vertical position."

Bearings — Lubrication

Lubricate electric motor bearings in accordance with the manufacturer's instructions.

Pump bearings are sealed one side, open one side ball bearings that are lubricated by grease in the bearing bracket. Normally, these bearings require no further attention. This grease cavity must not be overloaded and should not be filled more than about half full. Dolium R or equivalent grease must be used.

If, due to unusual operation conditions, it becomes necessary to revitalize the grease, proceed as follows:

(1) Remove bearings and shaft. (See instructions on "To Replace Bearings.")
(2) Clean out cavity between bearings
(3) Replace bearings and pump shaft. NOTE: Bearing open sides should face in toward grease cavity with seals facing out.
(4) Fill cavity about ½ full (approx. ½ pound) of Dolium R or equivalent through top ¼"NPT.

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 when not in operation.

Three individual chambers must be drained. These chambers include the suction (seal bracket) and the first and second stage impeller chambers.

A - To drain the suction chamber, remove the ¼" pipe plug that is in the bottom position, unless the suction pipe is pointing down. If this is the case, drainage means must be provided in suction piping leading to the pump.

B — To drain the first and second stage impeller chambers, remove the two ¼" pipe plugs which are in the lower position of the case and the ⅛" pipe plug in the crossover casting.

To Remove and Replace Worn Impeller and Wearing Rings

To service pump, the suction and discharge piping must first be disconnected.

A — Remove backplate (25). Remove impeller cap screw (17) and washer in outer impeller eye. Remove tap bolts which hold volute case (21) to bracket (7). With two large screwdrivers on opposite sides of volute case, pry evenly and carefully to get volute case and outer impeller off. Care must be exercised to avoid bending pump shaft. In the event that the impeller is extremely difficult to pull, it can be expanded by warming with a torch. Be careful not to get it really hot. Then, before it has time to conduct heat to shaft, the impeller can be pried off with two screwdrivers, as described previously.

B — Remove inner impeller (13) using two screwdrivers and heat, if necessary. Be careful not to get shaft hot. Remove snap ring (12). Slide old seal (11) off shaft. Remove tap bolts (5) holding bracket (7) to bearing bracket (1) and pull bracket off shaft. Remove old floating seat and seat cup from bracket.

C — Make sure the synthetic seat cup of the new seal is tight against the shoulder of the floating seat, with rounded edge at the rear to facilitate insertion. The seal is assembled this way when shipped. Wipe the lapped sealing face of the floating seat perfectly clean and oil face with a clean, light oil.

D — Oil outer surface of the seat cup, using light oil (not grease) and push this assembly into the cavity of the bracket, seating it firmly and squarely. If necessary to use a piece of tubing to push it in, bear on the outer edge of the floating seat, never on the lapped sealing face

E - Replace oil seal (2) and lubricate oil seal face with S.A.E. No. 30 oil. Clean and oil the surface of the shaft with a light oil. Make sure slinger (10) is in place. Bolt bracket (less impellers) back to bearing bracket, being careful not to strike floating seat with shaft. Wipe the face of the sealing washer perfectly clean, and oil with clean light oil. It is extremely important that only clean oil be used on the sealing faces. Any dirt whatsoever may cause seal failure. Put the sealing washer and bellows assembly on the shaft. Be sure sealing washer is in proper position. The notches on the washer should mate with lugs on the retainer. Use a sleeve of proper diameter to slide assembly into place. Note: When sliding seal assembly on shaft, be sure to press only on tail sections of bellows and driving band. A smooth sleeve of about 1 9/32" diameter (1/32" larger than shaft), with a wall thickness of about 1/2" is suitable. Press assembly on until it is tight against floating seat.

F - Slip shaft seal spring over shaft, making sure that it, and the spring holding plate, are seated properly. Slip snap ring over shaft and slide it forward until it drops into place. Install inner impeller, with suction opening toward bearing bracket, making sure that key is in place on shaft. The inner and outer impellers have different wearing ring diameters. Therefore, it is impossible to assemble impellers in reverse order.

G - Place volute case back and bolt it to bracket. Install outer impeller with suction opening away from bearing bracket. Ring the beveled washer (shaft side) with a bead of Permatex to seal keyway and impeller shaft from corrosion. Assemble the impeller cap screw, with a 3/8" helical spring lock washer (302 stainless steel), Myers part number 5454A15. Tighten the cap screw to 35 foot/pounds.

H - Be sure pump case is filled with water before operating. Seal must never be run dry.

Replacing Wearing Rings

With impellers removed, the wearing rings can be examined for wear. Replace wearing rings if clearance on diameter is over .030".

To remove and replace wearing rings:

(1) Cut worn rings from casing with cold chisel. Be careful not to cut or damage the iron castings when removing rings. Cut rings nearly in half on opposite sides, then they can be easily bumped out.

(2) Put new rings in place and bump in with a hardwood block. New impeller wearing rings should always be installed in a pump at the same time a new impeller is installed. Worn wearing rings will cause excessive wear on the new impeller, thereby reducing the amount of service obtained from a new impeller.

To Replace Bearings

Pump end must be removed. Pry pulley and bearing retaining ring out with a screwdriver. Press shaft and outer bearing through pulley end of bearing bracket. Press pulley end bearing off shaft. Pump end bearing will probably remain in bearing bracket and can be removed by removing pump end snap ring and pressing pump end bearing out of bearing bracket.

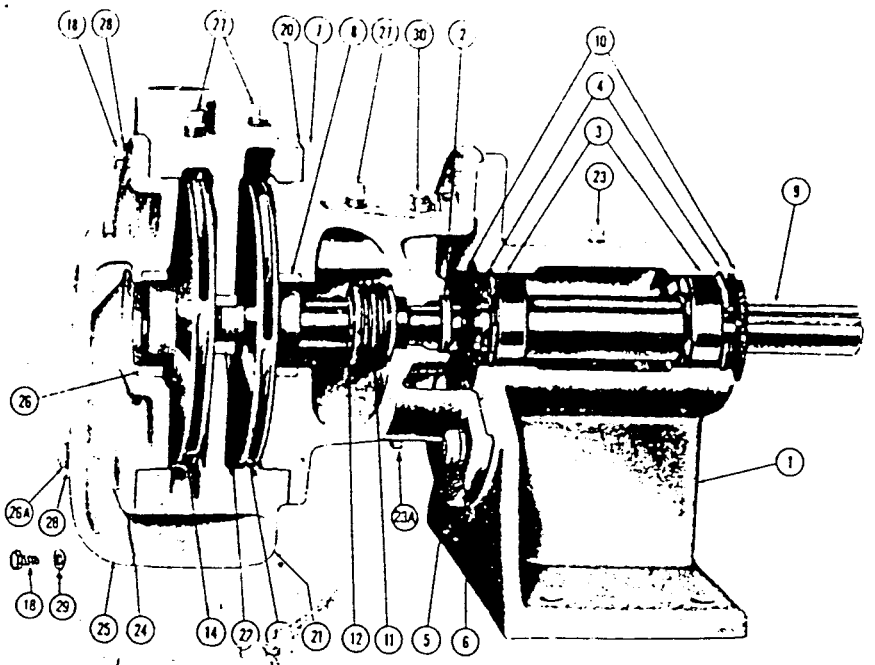
To reassemble: Press new pump end bearing into bearing bracket and replace snap ring. Press new pulley end bearing on shaft, pressing only on inner race of bearings. Press shaft and pulley bearing into housing. Note: Be sure that pump end bearing is supported on the inner race and pulley end bearing is supported on both inner and outer race during this operation. Also seals on bearings must face out on installation with open sides facing in (toward grease cavity).

SERVICE CHART TROUBLESHOOTING GUIDE

A No water delivered
B Not enough water delivered
C Not enough pressure
D Pump runs for short while, then loses prime

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 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. When pumping hot water recheck NPSH	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 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 wearing rings badly worn. Disassemble pump and replace impeller and wearing rings if clearance on diameter is over .030".		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				

I2C & I2CI/2C95 Pumps Parts List



Ref. No.	Part No.	Description
1	15035C	BRACKET, BEARING
2	5710A22	SEAL, LIP
3	11729A8	BEARING, BALL — 2 REQ'D
4	7756A7	RING, RETAINING — 2 REQ'D
5	19103A4	SCREW, ½ - 13UNC x 1¼ HEX HD. — 4 REQ'D
6	5454A4	WASHER, ½ LOCK — 4 REQ'D
7	17548D1	BRACKET, SEAL — WITH BRASS WEAR RING — I2C UNITS
7	17548D10	BRACKET, SEAL — WITH NI-RESIST WEAR RING — I2CI UNITS — REPLACES 17548D1 ON 2C95
8	12934A	RING, WEAR — BRASS — I2C UNITS
8	12934A1	RING, WEAR — NI-RESIST — I2CI UNITS — REPLACES 12934A ON 2C95
9	15037C	SHAFT
10	5059A263	SLINGER — 2 REQ'D
11	21181A16	SEAL, ROTARY — REPLACES 15218A & 15218A10 ON I2C, I2CI, & 2C95 — REPLACES 21181A8 ON I2CH. UNITS
12	12558A8	RING, RETAINING
13	17549C4	IMPELLER, 4 11/16 DIA. BRASS — I2C-5
13	17549C3	IMPELLER, 5 5/16 DIA. BRASS — I2C-7
13	17549C2	IMPELLER, 5 7/8 DIA. BRASS — I2C-10
13	17549C1	IMPELLER, 6 11/16 DIA. BRASS — I2C-15
13	17549C	IMPELLER, 7 DIA. BRASS — I2C-20
13	15038C4	IMPELLER, 4 11/16 DIA. C.I. — I2 CI-5
13	15038C3	IMPELLER, 5 5/16 DIA. C.I. — I2CI-7
13	15038C2	IMPELLER, 5 7/8 DIA. C.I. — I2CI-10
13	15038C1	IMPELLER, 6 11/16 DIA. C.I. — I2CI-15
13	15038C	IMPELLER, 7 DIA. C.I. — I2CI-20/2C95
14	17550C4	IMPELLER, 4 11/16 DIA. BRASS — I2C-5
14	17550C3	IMPELLER, 5 5/16 DIA. BRASS — I2C-7
14	17550C2	IMPELLER, 5 7/8 DIA. BRASS — I2C-10
14	17550C1	IMPELLER, 6 11/16 DIA. BRASS — I2C-15
14	17550C	IMPELLER, 7 DIA. BRASS — I2C-20
14	15039C4	IMPELLER, 4 11/16 DIA. C.I. — I2CI-5
14	15039C3	IMPELLER, 5 5/16 DIA. C.I. — I2CI-7
14	15039C2	IMPELLER, 5 7/8 DIA. C.I. — I2CI-10
14	15039C1	IMPELLER, 6 11/16 DIA. C.I. — I2CI-15
14	15039C	IMPELLER, 7 DIA. C.I. — I2CI-20/2C95
	5818A46	KEY, 3/16 SQ. x 2" SST
	8818A2	WASHER, 3/8 SST SPECIAL
	5454A15	WASHER, 3/8 SST LOCK
	17050A1	SCREW, 3/8 - 16 UNC x 1" SST NYLOK HEX HD

Ref. No.	Part No.	Description
18	19101A8	SCREW, 3/8 - 16 UNC x 7/8" HEX HD. — 16 REQ'D.
20	5863A18	GASKET
21	17547D1	CASE, VOLUTE — WITH BRASS WEAR RING — I2C UNITS
21	17547D10	CASE, VOLUTE — NI-RESIST WEAR RING — I2CI-5, I2CI-7 I2CI-10, I2CI-15
21	17547D11	CASE, VOLUTE — WITH NI-RESIST WEAR RING — I2CI-20/2C95 — REPLACES 17547D1 ON 2C95
22	15044A	RING, WEAR — BRASS — I2C UNITS
22	15044A1	RING, WEAR — NI-RESIST — I2CI UNITS — REPLACES 15044A ON 2C95
23	5022A9	PLUG, ¼ NPT GALV. PIPE
23A	5022A21	PLUG, ⅛ NPT GALV. PIPE
24	15041B	GASKET
25	15042D1	PLATE, BACK — WITH BRASS WEAR RING — I2C UNITS
25	15042D10	PLATE, BACK — WITH NI-RESIST WEAR RING — I2CI UNITS — REPLACES 15042D1 ON 2C95
26	15043A	RING, WEAR — BRASS — I2C UNITS
26	15043A1	RING, WEAR — NI-RESIST — I2CI UNITS — REPLACES 15043A ON 2C95
26A	19101A28	SCREW, 3/8 - 16 UNC x 2" HEX HD — 2 REQ'D — REPLACES 19101A29
27	B2164A	PLUG, ¼ NPT BRASS PIPE — 7 REQ'D ON I2C UNITS — 11 REQ'D ON I2CI-20/2C95
27	5022A6	PLUG, ¼ NPT STEEL PIPE — 7 REQ'D ON I2CI-5, I2CI-7, I2CI-10, I2CI-15
28	14946A3	WASHER, 3/8 SPECIAL SEALING — 16 REQ'D
29	5454A7	WASHER, 3/8 LOCK — 2 REQ'D
30	20362A1	CUP, OIL ⅛ NPT

MYERS
LIMITED WARRANTY
INDUSTRIAL PRODUCTS
CENTRIFUGAL AND RECIPROCATING PUMPS

The **F.E.MYERS**, A Pentair Company, warrants that its products are free from defects in material and workmanship for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of manufacture, whichever occurs first.

During the warranty period and subject to the conditions hereinafter set forth, **MYERS**, will repair or replace to the original user or consumer parts which prove defective due to defective materials or workmanship of **MYERS**. Contact your nearest authorized **MYERS** distributor or **MYERS** for warranty service. At all times, **MYERS** shall have and possess the sole right and option to determine whether to repair or replace defective equipment, parts or components.

WARRANTY EXCEPTIONS: Seals, piston cups, packing and liners are covered for a period of ninety (90) days. All engines and motors are warranted only to the extent of the warranty given by the engine and motor manufacturer.

LABOR, ETC. COSTS: **MYERS** shall IN NO EVENT be responsible or liable for the cost of field labor or other charges incurred by any customer in removing and/or reaffixing any **MYERS** product, part of component thereof.

THIS WARRANTY WILL NOT APPLY: (a)to defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printing instructions provided; (b) to failures resulting from abuse, accident, or negligence; (c) to normal maintenance services and the parts used in connection with such service; (d) to units which are not installed in accordance with applicable codes, ordinances and good trade practices; or (e) if the unit is moved from its original installation location and (f) unit is used for purposes other than for what it was designed and manufactured.

RETURN OR REPLACED COMPONENTS: any item to be replaced under this Warranty must be returned to **MYERS** at Ashland, Ohio, or such other places as **MYERS** may designate, freight prepaid.

PRODUCT IMPROVEMENTS: **MYERS** reserves the right to change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such change or improvement.

WARRANTY EXCLUSIONS: as to any specific **MYERS** Product, after the expiration of the time period of the warranty applicable thereto as set forth above. THERE WILL BE NO WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OF FITNESS FOR ANY PARTICULAR PURPOSE.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. No warrranties or representatives at any time made by any representative of **MYERS** shall vary or expand the provision hereof.

LIABILITY LIMITATION: IN NO EVENT SHALL **MYERS** BE LIABLE OR RESPONSIBLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES RESULTING FROM OR RELATED IN ANY MANNER TO ANY **MYERS** PRODUCT OR PARTS THEREOF.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state

In the absence of other suitable proof of this installation date, the effective date of this warranty will be based upon the date of manufacture plus 30 days.

Direct ALL notices, etc. to:

Service Department, **F.E.MYERS**, A Pentair Company, 1101 Myers Parkway, Ashland, Ohio 44805-1923.

22667A3

1/89

Myers®
F E Myers, A Pentair Company
1101 Myers Parkway
Ashland, Ohio 44805-1923
419/289-1144
FAX 419/289-6658, TLX 98-7443

AUTOMATIC CONTROLS CO.

6720 Best Friend Road, Norcross, Ga. 30071-2919 (404)447-5644

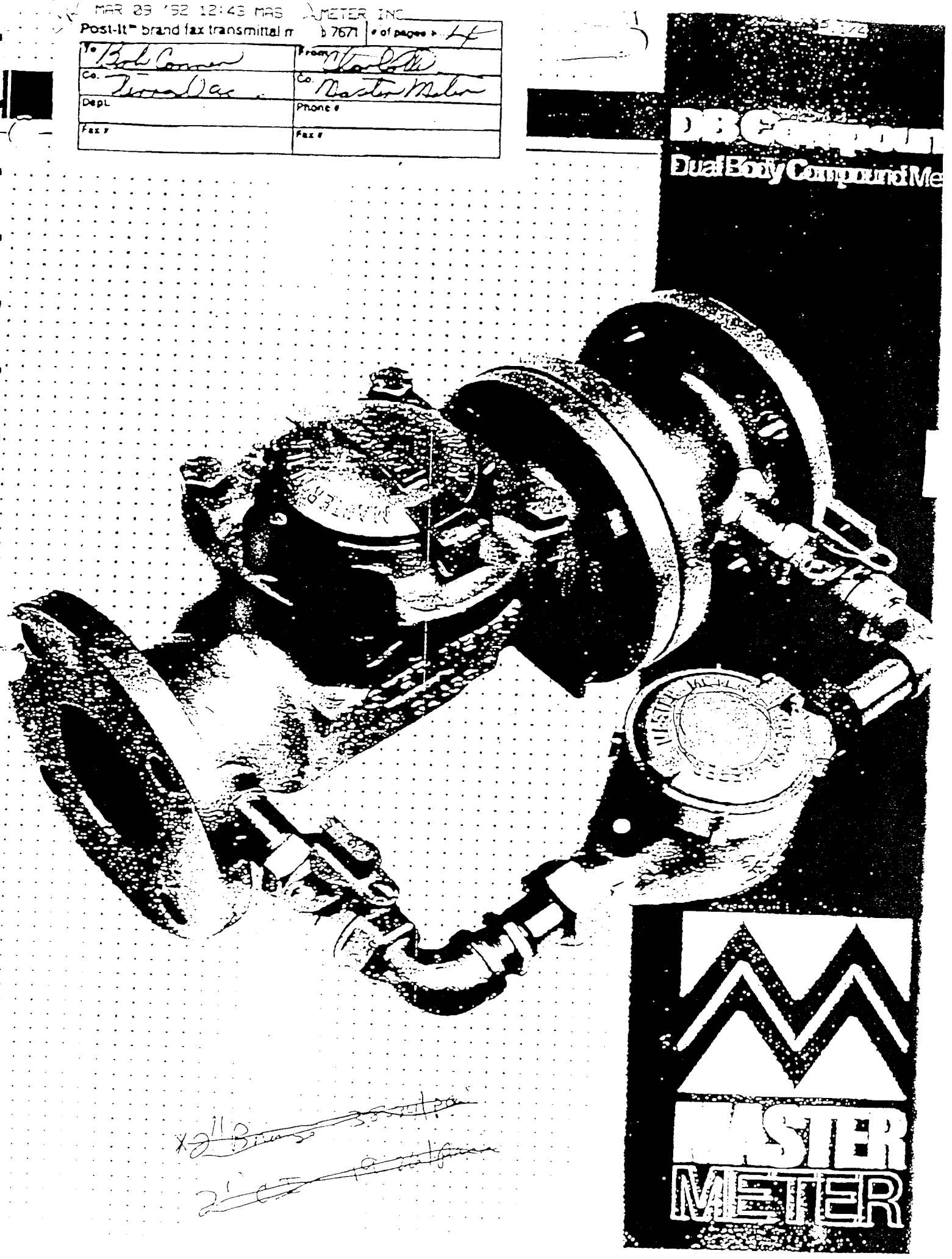
Factory Authorized Distribut

TANK & ENVIRONMENTAL TESTING
VILLAGE OF HARRIMAN, NY.
PO: ARE-01-04 ACC J/N 920011

GENERAL CONTROLS

MAR 89 '92 12:43 MAS METER INC

Post-it™ brand fax transmittal m	b 7671	# of pages ▸ 4
To Bob Conner	From Charlotte	
Co. Donaldson	Co. Master Meter	
Dept	Phone #	
Fax #	Fax #	



Reliable Measurement For A Wide Range Of Flows

The Master Meter DB (Dual Body) Compound Meter is designed to provide utilities with highly accurate measurement over a wide flow range. By incorporating a Master Meter multi-jet meter and turbine meter in one assembly, the DB Compound relies on proven velocity measurement to produce high and sustained accuracy over a broad range of flows.

	AWWA C-702	DB Compound
2" Compound Meter		
Minimum Flow	1/4 gpm	1/4 gpm
Continuous Operating Range	2-80 gpm	1-175 gpm
Maximum Flow	160 gpm	285 gpm
3" Compound Meter		
Minimum Flow	1/2 gpm	1/4 gpm
Continuous Operating Range	4-160 gpm	1-330 gpm
Maximum Flow	320 gpm	480 gpm
4" Compound Meter		
Minimum Flow	3/4 gpm	1/2 gpm
Continuous Operating Range	6-250 gpm	2-440 gpm
Maximum Flow	500 gpm	880 gpm

Design and Operation

The Master Meter compound meter combines a Master Meter turbine meter on the main flow line and appropriately-sized multi-jet meter on the low flow or by-pass line. A differential pressure valve controls the flow of water through the appropriate measuring device. Piping sized to the bypass line connects the meters in a single assembly.

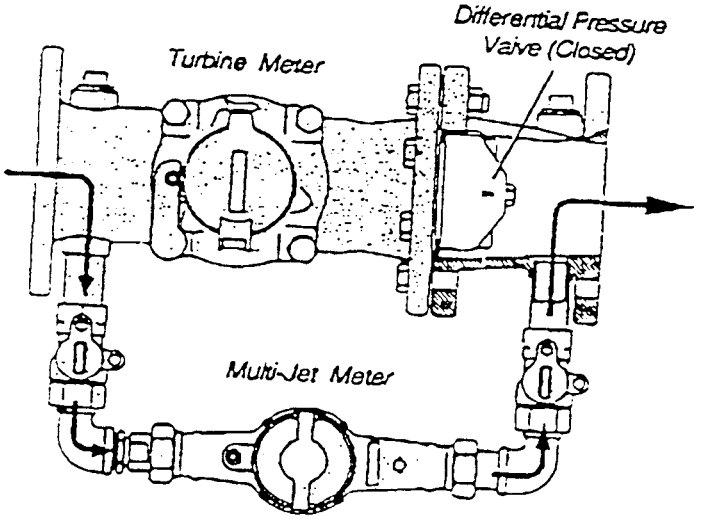
Water flows through a bypass meter, and usage is recorded on its register, until the flow rate reaches approximately one half the capacity of the bypass meter. At that point, the drop in pressure causes the differential pressure valve to open, and water flows through both the mainline and by-pass meters. In its full open position, the valve allows unimpeded flow through both chambers and registration is recorded on both meters. When flow is decreasing the process is reversed, directing low flows through the multi-jet chamber.

Broad Flow Range

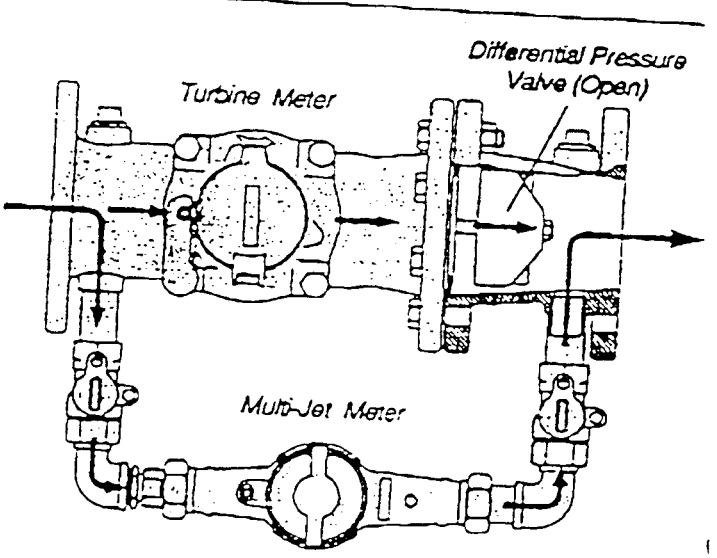
The Master Meter DB Compound Meter provides utilities accurate measurement over a significantly broader flow range than specified in AWWA C-702, as shown in the chart above, and beyond that available with many other compound designs. In addition, Master Meter guarantees the accuracy of its meters in these broader flow ranges.

High Accuracy At Crossover

With the DB Compound Meter, utilities need not fear revenue loss from meters operating in the crossover range. At crossover, when primary measurement of water flow shifts from one chamber to the other, the Master Meter DB Compound accurately measures at least 97 percent of flows, well above the AWWA specified 90%. Master Meter can provide high accuracy because of the DB Compound



DB Compound Meter Operation At Low Flows

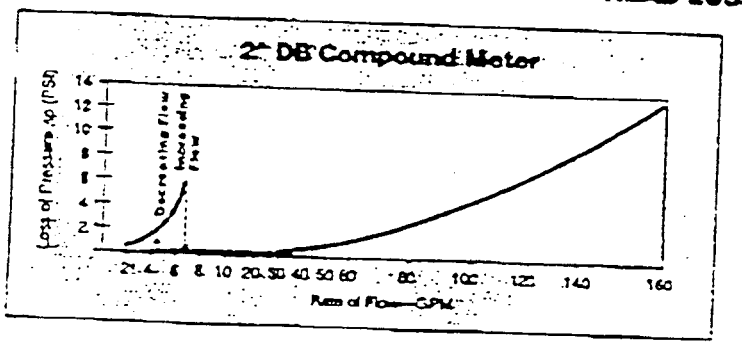


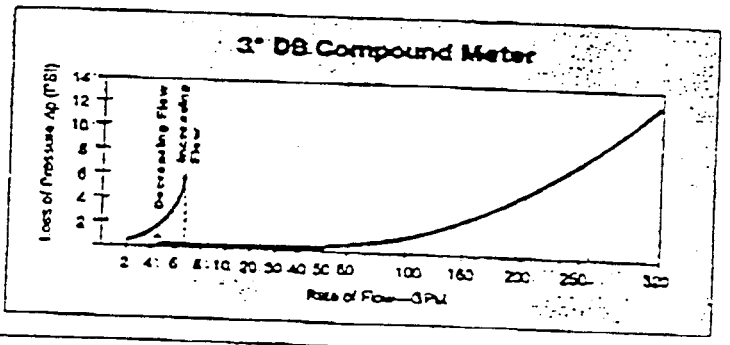
DB Compound Meter Operation At High Flows

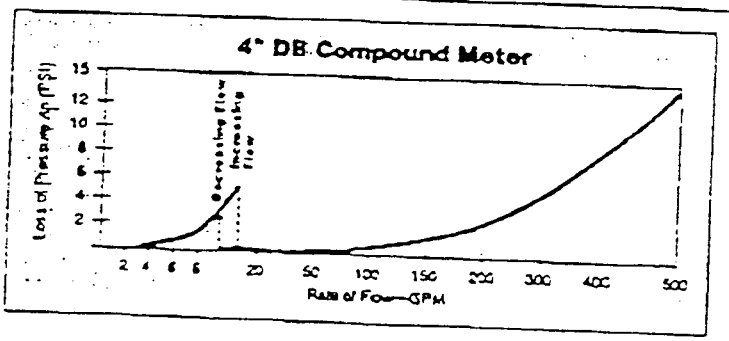
METER OPERATING CHARACTERISTICS AND DIMENSIONS

Characteristic/Dimension	2"	3"	4"
Continuous Operating Range (gpm)	1 - 175	1 - 330	2 - 440
Low Flow (gpm)	1/4	1/4	1/2
Maximum Flow - Intermittent (gpm)	285	480	880
Changeover (gpm): Increasing Flow	8.5	8.5	17.0
Decreasing Flow	4.5	5.3	13.0
Maximum Working Pressure (psi)	150	150	150
Maximum Working Temperature (F)	120°	120°	120°
Low Flow Meter Size	5/8"	5/8"	1"
Accuracy: Low Flow	±3%	±3%	±3%
Changeover	±3%	±3%	±3%
Normal Operating Range	±2%	±2%	±2%
Length	15-1/4"	17"	20"
Height	9-3/4"	8-3/4"	9-1/4"
Height - Bottom to Center Line	2-7/8"	4-1/4"	4-3/4"
Width	11-1/4"	13-1/4"	16-1/4"
Weight (lbs.)	44	66	90

HEAD LOSS CURVES



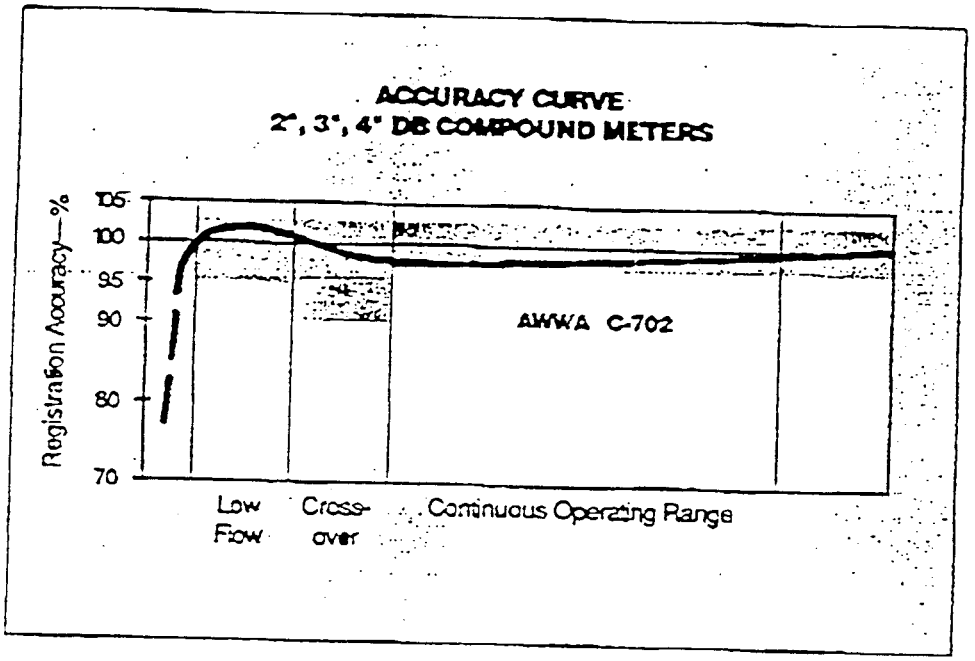




Distributed by:

1001 McKesson Drive
Longview, Texas 75604
1-800-765-6518
903-297-0635
FAX 903-297-5963

MASTER METER



design, where flow through the by-pass chamber continues to be measured, even once the turbine chamber is operating.

Installation and Service Flexibility

Master Meter compound meters are designed to maximize installation flexibility. Meters are designed to fit comfortably in any current compound meter installation, with dimensions smaller than currently installed models. For even greater flexibility, the by-pass meter can be installed on either side of the main line meter, to accommodate installations that may be close to walls of buildings or meter vaults.

To simplify service, shut-off valves are installed upstream and downstream of the multi-jet meter on the by-pass line. When necessary, flow can be directed through the turbine chamber while the multi-jet is repaired in-line or replaced with another meter. The Master Meter Turbine Meter can also be serviced without removal from the line. Lock wings are provided on the shut-off valves, should a utility desire to install locks to prevent customer diversion of low flows through the turbine chamber.

Both meters are sealed after factory calibration. For utility recalibration, to compensate for wear without parts replacement, external adjusting ports are available on both the main line and by-pass meters. External adjusting ports are sealed to prevent tampering and provide visual indication of tampering attempts.

Long-Life Design

To insure many years of dependable performance Master Meter's compound meter relies on proven materials and proven measurement designs.

The main cases housing both turbine and multi-jet measurement chambers are 81 percent copper composition; bronze register retaining rings and lids are standard. All piping and connections are bronze meeting AWWA Standard C-800. The bronze housing of the differential pressure valve surrounds an engineered plastic clapper with stainless steel shaft and rubber valve seat. The multi-jet and turbine chamber housings and impellers are constructed of rugged engineered plastics.

A reliable magnetic drive provides direct linkage between measurement elements and registers. No intermediate gearing is required; no gearing is exposed to water.

A flow straightener is housed upstream of the turbine chamber to condition flows for accurate measurement. And as is standard on all Master Meter Multi-jet Meters, the by-pass meter of the DB Compound Meter incorporates a full 360° strainer. Debris passing through the strainer will flow through the measuring chamber without damage to the impeller, allowing both survival and accurate measurement in installations in which other designs would stop. A non-return valve is installed in the outlet of the multi-jet meter to prevent a backward flow of water through the low-flow meter. As with all meters 2" and above, a separate strainer is recommended to protect the critical measurement element from fine-debris damage.

Reading Flexibility

Standard direct read, DIALOG™ Automated Meter Reading System and Electrical Contact registers are available for the DB Compound Meter. DIALOG registers are compatible with either on-site automated reading with a portable hand-held computer or telephone Automatic Meter Reading (AMR). Direct read and DIALOG registers are permanently sealed with a tempered glass lens, stainless steel base and wrap-around gasket to prevent intrusion of dirt or moisture.

For efficient on-site automated reading, DIALOG's capabilities enable the reading of both turbine and multi-jet registers from one ScanDisc™ mounted remote from the meter or in the top of a meter box lid.

Extended Warranties

Master Meter guarantees the DB Compound Meter for two full years. In addition, performance of the Master Meter Multi-jet Meter installed on the by-pass line is guaranteed for fifteen years – to operate to AWWA C-708 new meter accuracy for two full years and to repaired meter accuracy thru the fifteenth year (or specified registration limits.)

Master Meter DB Compound Meter: Accurate, Dependable, Flexible. Why Settle For Less.

DIALOG is a trademark of Master Meter Inc. ScanDisc is a trademark of Metagraph, Inc.

******* A N A L Y S I S OF S T R I P P I N G T O W E R *******

PROJECT : Village of Harriman

DATE : 3/12/1992

ENGINEER : Terra Vac

PAGE : 1/2

PHYSICAL CONSTANTS

Design temperature	:	50.0 degrees F.
Density of water	:	62.4 lb/ft^3
Density of air	:	0.0778 lb/ft^3
Viscosity of water	:	8.80E-04 lb/ft.s
Viscosity of air	:	1.16E-05 lb/ft.s
Surface tension of water	:	74 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

Name	:	Trichloroethylene
Molecular weight	:	131.3 g/mol
Boiling point	:	189 degrees F.
Molal volume at boiling point	:	0.1071 L/mol
Henry's Constant	:	0.38000
Temperature constant	:	1909 deg K
Molecular diffusivity in air	:	8.52E-05 ft^2/s
Molecular diffusivity in water	:	6.65E-09 ft^2/s

PACKING PROPERTIES

Name	:	Jaeger Tripacks
Packing Material	:	Plastic
Nominal Size	:	3.50 inch
Specific Area	:	38.1 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	29.0 ft
Air friction factor	:	14

******* A N A L Y S I S OF S T R I P P I N G T O W E R *******

PROJECT : Village of Harriman

DATE : 3/12/1992

ENGINEER : Terra Vac

PAGE : 2/2

LOADING RATES

Water mass loading rate	:	1.6	lb/ft^2.s *
Air mass loading rate	:	0.098	lb/ft^2.s *
Water volumetric loading rate	:	11.30	gpm/ft^2 *
Air volumetric loading rate	:	565	gpm/ft^2 *
Air pressure gradient	:	<.06	" H2O/ft #
Volumetric air/water ratio	:	50.0	
Stripping factor	:	11.6	

MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	45.3	%
Wetted packing area	:	17.3	ft^2/ft^3 *
Transfer rate constant in water	:	0.000491	ft/s
Transfer rate constant in air	:	0.007275	ft/s
Overall transfer rate constant	:	0.000380	ft/s
Overall mass transfer coefficient	:	0.0066	1/s
NTU	:	7.5694	
HTU	:	3.8312	ft

CONTAMINANT REMOVAL

Influent concentration	:	30.0	ug/L
Effluent concentration	:	0.0	ug/L
Fraction removed	:	99.9	%
Mass of contaminant removed	:	0.00407	lb/ft^2.day *
Concentration in airstream	:	0.00158	mg/ft^2.ft^3

* Expressed per unit of stripping tower cross-sectional area

\# Expressed per unit of tower length

******* A N A L Y S I S OF S T R I P P I N G T O W E R *******

PROJECT : Village of Harriman

ENGINEER : Terra Vac

DATE : 3/12/1992

PHYSICAL CONSTANTS

Design temperature	:	50.0 degrees F.
Density of water	:	62.4 lb/ft^3
Density of air	:	0.0778 lb/ft^3
Viscosity of water	:	8.80E-04 lb/ft.s
Viscosity of air	:	1.16E-05 lb/ft.s
Surface tension of water	:	74 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

lame	:	1,1,1-Trichloroethane
Molecular weight	:	133.4 g/mol
Boiling point	:	165 degrees F.
Molal volume at boiling point	:	0.1145 L/mol
Henry's Constant	:	0.56000
Temperature constant	:	1636 deg K
Molecular diffusivity in air	:	8.35E-05 ft^2/s
Molecular diffusivity in water	:	6.39E-09 ft^2/s

PACKING PROPERTIES

ame	:	Jaeger Tripacks
Packing Material	:	Plastic
ominal Size	:	3.50 inch
ecific Area	:	38.1 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	29.0 ft
ir friction factor	:	14

AIRSTRIP Ver. 1.2 (C) 1988 3209 Garner Ames. Iowa 50010

***** Thomas Jay Schmitt, P.G. *****

******* A N A L Y S I S OF S T R I P P I N G T O W E R *******

PROJECT : Village of Harriman

DATE : 3/12/1992

ENGINEER : Terra Vac

PAGE : 2/2

LOADING RATES

Water mass loading rate	:	1.6	lb/ft^2.s
Air mass loading rate	:	0.098	lb/ft^2.s
Water volumetric loading rate	:	11.30	gpm/ft^2
Air volumetric loading rate	:	565	gpm/ft^2
Air pressure gradient	:	<.06	" H20/ft
Volumetric air/water ratio	:	50.0	
Stripping factor	:	18.4	

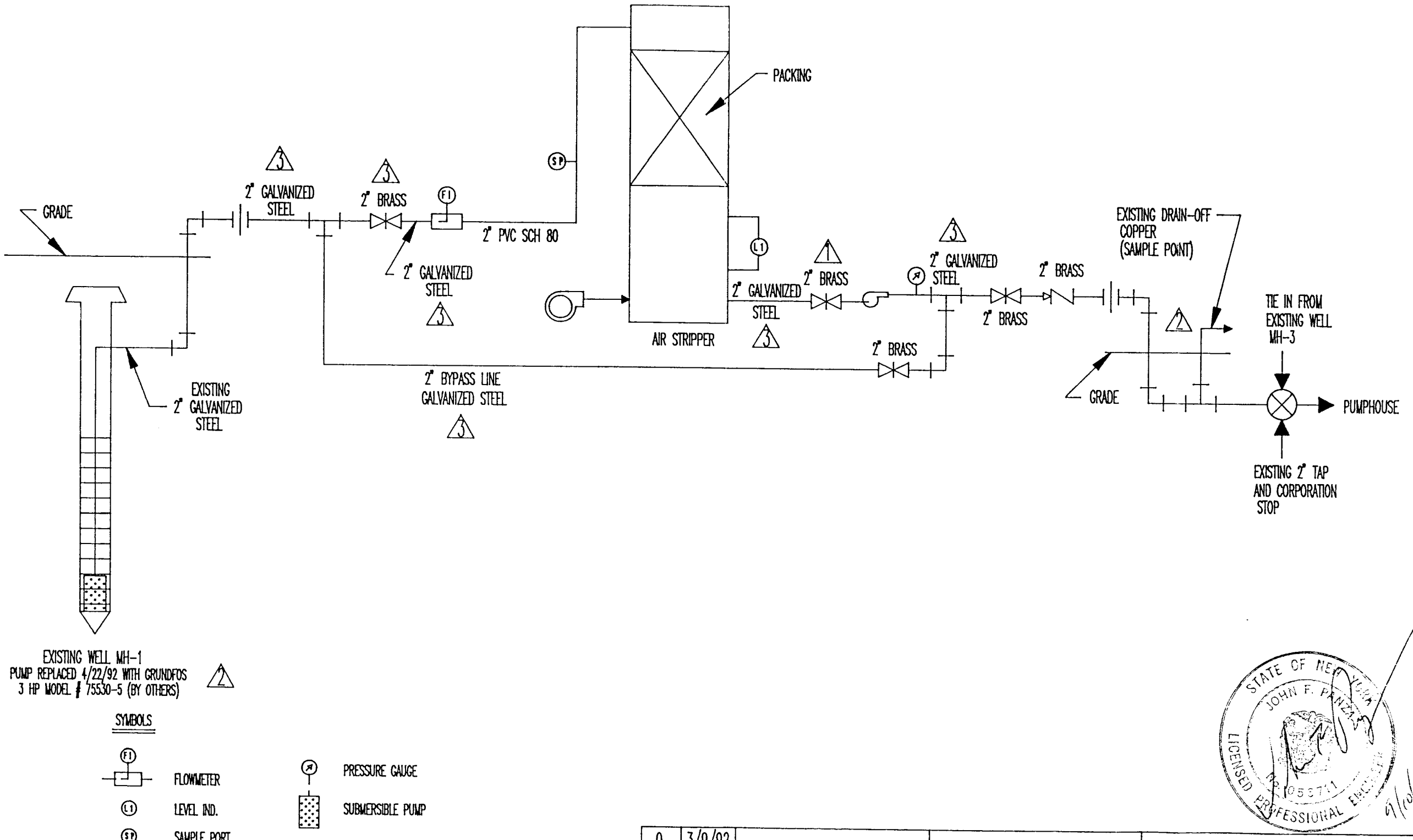
MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	45.3	%
Wetted packing area	:	17.3	ft^2/ft^3
Transfer rate constant in water	:	0.000482	ft/s
Transfer rate constant in air	:	0.007174	ft/s
Overall transfer rate constant	:	0.000407	ft/s
Overall mass transfer coefficient	:	0.0070	1/s
NTU	:	8.1058	
HTU	:	3.5777	ft

CONTAMINANT REMOVAL

Influent concentration	:	10.0	ug/L
Effluent concentration	:	0.0	ug/L
Fraction removed	:	100.0	%
Mass of contaminant removed	:	0.00136	lb/ft^2.day
Concentration in airstream	:	0.00053	mg/ft^2.ft^3

* Expressed per unit of stripping tower cross-sectional area
\# Expressed per unit of tower length



REV	DATE	DESIGN ENG.
0	3/9/92	
1	3/19/92	
2	4/29/92	
3	9/2/92	

TERRA VAC

HARRIMAN STRIPPER FACILITY
HARRIMAN, NEW YORK

PROCESS DIAGRAM

DRAWN: C CONNOLLY

SCALE: NOT TO SCALE

DWG. NO. 40-4127-01

STATE OF NEW YORK JOHN F. PANZA No. 055711 LICENSED PROFESSIONAL ENGINEER 6/10/92

APPENDIX C
FIELD INSPECTION REPORTS

Daily Inspection Report

Owner: _____ Report No. 1

Project Name: VILLAGE OF HARRIMAN AIR STRIP Date: 4/13/92

Project No.: P1533 Weather: A.M. SUNNY P.M. SUNNY

Contractor: D+J CORP Contract: _____ Temp. Range: (°F) High 45° Low 35°

Design Project No.: _____ Frost Depth: NONE

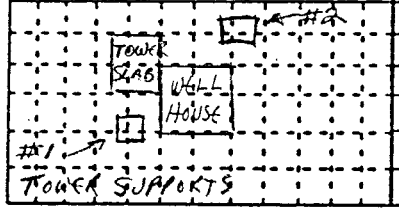
Construction Engineer: BOB LA ROSA Line and Grade Method: _____

Contractor Super.: LOU CASALE

Number and Function of Contractors' Personnel, Hours Worked (Identify Subcontractors Separately)

Contractor	Function	No.	Hours
D+J	LABORER	3	8
D+J	FMN.	1	8

Contractor	Function	No.	Hours

Sketch	Major Constr. Equip. Description	Size/Capacity	No.	No. in Use
	FLATBED (TILT)		1	4hrs.

Daily Notations:

1. Contractor had dug for concrete forms. On tower support excavation #1 electric lines were uncovered. The lines were wrapped with a 2½" PVC sleeve.

2. Steve Dortch (municipal Engineer) expressed concern over the effect of frost heave on the 18" thick stepped tower slab. He called project engineer Bob La Rosa. Bob said tower slab is a floating slab.

3. The planned location for tower support #2 was moved due to a conflict with the 4" CI water pipe to well house. This was discussed with Bob La Rosa by telephone. Bob wanted to discuss this with his structural engineer. It was determined to move the support 4 feet. Actual amount moved (cont)

Visitors	Representing
Steve Dortch	Municipal Engineer
Building Inspector	Harriman NY

Page 1 of 2

Inspector D. Hurley

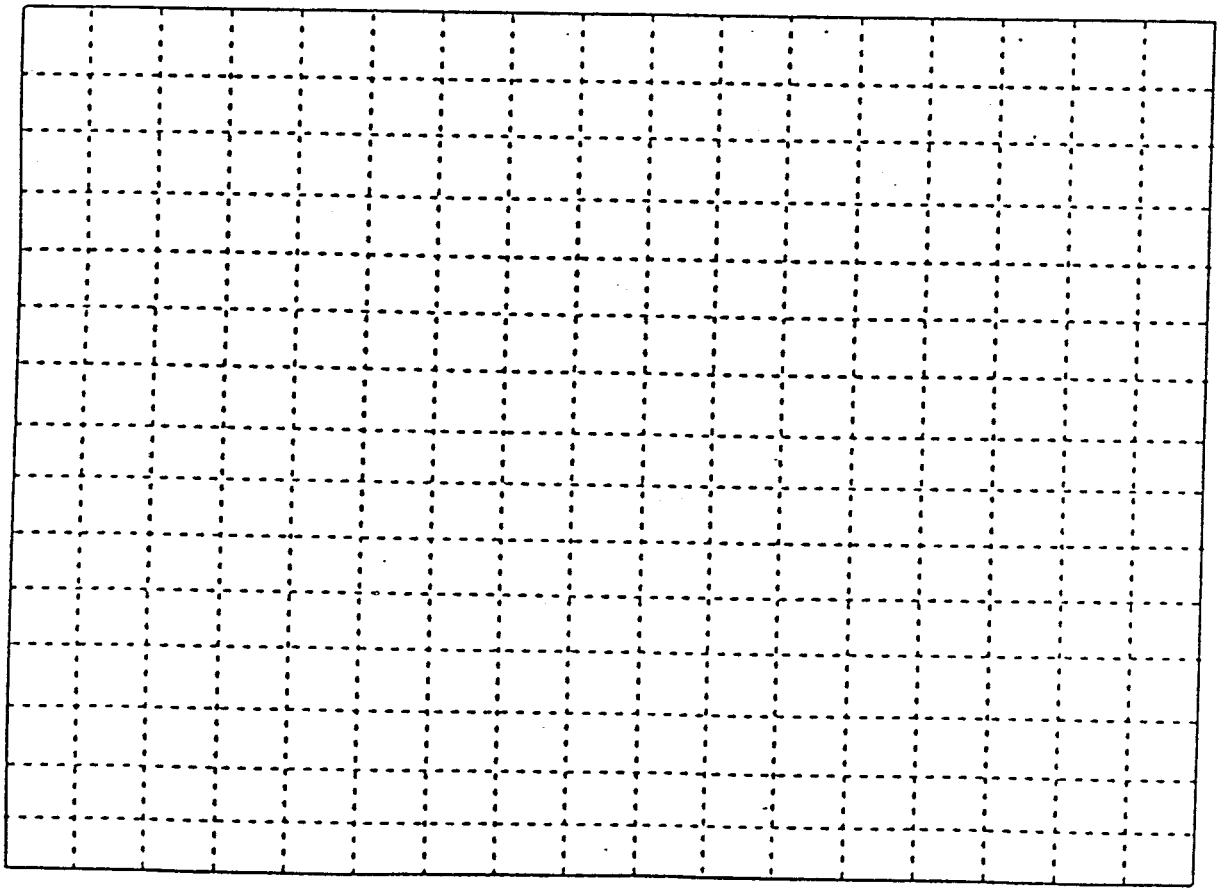
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was 5'1". Contractor claimed down time while waiting for a decision approx 2½ hrs.

4. At tower support #2's new location a 4" PVC to clay drain and a 2" copper well line were uncovered. The 2" copper was covered over & under with sand. The PVC to clay drain (4") was broken and required a 4" ferneo sleeve to repair. It was not observed whether the clay bell existed in a broken condition or was broken during hand excavation by contractor. Contractor claims the bell was broken

5. Steve Fritch expressed concern over the construction of the supporting tower on the concrete pad before the 28 day period. Bob La Rosa will sign off on this

Sketch (Plan Sheet Reference No. _____)



per our telephone conversation.

6. I advised the contractor to get chairs for the steel mat in the tower slab and to remove the stones on which he had it placed. I also requested he bring a vibrator for the pour, and to respace the tower mat steel.

7. Contractor was instructed to provide 4 test cylinders with the concrete.

8. Municipal Engineer asked that from excavations be covered overnight due to expected below freezing temperatures. Contractor covered excavations with plastic.

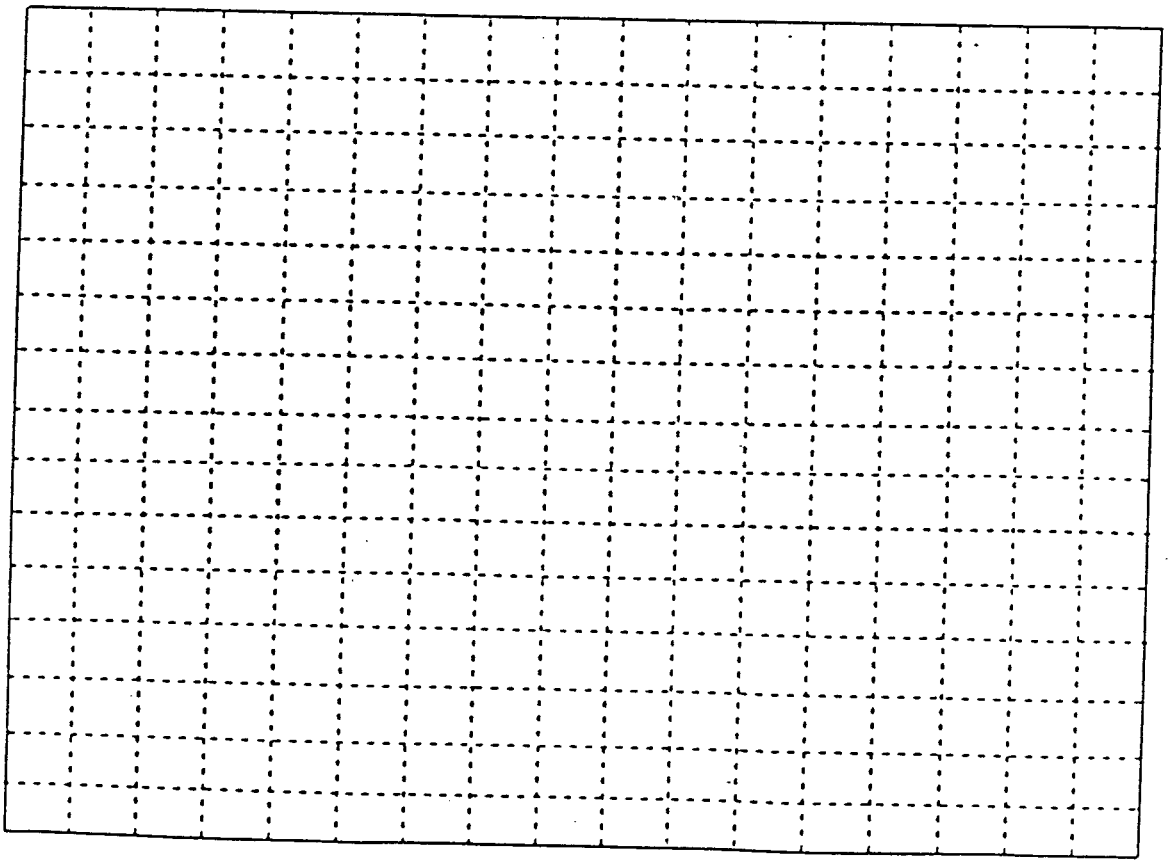
9. I discussed the lugs which will hold down the stripping towel with Bob LaRosa. They are to be Hilti type and will be installed after the pour is made and sets.

10. Tower slab excavations dug 42 inches deep from surface grade per request of Steve Dutch. (Municipal Engineer)

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Continued From Report No. _____ Page _____ Of _____

Sketch (Plan Sheet Reference No. _____)



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Daily Inspection Report

Owner: _____ Report No. 2

Project Name: VILLAGE OF HARRIMAN AIR STRIPPER Date: 4/14/92

Project No.: P1533 Weather: A.M. SUNNY P.M. SUNNY

Contractor: D+J CORP. Contract: _____ Temp. Range: (°F) High 55° Low 40°

Design Project No.: _____ Frost Depth: NONE

Construction Engineer: BOB LAROSA Line and Grade Method: _____

Contractor Super.: _____

Number and Function of Contractors' Personnel, Hours Worked (Identify Subcontractors Separately)

Contractor	Function	No.	Hours
D+J	FORMAN	1	6
D+J	LABOREK	1	6

Contractor	Function	No.	Hours

Sketch	Major Constr. Equip. Description	Size/Capacity	No.	No. in Use

Daily Notations:

1. Contractor re-spaced drop steel and placed chairs under steel as requested.

2. Concrete arrived at 8:45AM (4000 PSI MIX) including 4 test cylinders.

3. Contractor brought 6x6 wire mesh for tower support footings (and #4 rebar)

4 Contractor applied fence repair to clay pvc drain on tower support #2

5. Contractor covered pours with plastic after final finish. (Cont.)

Visitors	Representing
Christopher Sand	Terra Vac (Air Stripper)
Steve Sartek	Municipal Eng.

Page 1 of 4

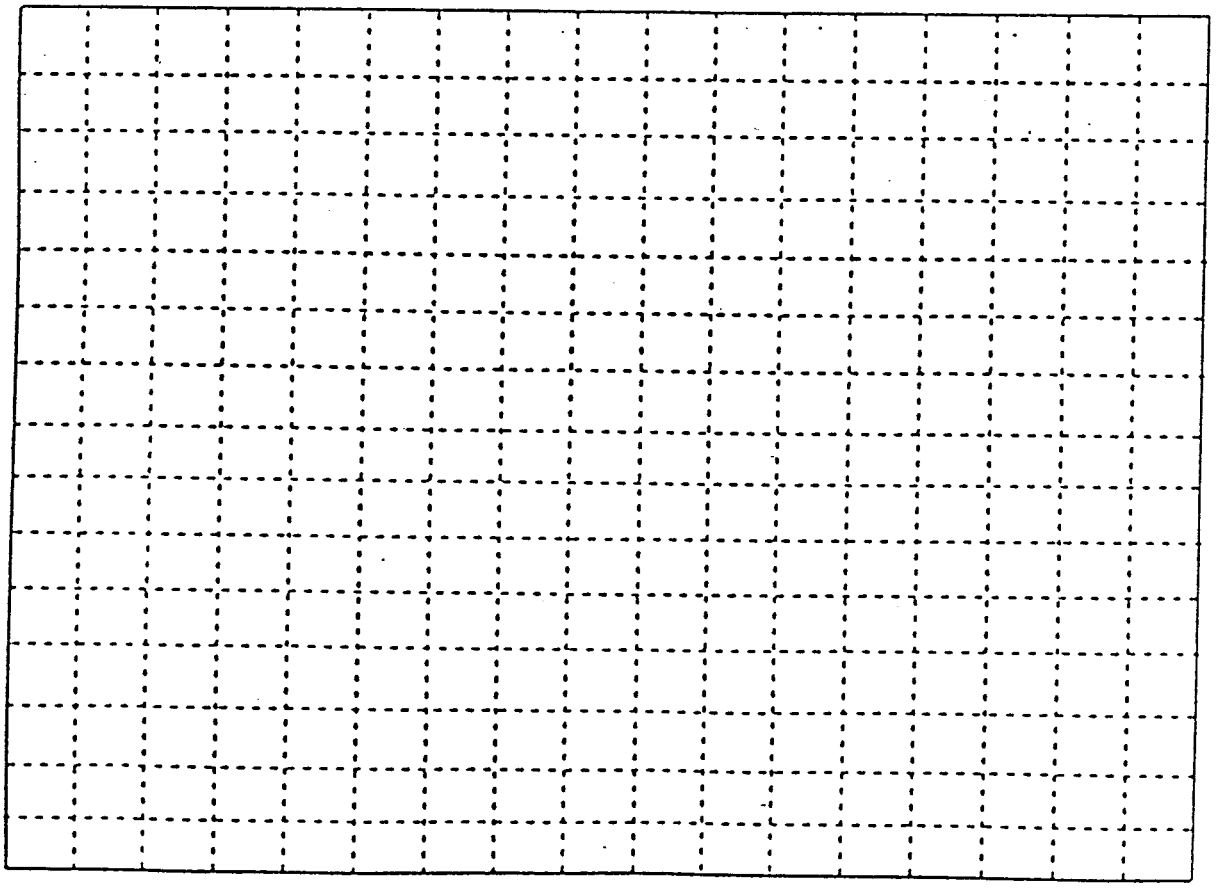
Inspector D. Hicks

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Continued From Report No. _____ Page ____ Of ____

6. Water Supt. (Harriman), John Karl, expressed concern over State Health Dept. permit acquisition.

Sketch (Plan Sheet Reference No. _____)



Blue Circle Raia Inc.

P. O. BOX 505 • HACKENSACK, NEW JERSEY 07602

2014

CONTROL NO.	008409
1 LEAVE PLANT	8.20
2 ARRIVE JOB SITE	8:45
3 START DISCHARGE	9.35
4 FINISH DISCHARGE	10.15
5 LEAVE JOB SITE	
6 ARRIVE PLANT	

**PLANTS LOCATED AT NEWPORT, LIBERTY & HOWELL ST., JERSEY CITY, N.J.
IN BOGOTA, N.J., TOTOWA, N.J., MAHWAH, N.J., RIVERDALE, N.J.,
MT. HOPE, N.J., HAMBURG, N.J., CHESTER, N.Y.**

CALL ANY PLANT 1-800-822-7242

EXECUTIVE OFFICES 201-488-0500

SAND AND GRAVEL • ROAD MATERIALS • CRUSHED STONE

FROM OUR FULLY AUTOMATED PLANTS
SERVING NEW JERSEY & NEW YORK

CAUTION KEEP OUT OF REACH OF CHILDREN

eshly mixed concrete may cause skin irritation. Avoid direct con-
ct where possible, wash exposed skin area promptly with water. If
y of the cementitious material gets into the eyes, rinse immediately
and repeatedly with water.

E DO NOT GUARANTEE FINISHED RESULTS OBTAINED FROM THIS LOAD OF CONCRETE. AS MANY IMPORTANT FACTORS AFFECTING THE ULTIMATE QUALITY OF THE OMPLETED JOB ARE OUT OF OUR CONTROL.

ESTIMATED DELIVERY SCHEDULES WILL BE MAINTAINED TO THE BEST OF OUR ABILITY BUT WE WILL NOT CONSIDER ANY CLAIMS FOR DAMAGES FOR FAILURE TO DO SO.

The individual accepting the delivery of this material is directly responsible for educating all people who may come in contact, of the hazards of cementitious material.

THIS LOAD OF CONCRETE IS PRODUCED IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR REDI-MIX CONCRETE ASTM. EXCESSIVE WATER IN CONCRETE REDUCES ITS FINAL STRENGTH.

Plant	Ticket No.	Truck	Load Size	Description	Slump
	1348075	274	7.00	4000 PSI CONC CONCRETE	7.0

Customer No.	Sold To	Tx Cd	Driver Name and No.	Ord. No.
13164	D & J CONCRETE CORP.		O'BRIEN, RI 7004	98

Del. Add./Inst.
MEADOW ST.OFF RIVER RD.OFF RT.17OFF THRU-WAY EXIT 15 CHESTER, NY

Date	Time Due		Use	P. O. No.	
4-APR-14	05:00	08:08	FOOTING		PROJECT NO.

LOAD QUAN.	CUMULATIVE QUAN.	ORDERED QUAN.	PRODUCT CODE	PRODUCT DESCRIPTION	UNIT OF MEASURE	UNIT PRICE	AMOUNT
7.00	7.00	7.00	574	4000 PSI CONC CONCR 4AP8 CYLINDER MOLDS			

IN THE EVENT OF DELIVERY BEYOND CURB LINE, THIS COMPANY WILL NOT ASSUME LIABILITY FOR DAMAGE TO CURBS, SIDEWALKS, DRIVEWAYS OR OTHER PROPERTY.
ANY WATER ADDED TO MIX ON JOB WILL BE AT THE PURCHASERS RISK. COMPANY RULES REQUIRE THAT ANY WATER ADDED MUST BE RECORDED.

ne in excess of free time will be charged at current delay rate. All C.O.D. deliveries must be paid to driver in advance
I ACCEPTING the load by signing this delivery receipt before pouring.
E TRUCK TIMES & WATER ADDED CORRECT? Purchaser acknowledges that all material and services shown have been received for use as indicated. Truck times shown are correct and gallons of water added at job at Purchaser's request.

Customer Signature X _____ Gals. add. at cust. req.: _____

C tomer acknowledges and understands all of the Terms and Conditions contained on both sides of this document.

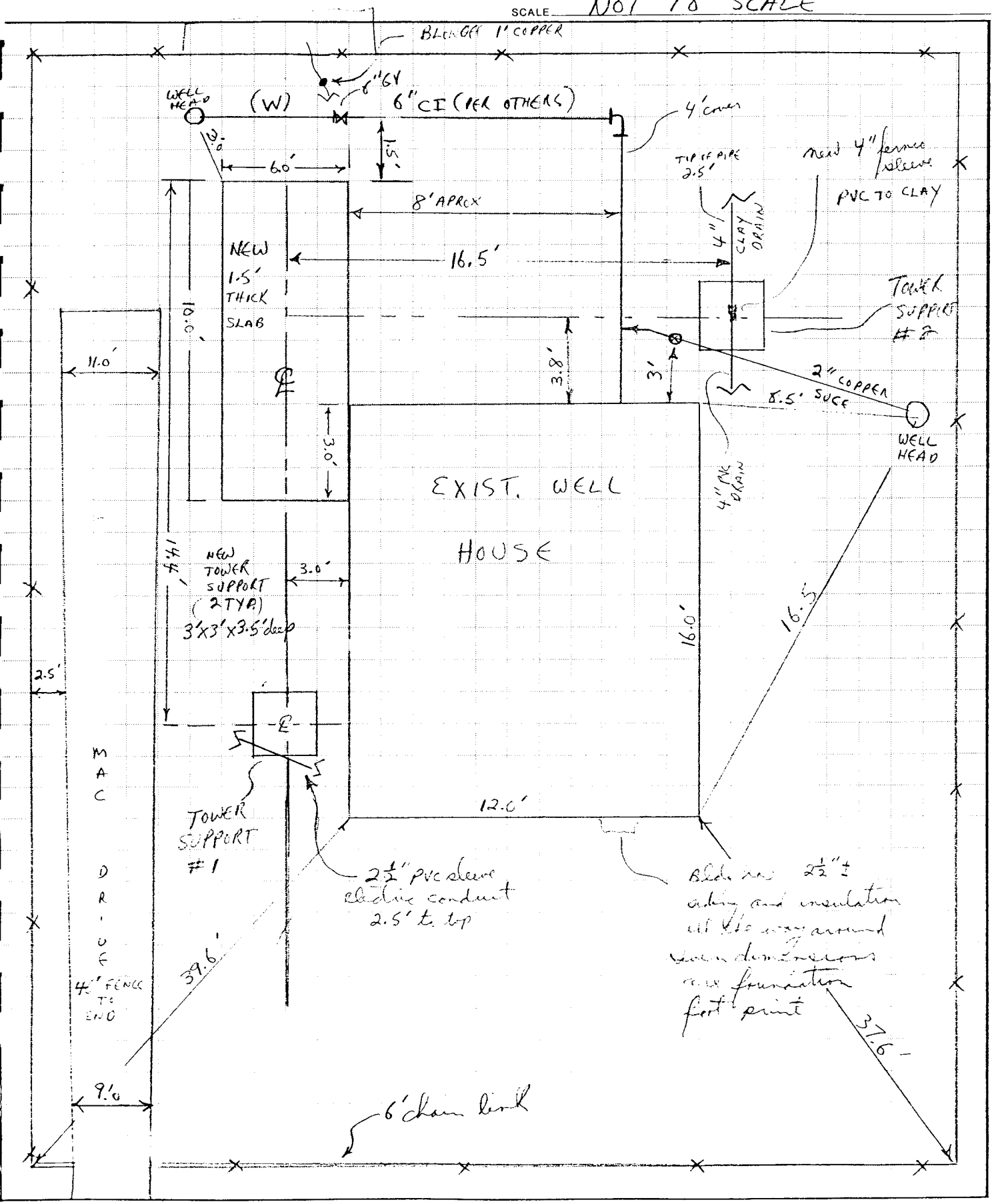
SUB TOTAL	
TAX	
TOTAL	

NOT RESPONSIBLE FOR VARIATION IN COLOR.

CUSTOMER'S EXTRA COPY(2)

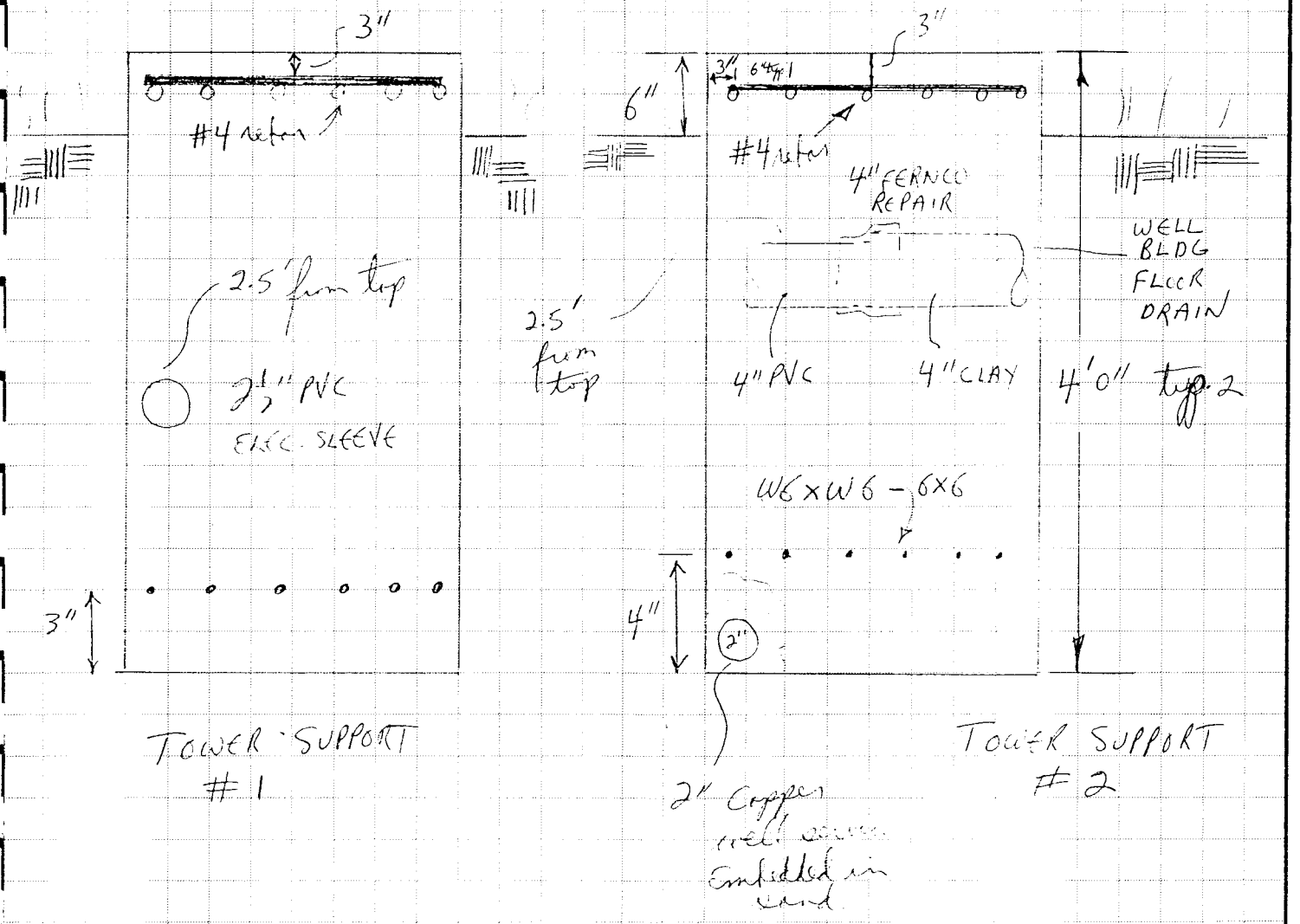
ALFRED CREW/DONOHUE
1200 MacArthur Blvd. Mahwah, NJ 07430
(201) 512-0070 FAX (201) 512-0970

JOB 873-W-01 / 5512.010 / SCC P1553-
SHEET NO. 3 OF 4
CALCULATED BY G. HICKEY DATE 4/15/92
CHECKED BY _____ DATE _____
SCALE NOT TO SCALE



ALFRED CREW/DONOHUE
1200 MacArthur Blvd. Mahwah, NJ 07430
(201) 512-0070 FAX (201) 512-0970

JOB 573-N-01 / 3C 572.000 / SEC P 1533
SHEET NO. 4 OF 4
CALCULATED BY SJTH DATE 4/15/92
CHECKED BY DATE
SCALE NOT TO SCALE



APPENDIX D
CONCRETE TEST RESULTS

SHIMEL and SOR TESTING LABORATORIES, INC.

Testing - Inspection - Consultation

98 Sand Park Road, Cedar Grove, NJ 07009
(201) 239-6001

FAX # (201) 239-8380

Branch Office:
118-120 Sandford St.
New Brunswick, N.J. 08903
(201) 494-2448

Kamil Sor, Ph.D.
Charles Shimel, P.E.

638

COMPRESSION TEST REPORT

STANDARD CONCRETE CYLINDERS, 6" x 12"

Client:	SEC/Donohue	Date:	4-14-92
Project:	Harriman, NY Stripping Tower (#P 1533)	Report No.:	92-1412 A
Location Poured:	Not specified		
Contractor:	D & M		
Class of Concrete:	4000 psi	Air Temp.:	°F
Cylinders-Made By:	Client	Delivered By: Client	Weather:

Field No.					MIX DATA
Identification (Lab)	638 A	B	C	D	Proportions/cu. yd.
Date Cast	4-14-92				Cement, Brand
Date Tested	4-22-92		5-12-92		Cement, lb.
Age of Specimen in Days	8	8	28	28	Admixture-type
Total Load-Pounds	99,500	111,000	194,000	197,000	F.A., lb.
Compressive Strength psi	3530	3930	6860	6970	C.A., lb.
Required psi at 28 Days	4000				C.A., lb.
Cylinder Weight As Rec'd.	28.6	28.8	28.7	28.3	Water, Gal.
Type Fracture	1	1	1	1	w/c Ratio
CURING Field-Method & No. Days	8	8	8	8	Slump, Inches
Laboratory-No. Days	0	0	20	20	Air, Percent
					Unit Weight, Wet
					Conc. Temp., °F
					Time of Sampling
					Truck Number

TYPICAL FRACTURES



cc: (1) Client (Bob LaRosa)

Laboratory Director

SHIMEL and SOR TESTING LABORATORIES, INC.

Testing - Inspection - Consultation

98 Sand Park Road, Cedar Grove, NJ 07009
(201) 239-6001

FAX # (201) 239-8380

Branch Office:
118-120 Sandford St.
New Brunswick, N.J. 08903
(201) 494-2448

Kamil Sor, Ph.D.
Charles Shimel, P.E.

873W01

GH

MS

ALFRED BENESCH CONS. ENGRS. INC.
RECEIVED
MAY 11 1992
ANSWERED .....

COMPRESSION TEST REPORT

STANDARD CONCRETE CYLINDERS, 6"x 12"

Client:	SEC/Donohue	Date:	4-14-92
Project:	Harriman, NY Stripping Tower (#P 1533)	Report No.:	92-1412
Location Poured:	Not specified		
Contractor:	D & M		
Class of Concrete:	4000 psi	Air Temp.:	°F
Cylinders-Made By:	Client	Delivered By: Client	Weather:

Field No.					MIX DATA
Identification (Lab)	638 A	B	C	D	Proportions/cu. yd.
Date Cast	4-14-92				Cement, Brand
Date Tested	4-22-92		5-12-92		Cement, lb.
Age of Specimen in Days	8	8	28	28	Admixture-type
Total Load-Pounds	99,500	111,000			F.A., lb.
Compressive Strength psi	3530	3930			C.A., lb.
Required psi at 28 Days	4000				C.A., lb.
Cylinder Weight As Rec'd.	28.6	28.8	28.7	28.3	Water, Gal.
Type Fracture	1	1			w/c Ratio
CURING Field-Method & No. Days	8	8	8	8	Slump, Inches
Laboratory-No. Days	0	0	20	20	Air, Percent
					Unit Weight, Wet
					Conc. Temp., °F
					Time of Sampling
					Truck Number

TYPICAL FRACTURES 1 2 3 4



cc: (1) Client

Laboratory Director

APPENDIX E
PUMP CALCULATIONS

SIRRINE ENVIRONMENTAL CONSULTANTS

CALCULATION SHEET

CLIENT CWM LOCATION HARRIMAN, NY JOB NO. P1533

SUBJECT MH2 PUMP PERFORMANCE VS AIR STRIPPER SYSTEM DYNAMIC HEAD

BY CWM DATE 12/11/91 CHECKED BY RAL DATE 12/12/91

OBJECTIVE: DEVELOP SYSTEM HEAD CURVE TO DETERMINE OPERATING POINT USING PUMP PERFORMANCE CURVE

METHOD: USE BERNOULLI EQUATION TO SOLVE FOR SYSTEM HEAD FOR VARIOUS FLOW RATES.

ASSUMPTIONS:

1. FLOW IS FULLY TURBULENT
2. ENTIRE LENGTH OF PIPE IS GALVANIZED STEEL
3. PIPE IS 2" DIA.

BERNOULLI EQUATION

$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + z_1 + E_m - H_{L_{1\to 2}} = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + z_2$$

WHERE:

$\frac{P_1}{\gamma}$ = PRESSURE HEAD AT PUMP = 0 ft

$\frac{V_1^2}{2g}$ = VELOCITY HEAD AT PUMP = 0 ft

z_1 = ELEVATION DATUM AT PUMP INTAKE = 0 ft

E_m = PUMP HEAD (UNKNOWN)

$H_{L_{1\to 2}}$ = TOTAL HEAD LOSS FOR SYSTEM (UNKNOWN)

$\frac{P_2}{\gamma}$ = PRESSURE HEAD AT FILTER TANK = 0 FT

$\frac{V_2^2}{2g}$ = VELOCITY HEAD AT FILTER TANK = 0 FT.

z_2 = ELEVATION AT FILTER TANK = 98 FT.

CONCLUSION:

OPERATING POINT IS A E_m = 141 FT.

Q = 131 GPM.

SIRRINE ENVIRONMENTAL CONSULTANTS

CALCULATION SHEET

CLIENT CWSM LOCATION HARRIMAN, NY JOB NO. P1533

SUBJECT MH1 PUMP PERFORMANCE VS. AIR STRIPPER SYSTEM DYNAMIC HEAD

BY CWSM DATE 12/11/91 CHECKED BY RAL DATE 12/12/91

SOLVE FOR LOSSES

(1) MAJOR HEAD LOSSES

FRICTION LOSS

$$h_f = f\left(\frac{L}{D}\right)\frac{V^2}{2g} \quad \text{SINCE} \quad Q = VA$$

$$h_f = f\left(\frac{L}{D}\right)\frac{Q^2}{A^2 2g} \quad \text{(DARCY-WEISBACH FORMULA)}$$

$L = 108'$ $\quad \epsilon = 0.00015$ FROM FLUID MECHANICS W/ ENG. APPL. EIGHTH EDITION DAUGHERTY, FRANZINI, FINNEMORE

$D = 0.16'$ $\quad \epsilon/D = 0.0009$

$A = 0.0218\ ft^2$ $\quad f = .019$ FROM MOODY DIAGRAM

$$h_f = 0.019\left(\frac{108'}{0.16'}\right)\frac{Q^2}{(0.0218)^2(2)(32.2)}$$

$$h_f = 41371\,Q^2 \text{ cfs}$$

(2) MINOR HEAD LOSSES

$$\text{EXIT} = 1.0\frac{Q^2}{A^2 2g}$$

$$\text{ENTRANCE} = (1.0)\frac{Q^2}{A^2 2g}$$

BENDS (5) $K_b = 1.1$ FROM FLUID MECHANICS W/ ENG. APPL.

$$= 5.5\frac{Q^2}{A^2 2g}$$

$$h_m = (5.5 + 1.0 + 1.0)\frac{Q^2}{0.031} = 241.9\,Q^2$$

$$H_{L_{1\to 2}} = h_f + h_m = 41371Q^2 + 241.9Q^2 = 65564\,Q^2 \text{ cfs}$$

SIRRINE ENVIRONMENTAL CONSULTANTS

CALCULATION SHEET

CLIENT CWM LOCATION HARRIMAN, NY JOB NO. P1533

SUBJECT MH 1 PUMP PERFORMANCE VS. AIR STRIPPER SYSTEM DYNAMIC HEAD

BY CMM DATE 12/11/91 CHECKED BY RAL DATE 12/12/91

BERNOULLI EQUATION

$$E_m = 88 + 655.64\,Q^2 \text{ cfs}$$

(CONVERT TO GPM)

$$= 88 + 3.25 \times 10^{-3} Q^2 \text{ GPM}$$

$$E_m = 88 + 3.25 \times 10^{-3} Q^2 \text{ GPM}$$

Q (GPM)	E_m (FT)
0	88
10	88.32
20	89.30
30	90.92
40	93.20
50	96.12
60	99.70
70	103.92
80	108.80
90	114.32
100	120.50
110	127.32
120	134.80
130	142.92
140	151.70

PLOT THIS DATA AGAINST PUMP PERFORMANCE CURVE TO GENERATE OPERATING POINT.

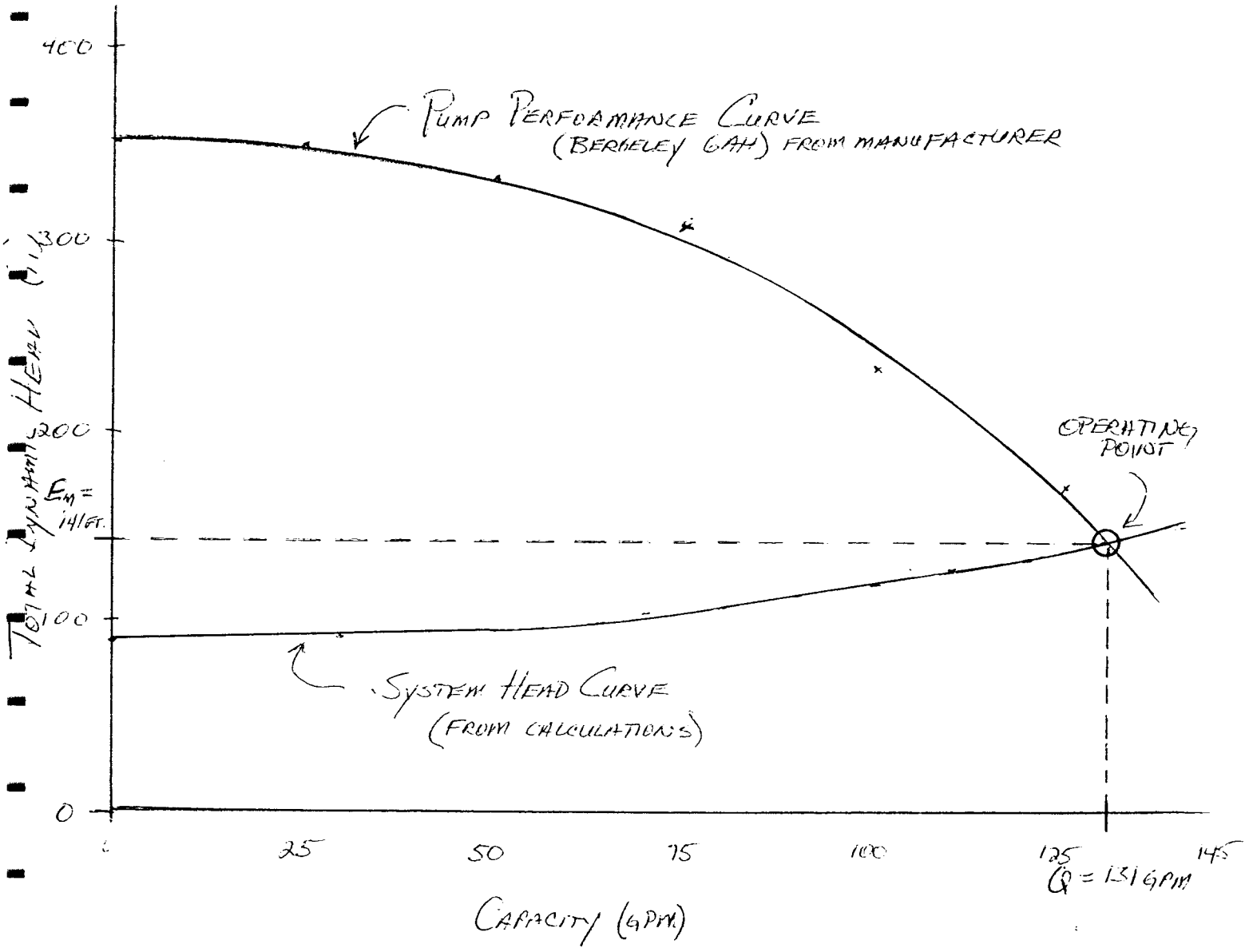
SIRRINE ENVIRONMENTAL CONSULTANTS

CALCULATION SHEET

CLIENT CWM LOCATION HARRIMAN, NY JOB NO. P1533

SUBJECT MH 1 PUMP PERFORMANCE VS. AIR STRIPPER SYSTEM DYNAMIC HEAD

BY CMM DATE 12/11/91 CHECKED BY RAL DATE 12/12/91



OPERATING POINT IS AT E_M = 141 FT

Q = 131 GPM

SIRRINE
ENVIRONMENTAL CONSULTANTS

CALCULATION SHEET

CLIENT CWM LOCATION HARRIMAN, NY. JOB NO. P1533

SUBJECT PUMP SIZING FOR MH 1

BY [illegible] DATE 3-4-92 CHECKED BY _____ DATE _____

OBJECTIVE: SIZE PUMP FOR 60-80 GPM

METHOD: USING EXISTING SYSTEM HEAD CURVE USED TO ANALIZE EXISTING PUMP; PLOT ON NEW PUMP CHARACTERISTIC CURVE.

ASSUMPTIONS: SAME AS PREVIOUS CALCULATIONS

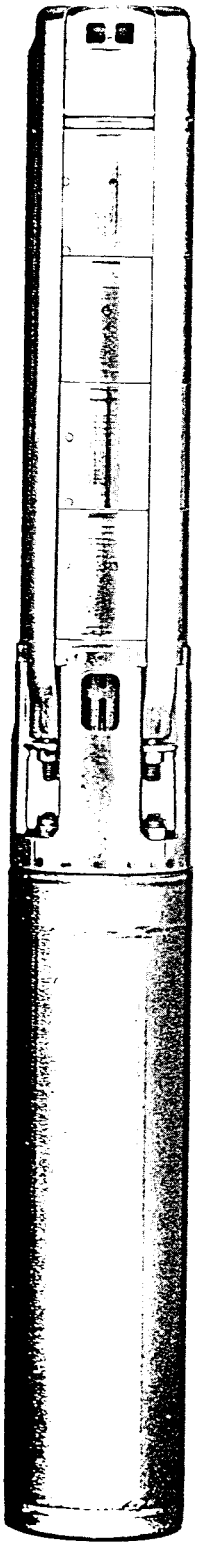
CONCLUSION: USE 3HP PUMP w/ 2" NPT
OPERATING POINT Q_p = 78.3 GPM, E_p = 105 FT.
GRUNDFOS 75530-5

MODEL 75S — 75 GPM — GRUNDFOS

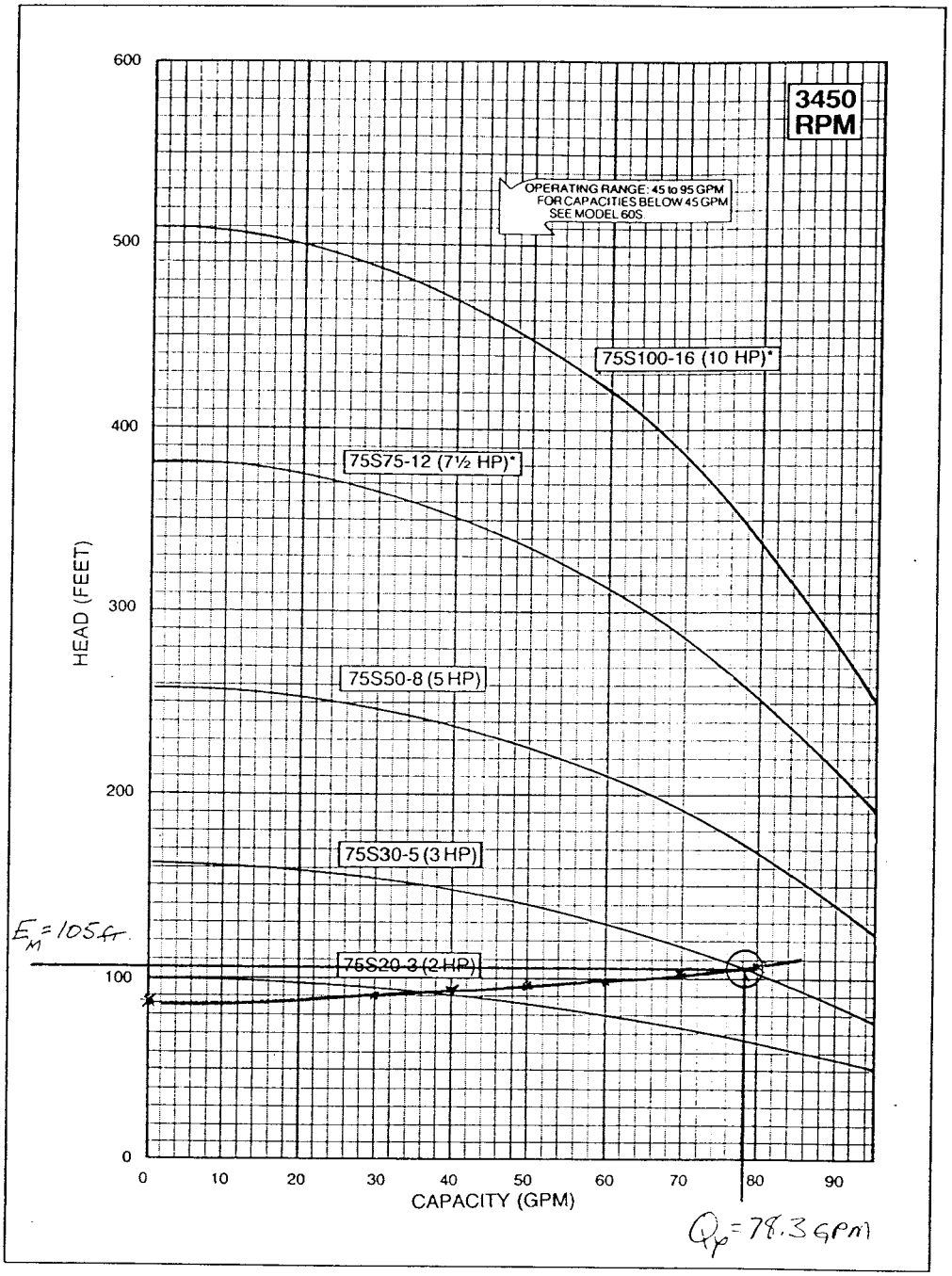
2 of 2.

FLOW RANGE
45 to 95 GPM

PUMP OUTLET
2" NPT



PERFORMANCE CURVES



DIMENSIONS AND WEIGHTS

MODEL NO.	HP	LENGTH (INCHES)	WIDTH (INCHES)	APPROX. UNIT SHIPPING WT. (LBS.)
75S20-3	2	28 5/8	3 15/16	38
75S30-5	3	40 3/4	3 15/16	64
75S50-8	5	51 1/4	3 15/16	78
75S75-12	7 1/2*	67 1/2	3 15/16	100
75S100-16	10*	92 1/8	3 15/16	155

Specifications are subject to change without notice.

* A 4-inch motor is provided as standard on these models.

APPENDIX F
SPECIAL CONDITIONS

Special Conditions for Inclusion
In Plans and Specifications for the Proposed Organic
Chemical Treatment System for Mary-Harriman #1

Special Conditions

1. Prior to placing the proposed treatment system in service the system must be thoroughly tested. Sampling of both raw and treated water shall be taken and analysis shall be conducted by a New York State Department of Health ("NYSDOH") approved lab in conformance with EPA methods 502.1 for Volatile Halocarbons and 503.1 for Volatile Aromatics. The results of these analyses are to be submitted to NSDOH for review. Once effluent results are determined to be non-detectable, the treatment facility can be placed in service. If, however, detectable results are obtained, additional sampling will be required.

2. Once in operation, raw and treated water samples are to be analyzed in accordance with the methods discussed in Condition 1 (directly above) on a daily basis for the first week, and on a weekly basis for the next four weeks, with results submitted to the NYSDOH for review.

   Thereafter, raw and treated samples are to be taken and analyzed monthly for Methods 502.1 and 503.1 for six months. Assuming non-detectable affluent results are

achieved during this initial period, a Completed Works Approval will be issued by the NYSDOH. Although Method 502.1 sampling will continue on a monthly basis, Method 503.1 sampling can revert to a quarterly monitoring basis after Completed Works Approval. If combined 1,1,1-Trichloroethane and Trichloroethylene influent levels fall below 10 ppb for a continuous six month period, then both 502.1 and 503.1 monitoring can continue on a quarterly basis. Monthly sampling for both contaminants will be necessary if combined influent levels again exceed 10 ppb.

3. Microbiological testing of treated water samples are to be conducted monthly for the first six months to determine if any biological growth is occurring within the tower. The results are to be submitted to the NYSDOH.

4. When the treatment removal system is on-line and operating, effluent monitoring results must be non-detectable for corresponding influent concentrations of 30 ppb or less. For influent concentrations greater than 30 ppb, a 98.3 percent removal efficiency must be achieved. In the event that effluent residuals are detected, the following action steps will be taken:

   a. For detectable results where the required removal efficiency is not achieved, but concentrations are

less than 50 percent of the maximum contaminant levels ("MCL"), the monitoring frequencies for influent and effluent will be increased to a monthly basis for both 502.1 and 503.1 monitoring. The Respondent will evaluate and correct treatment operations to achieve the required treatment removals. A summary report on this evaluation will be provided to the NYSDOH, identifying problems and corrective measures taken.

b. For detectable results where removal efficiency is achieved and effluent concentrations are less than 50 percent of the MCL, monthly monitoring of influent and effluent will be conducted.

c. In all situations where the effluent concentration exceeds 50 percent of the MCL, the frequency of monitoring will be increased to a monthly basis, and the Respondent will immediately initiate an evaluation of the treatment system operation. The supplier of water will make any necessary repairs, adjustments, or additions to the system that are necessary to reduce the contaminant level in the effluent to a non-detectable level. If treatment repairs, adjustments or additions are unsuccessful, a hydrological study will be conducted to determine the cause of the elevated contamination levels reaching the influent and effluent streams. The Respondent will also initiate monthly sampling of

influent and effluent streams and will submit a report to NYSDOH identifying the causes for this increase.

d. In the event that the levels of contamination in the effluent exceed the MCLs, the well supply will be immediately taken off-line, public notification as per Part 5-1 of the New York State Sanitary Code will be made, and required resampling program will be undertaken. The Respondent will immediately initiate an evaluation of the treatment system operation. The supplier of water will make any necessary repairs, adjustments, or additions to the system that are necessary to reduce the contamination level in the effluent to acceptable levels. The Respondent will initiate appropriate sampling of influent and effluent streams and will submit a report to NYSDOH and the Village identifying the causes for this increase. Following documentation of improved treatment of water to acceptable levels, the well and organic chemical treatment system can be put back on-line.

5. Any major changes proposed to the plans of the treatment system shall be approved by NYSDOH prior to actual construction.

APPENDIX G
AIR PERMIT

New York State Department of Environmental Conservation
21 South Putt Corners Road, New Paltz, New York 12561
(914) 255-5453 or (914) 255-3121

JUL - 9 1992

Thomas C. Jorling
Commissioner

Date: July 7, 1992

Re: Source(s) of Air Contamination
DEC Permit No.: 3-3340-175/2-0
Facility ID No.: 3-3340-175
Owner ID No.: 39944

Dear Applicant:

Enclosed please find your approved:

☐ Permit(s) to Construct for Emission Point(s): _____

Important: Upon completion of construction, please sign and date the permit(s) in box number _____ and return it to the Division of Regulatory Affairs as your application for a Certificate to Operate. In addition, please return the bottom portion of this form with the signed permit in order to expedite processing.

☒ Certificate(s) to Operate for Emission Point(s): 00001

In accordance with the provisions of 6NYCRR 201.2 you may continue to operate the source(s) in a manner consistent with the Environmental Conservation Law and information contained in the application(s).

Please note we will no longer be sending a computer generated Certificate.

If you have any questions regarding your permit(s) or certificate(s), please contact the Division of Regulatory Affairs at the above address and telephone number. Please retain the above numbers for your records and reference the Facility and Owner ID numbers in all future correspondence related to this permit. Thank you for your cooperation.

Respectfully,

Richard Speidel
Division of Regulatory Affairs
Region 3

----------detach here----------

To: Division of Regulatory Affairs, attention Richard Speidel

Re: Facility ID Number: _____ Owner ID Number: _____

Attached please find a signed application for a Certificate to Operate a Source of Air Contamination. Please process expeditiously.

3-3340-7311-0

RECEIVED
MAR 9 1992
NYS - DEC
REGION 3-NEW PALTZ

RECEIVED
MAR 18 1992
NYS DEC
REGION 3-NEW PALTZ

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

COPIES
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WHITE - REGIONAL OFFICE
PINK - AGENCY
YELLOW - APPLICANT

OP LOCATION FACILITY EMISSION POINT
A 3340703 R 00 00 0001

A ADD
C CHANGE
D DELETE

READ INSTRUCTIONS CONTAINED IN FORM 76-1-12 BEFORE ANSWERING ANY QUESTION

PROCESS, EXHAUST OR VENTILATION SYSTEM
APPLICATION FOR PERMIT TO CONSTRUCT OR CERTIFICATE TO OPERATE

SECTION A

1 NAME OF OWNER/FIRM: Chemical Waste Management, Inc.

2 NUMBER AND STREET ADDRESS: 100 Nassau Park Boulevard

3 CITY - TOWN - VILLAGE: Princeton | 4 STATE: N.J. | 5 ZIP: 08540

6 OWNER CLASSIFICATION: A [X] COMMERCIAL B [ ] INDUSTRIAL C [ ] UTILITY D [ ] FEDERAL E [ ] STATE F [ ] MUNICIPAL G [ ] EDUC INST H [ ] HOSPITAL I [ ] RESIDENTIAL J [ ] OTHER

7 NAME & TITLE OF OWNERS REPRESENTATIVE: Thomas Frazer, Regional Hydrogeologist

8 TELEPHONE: 609-243-~~7836~~ 7836

9 NAME OF AUTHORIZED AGENT

10 TELEPHONE

11 NUMBER AND STREET ADDRESS

12 CITY - TOWN - VILLAGE | 13 STATE | 14 ZIP

15 NAME OF P.E. OR ARCHITECT PREPARING APPLICATION | 16 N.Y.S. P.E. OR ARCHITECT LICENSE NO. | 17 TELEPHONE

18 SIGNATURE OF OWNERS REPRESENTATIVE OR AGENT WHEN APPLYING FOR A PERMIT TO CONSTRUCT

19 FACILITY NAME (IF DIFFERENT FROM OWNER/FIRM): Village of Harriman Water Dept.

20 FACILITY LOCATION (NUMBER AND STREET ADDRESS): Meadow Avenue

21 CITY - TOWN - VILLAGE: Harriman | 22 ZIP: 10926

23 BUILDING NAME OR NUMBER: BUILDING | 24 FLOOR NAME OR NUMBER: FLOOR

25 START UP DATE: 4 / 92 (MO / YR)

26 DRAWING NUMBERS OF PLANS SUBMITTED

27 PERMIT TO CONSTRUCT: A [ ] NEW SOURCE B [ ] MODIFICATION

28 CERTIFICATE TO OPERATE: A [X] NEW SOURCE B [ ] MODIFICATION C [ ] EXISTING SOURCE

SECTION B

29 EMISSION POINT ID	30 GROUND ELEVATION (FT)	31 HEIGHT ABOVE STRUCTURES (FT)	32 STACK HEIGHT (FT)	33 INSIDE DIMENSIONS (IN)	34 EXIT TEMP (°F)	35 EXIT VELOCITY (FT/SEC)	36 EXIT FLOW RATE (ACFM)
00001	529 AMSL	20	35	36	50	1.65	700

37 SOURCE CODE	38 HRS/DAY	39 DAYS/YR	40 % OPERATION BY SEASON Winter	Spring	Summer	Fall
A2218	24	365	25	25	25	25

SECTION C

41 DESCRIBE PROCESS OR UNIT

1. Air stripping ~~tower~~ to remove volatile organics from groundwater
2.
3.
4.
5.
6.
7.
8.

SECTION D

EMISSION CONTROL EQUIPMENT I.D.	CONTROL TYPE	MANUFACTURER'S NAME AND MODEL NUMBER	DISPOSAL METHOD	DATE INSTALLED MONTH / YEAR	USEFUL LIFE
42	43 99	44	45	46 /	47
48	49	50	51	52 /	53

NOT SUPERFUND

CALCULATIONS See attachments.

SECTION E

SECTION E

CONTAMINANT NAME	CAS NUMBER	INPUT OR PRODUCTION	UNIT	ENV. RATING	EMISSIONS ACTUAL	EMISSIONS UNIT	EMISSIONS HOW OFT	EMISSIONS PERMISSIBLE	% CONTROL EFFIC'CY	HOURLY EMISSIONS (LBS/HR) ERP	HOURLY EMISSIONS (LBS/HR) ACTUAL	ANNUAL EMISSIONS (LBS/YR) ACTUAL	ANNUAL EMISSIONS (LBS/YR) 10^x	ANNUAL EMISSIONS (LBS/YR) PERMISSIBLE
55 Trichloroethylene	56 00079-01-6	56	57	58 B	59 0.02	60 4	61 6	62 0.02	63	64	65	66 7.3	67 0	68 7.3
69 1,1,1 Trichloroethane	70 00071-55-6	71	72	73 C	74 0.01	75 4	76 6	77 0.01	78	79	80	81 3.65	82 0	83 3.65
84	85	86	87	88	89	90	91	92	93	94	95	96	97	98
99	100	101	102	103	104	105	106	107	108	109	110	111	112	113
114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142	143

SECTION G

SOLID FUEL TYPE	SOLID FUEL TONS/YR	SOLID FUEL %S	OIL TYPE	OIL THOUSANDS OF GALLONS/YR	OIL %S	GAS TYPE	GAS THOUSANDS OF CF/YR	GAS BTU/CF
144	145	146	147	148	149	150	151	152

APPLICABLE RULE	APPLICABLE RULE
153 212	154

Upon completion of construction sign the statement listed below and forward to the appropriate field representative

THE PROCESS EQUIPMENT OR VENTILATION SYSTEM HAS BEEN CONSTRUCTED AND WILL BE OPERATED IN ACCORDANCE WITH STATED [illegible] AND IN CONFORMANCE WITH ALL PROVISIONS OF EXISTING REGULATIONS

155 SIGNATURE OF AUTHORIZED REPRESENTATIVE OR AGENT [signature] DATE 5/4/92

AGENCY USE ONLY

156 COUNTY & CODE	157 FACILITY ID NO.	158 UTM (E)	159 UTM (N)	160 SIC NUMBER	161 DATE APPL. RECEIVED	162 DATE APPL. REVIEWED	163 REVIEWED BY
33 ØØ3	R Ø Ø 1 5	2 1 4	5 7 3 2 9	5 1 1	/ /	3/18/92 2/3/92	JB JB

PERMIT TO CONSTRUCT

164 DATE ISSUED	165 EXPIRATION DATE	166 SIGNATURE OF APPROVAL	167 FEE
4 30 92	4/30/93	[signature]	$50

168
1 DEVIATION FROM APPROVED APPLICATION SHALL VOID THIS PERMIT
2 THIS IS NOT A CERTIFICATE TO OPERATE
3 TESTS AND/OR ADDITIONAL EMISSION CONTROL EQUIPMENT MAY BE REQUIRED PRIOR TO THE ISSUANCE OF A CERTIFICATE TO OPERATE

RECOMMENDED ACTION RE: C.O

[illegible]	[illegible] EXPIRATION DATE	[illegible] SIGNATURE OF APPROVAL	[illegible] FEE
7 7 92	7/7/97	[signature]	0

175
1 [ ] INSPECTED BY ____ DATE ____
2 [ ] INSPECTION DISCLOSED DIFFERENCES AS BUILT VS. PERMIT, CHANGES INDICATED ON FORM
3 [X] ISSUE CERTIFICATE TO OPERATE FOR SOURCE AS BUILT
4 [ ] APPLICATION FOR C.O DENIED ____ DATE ____ INITIALED ____

- FACILITY MUST GRANT THE DEPARTMENT ACCESS
- PURPOSE OF DETERMINING COMPLIANCE.
- MUST COMPLY WITH THE ORDER ON CONSENT.
- DURING NORMAL OPERATING HOURS FOR THE
- OPERATION OF THIS EMISSION SOURCE

APPENDIX H
PHOTOGRAPHS

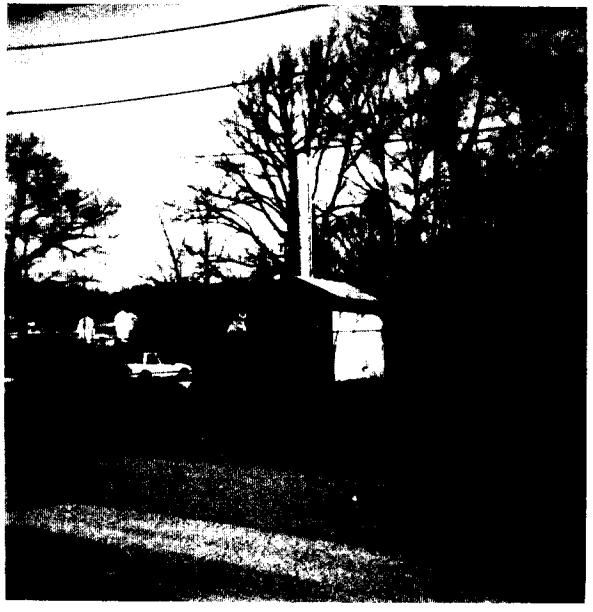


Photo 1 - Air stripper tower - looking east.

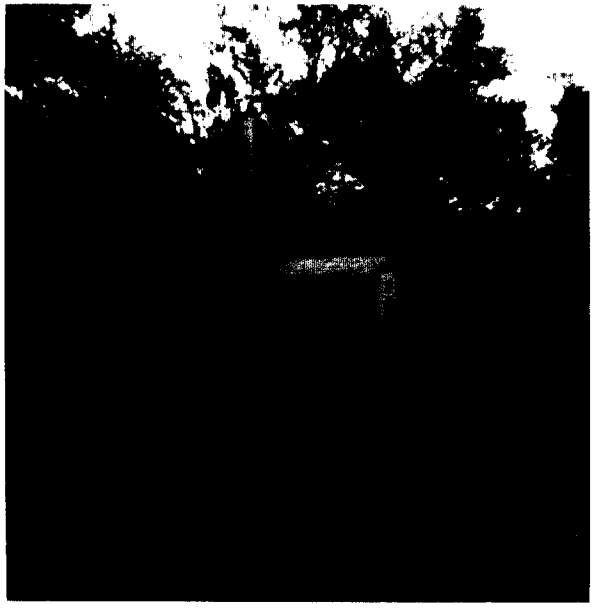


Photo 2 - Air stripper tower - looking south.



Photo 3 - Influent piping, sump viewport and packing viewport. Note MH-1 wellhead in foreground.



Photo 4 - Influent and effluent piping. Note pipe supports.

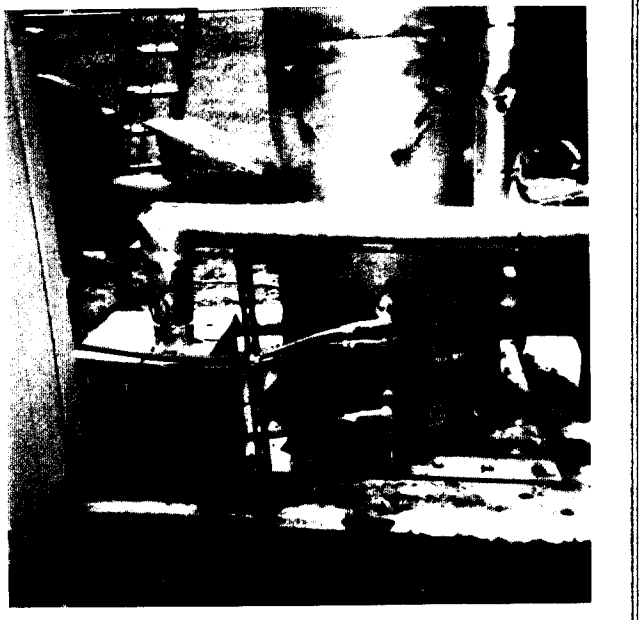


Photo 5 - Level controls and effluent pipe.



Photo 6 - Blower assembly and stand (foreground right), tower effluent (foreground left) and effluent pump (background) prior to installation of insulation.



Photo 7 - Blower assembly and transfer pump assembly.



Photo 8 - Control panels for air stripper: (l to r) heat trace, main control panel (w/ Terra Vac placard), junction box and electric company meter (O & R Utilities).



Photo 9 - Tower support strut welded to tower.

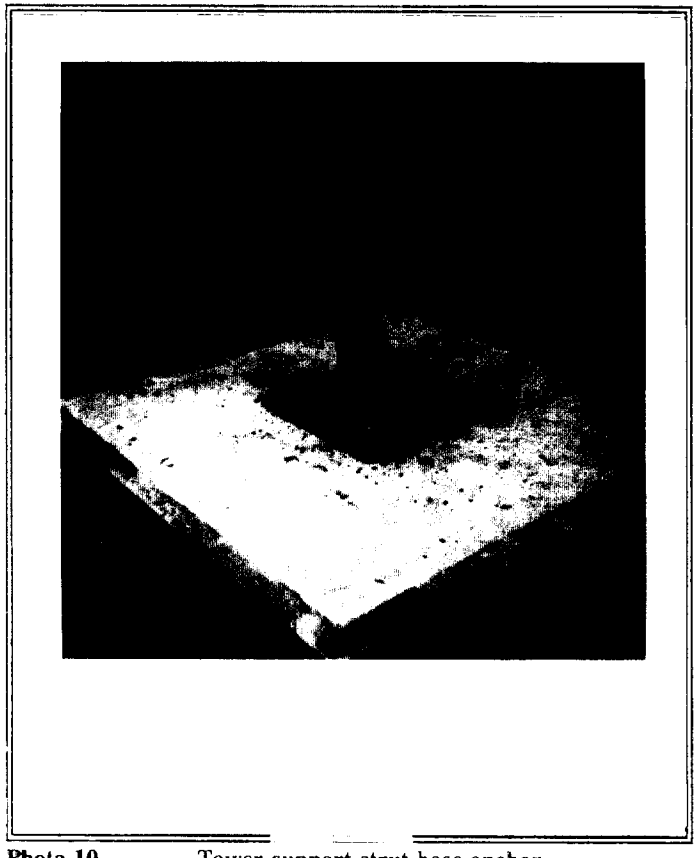


Photo 10 - Tower support strut base anchor.

APPENDIX I
OPERATIONS AND MAINTENANCE MANUAL

TERRA VAC

INSTRUCTION AND MAINTENANCE MANUAL
for
TERRA VAC
AIR STRIPPING FACILITY

VILLAGE OF HARRIMAN
ORANGE COUNTY, NEW YORK

FOR HELP, CALL ONE OR ANY OF THE FOLLOWING PEOPLE:

CHRIS LAND:	609-530-0003 (TERRA VAC)
WILLIAM WIMBERLY OR DEE O'BRIAN:	803-754-3688 (ARE)
TOM SCHMIDT:	404-377-4815

PREPARED BY:

TERRA VAC
806 SILVIA STREET
WEST TRENTON, NEW JERSEY 08628

MAY 21, 1992

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APPENDIX B:	STANDARD OPERATING PROCEDURE
APPENDIX C:	MAINTENANCE SCHEDULE
APPENDIX D:	SPECIAL SEASONAL ISSUES
APPENDIX E:	PARTS DESCRIPTIONS
	TOWER
	PIPING
	NOZZLE
	PACKING
	RE-DISTRIBUTOR PLATE
	BLOWER
	LEVEL AND FLOW SWITCHES
	TRANSFER PUMP
	CONTROL PANEL
APPENDIX F:	DESIGN PARAMETERS

0.0 SYSTEM DESCRIPTION

The air stripping tower was manufactured for Terra Vac by Aquifer Restoration Equipment (ARE) of Columbia, South Carolina. The model number of the tower is ARE-01-03-29/35. The ARE-01-03-29/35 is a cross current air stripper designed to remove volatile organic compounds from ground water.

System specifications:

Site:	Village of Harriman, New York
Installed:	April 22, 1992 - April 25, 1992
Tower Material:	10 gauge 304 stainless steel
Diameter:	3 feet
Overall Height:	35 feet
Packed Height:	29 feet
Packing:	3.5 inch Jaeger Tri-Pac
Blower:	Twin Cities Fan Company, Minneapolis, Minnesota, 1 HP, 230 Volt, 3 phase.
Flow Switch:	Sail switch type, Flotect brand, Dwyer Instruments Inc. Kansas City MO
Level Switches:	Flotect model L6
Transfer Pump:	Meyer's model I2C10 two stage centrifugal pump coupled to a 10 HP 3450 RPM, 230 Volt, 3-phase, TEFC motor.
Flow meter:	Two inch, compound type, manufactured by Master Meter Inc.

0.1 HOW IT WORKS

To operate and maintain this air stripping facility it is important to know how it works. How it works will be described in three parts:

1. The physical principles.
2. How the principles are implemented.
3. The physical processing of the water through the tower.

This discussion is for the operators and mechanics who will work on the tower. The engineering calculations are presented in the various licensing documents.

0.1.1 PHYSICAL PRINCIPLES

Physical Principle Number One. If contaminants in water evaporate more quickly than water does, then you can remove those contaminants by evaporation. For example, this tower will do nothing to remove lead from water, as lead does not evaporate readily. This tower will, however, remove radon and other gases very well since radon evaporates very fast.

Physical Principle Number Two. The more surface area upon which the water is spread out, the faster the evaporation process. For example, a quart of water will evaporate faster if poured on to a pizza pan than if left in an open quart bottle.

Physical Principle Number Three. The evaporation process is more efficient when the surface of the water is subjected to air flow. For example, if you are riding in a car and hang a wet towel out of the window, it will dry faster than a wet towel left in the car.

The air stripping tower works by these three principles and these three principles only. The analysis for the design for a tower is quite complicated. It involves considerable calculations and use of experimentally derived constants. However, the purpose of these calculations is to apply the previously described principles to predict how well the tower will work for specific chemicals.

0.1.2 IMPLEMENTATION OF PHYSICAL PRINCIPLES

Principle Number One. Well MH-1 is contaminated with two compounds: 1,1,1-Trichloroethane and Trichloroethylene. They evaporate much faster than water, as a result they are classified as volatile organic compounds (VOCs). Thus, the water can be cleaned by air stripping (evaporation).

Principle Number Two. To increase the surface area upon which the water is spread so that the evaporation process can occur faster, the contaminated water is sprayed on the packing (in this case, plastic wiffle balls). All the packing does is increase the surface area from which the water and contaminants evaporate - they take no active role in any chemical reaction. If there were enough room and you had enough money, no packing would be necessary. The contaminated water could be sprayed through a series of decorative fountains!

Principle Number Three. To get more air flowing across the water so that evaporation occurs faster, there is a blower at the base of the tower. It blows several hundred cubic feet of air per minute across the packing.

This is all that is happening in the air stripping tower. If there is a problem with the tower, (IN OTHER WORDS, THE WATER COMING OUT OF THE BASE IS NOT CLEAN ENOUGH) it is related to the implementation of one or more of the three previously discussed principles. One (or more) of four things is happening:

1. The water flow has increased (exceeding the design basis),

2. The level of contamination has increased in the well (exceeding the design basis),

3. The surface area has decreased due to fouling of the packing,

4. The air flow has decreased due to fouling of the packing or some other part of the system.

0.1.3 THE TOWER AS THE WATER SEES IT

Water is pumped from well MH-1 by a submersible pump. It travels up the side of the tower through a two inch pipe. All piping is insulated and has an electrical resistance heater to protect it from freezing. The water is discharged to the top of the tower through a nozzle (manufactured by BEX, product number 2R65). The purpose of the nozzle is to evenly distribute the water across the packing. Directly above the nozzle is a fiber mesh type mist eliminator. The purpose of the mist eliminator is to reduce the mist that can be emitted from the tower. The water falls about 18 inches to the packing (manufactured by Jaeger Products of Houston Texas, the specific packing is 3.5 inch Jaeger TriPacs). Air is flowing through the packing from the base of the tower. The water continues to fall through the packing.

As the water falls through the packing, the water tends to move towards the sides of the tower and the air tends to concentrate in the center of the packing. This is because air encounters more friction at the sides of the tower than it does through the packing. Because of this friction, there is a redistributor plate about half way up the tower that redistributes the air and water evenly across the packing. Six inches above the plate there is a screen that holds the packing. This screen is necessary to protect the redistributor plate. There is an access port just above the screen and another access port just below the redistribution plate.

The water falls through the remainder of the packing. At the base there is a reservoir that serves two purposes. It is where the air is introduced to the system through a blower duct, and it also serves as a holding tank for the treated water. Above the reservoir there is a screen that holds the packing. There is a view port just above the screen and another view port in the reservoir. There are three level switches in the reservoir. Two of the level switches run a pump up/down relay that controls the transfer pump that pumps the water to the city water system. The top switch is a high-high switch that shuts off the MH-1 submersible pump if the level in the reservoir is too high. This protects the blower from flooding out during operations. On the blower discharge there is a flow switch that will shut off the entire system if the blower fails.

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0.1.4 Standard Operating Procedure

Normal operations of the air stripping facility are extremely simple. The system is designed for a minimal effort start-up and for minimal operator interaction. The procedure is as follows:

(1) Open suction valve for transfer pump fully.

(2) Open supply valve to tower fully.

(3) Check bypass valve shut.

(4) Open transfer pump discharge valve fully.

(5) Align other water system valves to either discharge water to the lawn or to the water system.

(6) Place submersible pump (MH-1) switch in "on" position. (red switch in pump house)

(7) Check transfer pump and blower supply breakers to be on. Check manual start buttons on starters in control panel are on.

(8) Check blower inlet clear.

(9) Place main breaker in control panel to "on" position. Blower should start, MH-1 submersible pump should start and start sending water to the tower. Water level in the reservoir will start to rise and the transfer pump should come on when level hits the middle level probe (just above the view port).

(10) The system is now operating in automatic (normal mode) Adjust the transfer pump discharge valve so that its capacity most closely matches that of the submersible pump MH-1 (evidenced by a static reservoir level seen in the view port).

(11) Should everything not act normally during start up, secure system by opening main supply breaker in control panel, and start troubleshooting.

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1.0 MAINTENANCE SCHEDULE

It is best to keep a maintenance log of the system. Any observations are important should future troubleshooting become necessary.

It is recommended that three sections be maintained in the log:

1. Scheduled observations
2. Any maintenance to the system
3. Records of influent and effluent analyses

1.1 DAILY

1. Record the flow from the influent flow meter.
2. Check clear/clean the filter screen on the blower.
3. From the flow meter and a stopwatch check the flow rate.
4. Record the flowrate.
5. Observe the transfer pump.
   (1) Record the pump discharge pressure when running.
   (2) Is the pump cycling on/off more than 5 times per hour?
   - If so, then throttle the transfer pump discharge to increase the backpressure on the pump until the pump cycles on/off less than 5 times per hour.
6. Check the system for leaks.
   (1) View ports
   (2) Pipes
   (3) Transfer pump
   (4) Valves
7. Is there mist coming out of the top of the tower?
8. Note any abnormal noises.
9. Look in the view ports.
   (1) Is water flowing?
   (2) Is the packing the right color or is it coated?
   (3) Are any bugs or other foreign material on the packing?
10. Check the bolts on the blower tight.
11. Check the rubber shroud that connects the blower to the tower and make sure the connection is tight.

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12. Are the electric motors hot to the touch? (They will be warm.)

    (1) If so, check the amperage on each leg and record them in the log.

        a. Are the amperages within motor plate ratings?
        b. Are the amperages within 10% of each other? If not, have an electrician check connections, power source, and motors.

13. Check oil level in transfer pump every 50 hours.

1.2 WEEKLY

1. Turn off the power to the system and inspect the blower.

    (1) Take the belt cover off and inspect the belts.

        a. Are they worn?
        b. Are they too loose?
        c. Are they too tight?

    (2) Check the bearings

        a. Are the bearings leaking grease?
        b. Are the bearings excessively hot?

    (3) Lubricate the bearings according to the schedule on the blower.

1.3 MONTHLY

1. Check the amperage on all three legs to the blower and transfer pump and record them in the log.

    (1) Are the amperages within the motor name plate ratings?
    (2) Are the amperages within 10% of each other?
        - If not, have an electrician check connections, power source, and motors.

2. Turn off tower and drain the reservoir by removing the bottom view port or the plug in the bottom of the tower (1" NPT)

    (1) Is the water clean?
    (2) Are there any foreign objects floating on the surface?
    (3) Is there any scum in the reservoir?
        - If so, what color, what consistency?

    (4) Run the tower for a few seconds with the reservoir open to flush it out. Note any material floating in it.

3. Check anchor bolts/nuts, and metal strut hardware tight.

1.4 Periodic

1. Whenever there has been an influent and effluent contamination analysis, record the results in the log book.

2. As necessary, acid wash. If the packing begins to foul, then acid wash the tower.

   (1) Turn off the power. Jumper the air blower flow switch (see wiring diagram). Turn the blower off by the manual switch in the control panel.

   (2) Rig the tower for closed loop running; that is, shut the influent and effluent supply valves and open the bypass. (Note: Throttle the transfer pump discharge valve to maintain a minimum of 100 psig of discharge pressure.)

   (3) It may be easiest to move the blower out of the way for the next steps.

   (4) Turn the system on to recirculate the water. If the transfer pump does not come on, it is because the pump relay is not on. Fill the tower with enough water to turn the pump relay on. (You must get the middle level probe wet.) A hose through the blower port is the easiest way to accomplish this, if the blower has been moved out of the way.

   (5) Once the tower is recirculating, add the acid. Citric acid works quite well if you catch the problem soon enough. It is safer than other acids. HOWEVER, YOU MUST STILL BE CAREFUL HANDLING ANY ACID. USE EYE, SKIN, AND RESPIRATORY PROTECTION. It will be trial and error as to how much acid to use. Your chemical supplier will help you with that. They will recommend the appropriate pH.

   Hydrochloric acid also works quite well, but it is considerably more dangerous to use than is citric acid. BE VERY CAREFUL. USE EYE, SKIN, AND RESPIRATORY PROTECTION.

   (6) It takes about a day of recirculation to do anything and sometimes more. Observe the tower periodically, and check the pH of the recirculating fluid. If the pH changes toward neutral, then add more acid. As long as it keeps cleaning up, continue to recirculate. Monitor the performance of the transfer pump closely, especially at the start of the closed loop running operations. The pump is relatively large in size and needs at least 100 psig of backpressure to operate. Monitor the pump frequently for signs of overheating.

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(8) When recirculation is complete, carefully bring the tower chemistry back to neutral with caustic soda. BE VERY CAREFUL. USE EYE, SKIN, AND RESPIRATORY PROTECTION.

(9) Drain the tower and flush out with clean water.

(10) Turn power off, remove flow switch jumper in control panel, turn power back on.

(11) Replace blower, if you moved it.

(12) Realign for normal running, disinfect as required, and restart the system.

1.5 As required, replace the packing.

(1) If the packing becomes too fouled to acid wash, then it must be replaced. The packing can be replaced with the tower standing.

(2) Order the packing from Jaeger Products. They will help determine the amount needed. The tower should be in their records.

(3) A boom truck or man lift will be necessary to remove the packing and to replace it.

(4) The packing is in two sections (see tower drawing)

a. Above the top view port.
b. Between the middle two view ports.

(5) Remove the view ports and mist eliminator. Start pulling the packing out. If the packing is changed soon enough, then the balls will fall out easily. If not, then get long sections of one inch pvc pipe and start ramming it up the tower to break the packing loose. One can also ram the pipe down from the top or the top view port. A high pressure washer can also help break the packing loose.

(6) After the packing has been removed, hose or pressure wash the tower. Wash out the reservoir also. Broken packing can foul the transfer pump.

(7) Replace the top view port and the bottom two view ports.

(8) Place new packing in the top section of the tower from the top. The packing should come to 18 inches from the bottom of the nozzle.

(9) Replace the mist eliminator.

(10) Place new packing in the bottom section from the third view port access.

(11) Replace the view port.

(12) Rig tower for closed loop running. (See section on acid washing.)

(13) Disinfect the tower as required.

(14) When the tower effluent passes appropriate bacteriological tests, realign the system for normal running and place it on line.

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2.0 SPECIAL SEASONAL ISSUES

2.1 Seasonally - Summer

(1) During summer, be particularly careful to check the packing for bugs. There is a bug screen on the intake of the blower, however this could clog up with bugs. This is a point that will have to be addressed with operation. Should the bugs get past the screen, they will probably collect on the top of the water in the reservoir. Weekly cleaning of the reservoir will indicate if a problem exists.

(2) At least once during the summer, clean the reservoir by removing the view port.

2.2 Seasonally - Winter

(1) During winter there can be a problem with the mist eliminator. It could freeze up and restrict the air flow through the system. This is unlikely because the air flowing through the system will be warmed by the water in the tower. However, under extreme cold, if the tower is turned off for a long time, then freezing could occur in the tower and on the mist eliminator.

(2) Do not let the reservoir freeze up! If the tower will be turned off, then drain it through the drain plug. Freezing will probably not harm the tower, but it is likely to damage the level switches.

(3) During a severe snowstorm, the blower inlet could clog with snow. Perform adequate inspections to prevent this snow build up.

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SPECIFICATIONS FOR AIR STRIPPING FACILITY
VILLAGE OF HARRIMAN MUNICIPAL WELL MH-1

GENERAL

A 80 gpm operating capacity air stripping facility shall be provided. The unit shall be designed to achieve 99.7 percent removal of trichloroethylene, and 99.9 percent removal of 1,1,1-trichloroethane. This is based on influent concentrations of 30ug/L for trichloroethlyene and 10ug/L for 1,1,1-trichloroethane. The system shall meet these criteria at the design water flow rate of 80 gpm. The system shall also be capable of handling hydraulic loads as high as 100 gpm. It shall be the responsibility of the tower manufacturer to select and size all components of the column to meet the removal criteria.

AIR STRIPPING TOWER

The tower shall have a minimum effective internal cross sectional area of 7.1 square feet and an overall height of 35 feet. It shall be constructed entirely of stainless steel alloy 304L. Design snow and wind loads shall be as per relevant American National Standard Institute Codes. Earthquake and vibrational effects shall also be considered. The tower shall be completely self-supporting when anchored to a suitable concrete base and supported by guy wires or equivalent. Sufficient anchoring points shall be provided to be compatible with the concrete slab design.

INTERNALS OF AIR STRIPPING TOWER

Sufficient high efficiency packing shall be provided to yield a nominal packing depth of 29 feet. Packing shall be Jaeger Tri Pac. Due to the varying mass-transfer properties of different packings, no substitutes will be accepted. A packing support plate shall be provided which is compatible with the packing furnished. The support plate shall be made of stainless steel. A 90 degree cone nozzle shall be provided to uniformly distribute the water flow over the surface of the packing. The flow nozzle shall be capable of handling a water flow range of zero to 80gpm. The nozzle will be constructed of brass or stainless steel. Liquid redistribution shall be provided at approximately 15 feet on the stripper column to provide for efficient packing performance. One redistributor shall be provided. A moisture separation system shall be provided which will eliminate water droplets in the exhaust air stream. A polypropylene or equivalent mesh type mist eliminator shall be provided for this purpose. All air inlet and outlet openings will be provided with insect screens.

BLOWER ASSEMBLY

A complete blower assembly shall be provided including : one blower, flexible connection, ductwork to tower, and all necessary fasteners and gaskets. The blower shall deliver a minimum of 720

cfm at a static pressure of two inches of water. An open drip proof motor connected by a belt drive to the fan shall be provided. the blower assembly and motor will be mounted on a common base. The blower shall be designed so as to be non-overloading. The motor shall be 230 volts, three phase, 60 cycle, and shall not exceed one hp. The fan assembly shall be as manufactured by Twin City Fan and Blower Company of Minneapolis, Minnesota, or equal. A flexible rubber sleeve will couple the blower discharge to the stripper tower.

TRANSFER PUMP

One transfer pump assembly shall be installed to pump the effluent of the air stripping tower to the Harriman water supply. The pump will be from the Meyer's Pump Company model number I2C10. The unit shall consist of a two stage centrifugal pump coupled to a 10 hp, 3450 rpm, three phase, 60 cycle, 230 volt TEFC motor, mounted on a structural steel base with coupling and coupling guard. For more details on the transfer pump see attached manufacturer specification sheet.

VALVES

Four two inch brass gate valves will be installed to provide isolation, and bypass capability for the air stripping facility. One two inch check valve will be installed to provide back-leakage protection from the water main system to the air stripping facility.

FLOW METER

One two inch compound type flow meter will be installed in the inlet line to the air stripper tower. The meter will be manufactured by Master Meter Inc.. The meter has a continuous operating range of 1-175 gpm with a low flow threshold of 1/4 gpm and a maximum flow threshold of 285 gpm. The accuracy of the meter in the continuous operating range is +/- 3%. For more details on the flow meter see attached manufacturer specification sheet.

INTERCONNECTING PIPING AND FITTINGS

All interconnecting piping and fittings shall be made of schedule 80 PVC. Piping size shall be two inch. All joints will be threaded.

CONTROL PANEL

One control panel will be installed to provide the following controls:

1. Manual control of the air blower
2. Manual control of the transfer pump
3. Securing the existing submersible pump should the air blower stop operating
4. Securing the existing submersible pump should the tower

resevoir become full
5. Securing the transfer pump should the tower resevoir become empty

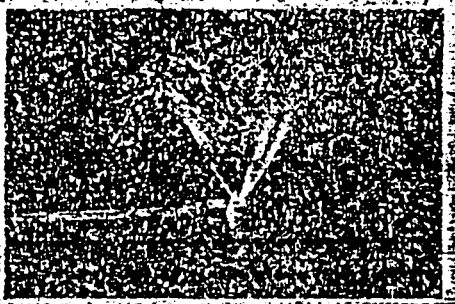
All components used for the construction of the control panel will be UL rated.

BEX R Series High Capacity Hollow Cone Spray Nozzles

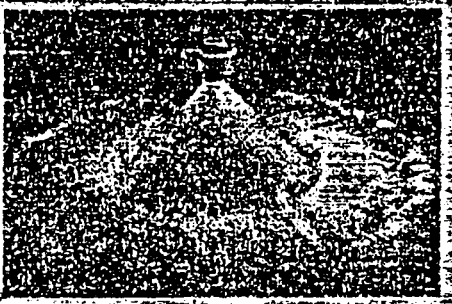
SPRAY CHARACTERISTICS: A high capacity hollow cone spray pattern with uniform distribution. The large body and orifice diameters minimize clogging.

CONSTRUCTION: One piece cast construction. Standard materials are cast iron, bronze and 316 stainless steel. All the R series nozzles have a female N.P.T. pipe connection.

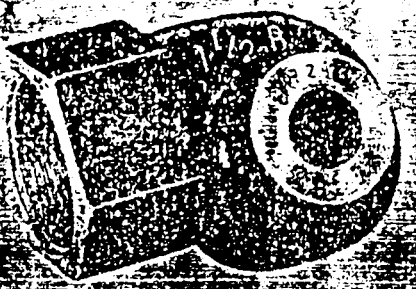
TYPICAL APPLICATIONS:
- Aeration & Pollution Control
- Cooling Ponds
- Scrubbing and Washing gases and fumes
- Cooling Coil
- Dust Proofing
- Chemical Processes



At 1 p.s.i.: Wide spray angle with large droplets and minimal misting.



At 15 p.s.i.: Uniform distribution with larger flow rates.



DIMENSIONS



MODEL	DIMENSIONS (inches)				
	A	B	C	D	L
1R	2	2 1/8	1/2	1 1/8	2 3/4
1 1/4R	2 1/8	2 1/4	1/2	1 1/4	3 1/8
1 1/2R	2 3/8	2 1/2	9/16	1 3/4	3 3/8
2R	2 3/4	3 1/8	1	2 1/4	4 3/4
2 1/2R	3 1/2	4 3/4	1 1/8	2 3/4	5 7/8

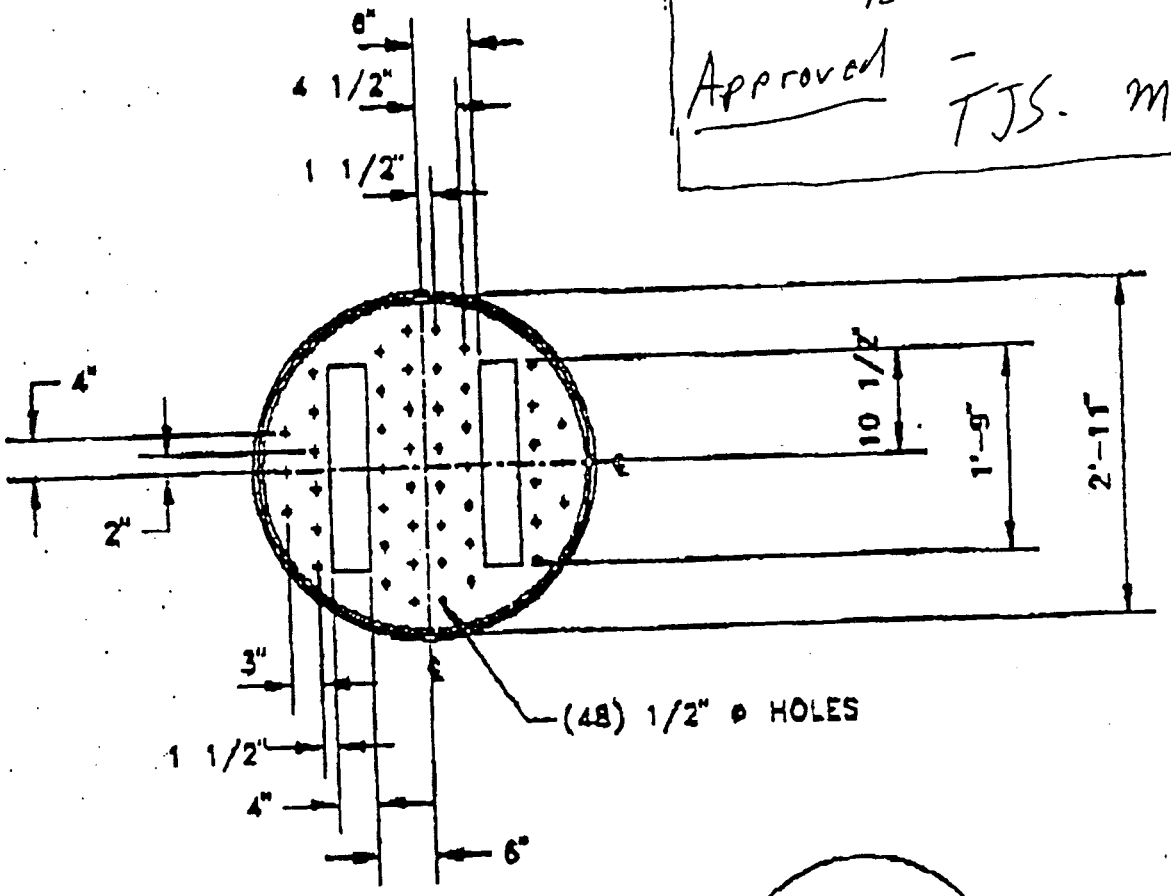
MODEL NUMBER	PIPE SIZE N.P.T. (female)	MINIMUM PASSAGE (inches)	CAPACITY (G.P.M.) AT VARIOUS PRESSURES (p.s.i.)												SPRAY ANGLE @		
			2 p.s.i.	3 p.s.i.	5 p.s.i.	7 p.s.i.	10 p.s.i.	15 p.s.i.	20 p.s.i.	30 p.s.i.	40 p.s.i.	60 p.s.i.	80 p.s.i.	100 p.s.i.	7 p.s.i.	20 p.s.i.	60 p.s.i.
1R10	1/8	5/32	4.5	5.5	7.1	8.4	10	12.2	14.1	17.3	20	24	28	32	65°	72°	74°
1R12	1/8	17/32	5.4	6.6	8.5	10.0	12	14.7	17.0	21	24	29	34	38	71°	74°	76°
1R14	1/8	9/16	6.3	7.7	9.9	11.7	14	17.1	19.8	24	28	34	40	44	74°	79°	80°
1R16	1/8	9/16	7.2	8.8	11.3	13.4	16	19.6	23	28	32	39	45	51	77°	83°	83°
1R18	1/8	9/16	8.0	9.9	12.7	15.1	18	22	25	31	36	44	51	57	80°	86°	86°
1 1/4R12	1/4	17/32	5.4	6.6	8.5	10.0	12	14.7	17	21	24	29	34	38	64°	68°	69°
1 1/4R14	1/4	9/16	6.3	7.7	9.9	11.7	14	17.1	20	24	28	34	40	44	66°	71°	71°
1 1/4R16	1/4	5/8	7.2	8.8	11.3	13.4	16	19.6	23	28	32	39	45	51	71°	75°	75°
1 1/4R18	1/4	5/8	8.0	9.9	12.7	15.1	18	22	25	31	36	44	51	57	76°	78°	79°
1 1/4R21	1/4	5/8	9.4	11.5	14.8	17.6	21	26	30	36	42	51	59	66	79°	82°	82°
1 1/4R24	1/4	5/8	10.7	13.1	17.0	20	24	29	34	42	48	59	68	76	81°	86°	86°
1 1/2R18	1/2	5/8	8.0	9.9	12.7	15.1	18	22	25	31	36	44	51	57	66°	70°	71°
1 1/2R21	1/2	11/16	9.4	11.5	14.8	17.6	21	26	30	36	42	51	59	66	70°	74°	74°
1 1/2R24	1/2	3/4	10.7	13.1	17.0	20	24	29	34	42	48	59	68	76	73°	76°	76°
1 1/2R28	1/2	3/4	12.5	15.3	19.8	23	28	34	40	48	56	69	79	89	79°	79°	80°
1 1/2R32	1/2	3/4	14.3	17.5	23	27	32	39	45	55	64	78	91	101	79°	84°	84°
1 1/2R37	1/2	3/4	16.5	20	26	31	37	45	52	64	74	91	105	117	84°	88°	88°
2R37	2	7/8	16.5	20	26	31	37	45	52	64	74	91	105	117	82°	84°	85°
2R43		15/16	19	24	30	36	43	53	61	74	86	105	122	136	86°	70°	72°
2R49		1	22	27	35	41	49	60	69	85	98	120	139	155	76°	72°	73°
2R57		1 1/16	25	31	40	48	57	70	81	99	114	140	161	180	74°	77°	77°
2R65		1 1/16	29	36	46	54	65	80	92	113	130	159	184	200	75°	79°	79°
2R75		1 1/16	34	41	53	63	75	92	106	130	150	184	210	240	78°	81°	81°
2R85		1 1/16	38	47	61	72	86	105	122	149	172	210	240	270	80°	83°	83°
2 1/2R75	2 1/2	1 5/16	34	41	53	63	75	92	106	130	150	184	210	240	67°	72°	72°
2 1/2R85		1 5/16	38	47	61	72	86	105	122	149	172	210	240	270	73°	76°	76°
2 1/2R100		1 5/16	45	55	71	84	100	122	141	173	200	245	280	320	79°	80°	80°
2 1/2R115		1 5/16	51	63	81	96	115	141	163	199	230	280	330	370	80°	84°	85°
2 1/2R132		1 5/16	58	72	93	110	132	162	187	230	266	330	378	420	82°	87°	87°

(A) Tolerances to G.P.M. are an U.S.G.P.M.

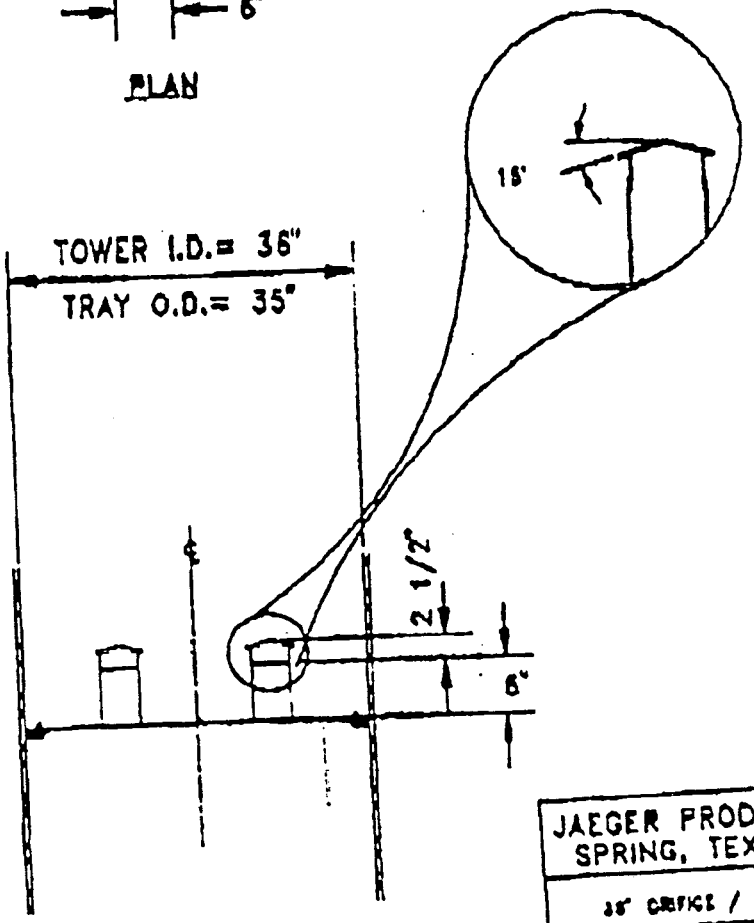
See pages 2 and 3 for engineering data and spray coverage.

Tower - redistribution
- Village of Harriman -
- Tarn Vac Job

Approved - TJS. March 12 92



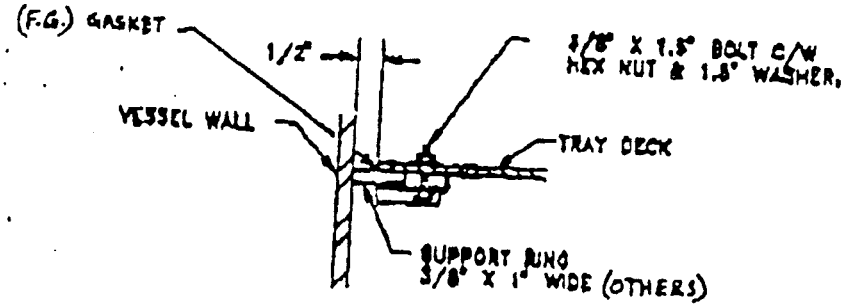
PLAN



ELEVATION

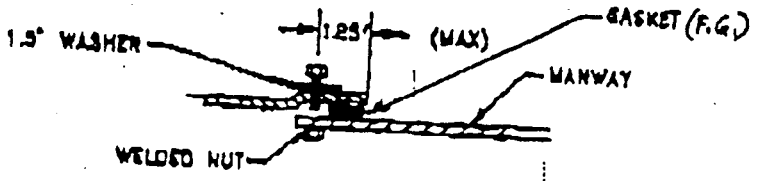
JAEGER PRODUCTS SPRING, TEXAS				
35" ORIFICE / RISER LIQUID DISTRIBUTOR/REDISTRIBUTOR				
		03/09/01	0392015	

BILL OF MATERIALS			
ITEM #	QTY	DESCRIPTION	MATL
1	1	14 GAUGE THK. (TY-832)	304L SS
2	1	14 GAUGE THK. (TY-818)	304L SS
3	4	21" X 8" X 14 GA. PLATE	304L SS
4	4	4" X 8" X 14 GA. PLATE	304L SS
5	4	2 9/16" X 33" LG. X 14 GA. THK.	304L SS
6	18	1" X 2.5" X .12" THK.	304L SS
7	18	TRAY CLAMPS (A23-B)	304L SS
8	35	WASHER 1.5 O (A817)	304L SS
9	7	3/8" X 1" LG. BOLTS	304L SS
10	7	3/8" WELDED NUTS	304L SS
11	3"	1/16" X 1" GASKET	FIBERGLASS



TYP. CLAMP DETAIL
FOR TRAY

Approve TJS
Mar 12 1992



JOINT DET.

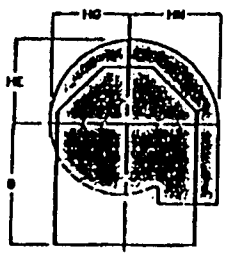
NOTES:
1. (1) TRAY REQUIDED.
2. ALL PARTS TO PASS THRU. 20" I.D. MANWAY.
3. REMOVABLE FROM TOP ONLY.
4. ALL PLATES 14 GAUGE THICK

JAEGER PRODUCTS SPRING, TEXAS	REV	BY	DATE	DESCRIPTION
36" ORIFICE / RISER LIQUID DISTRIBUTOR/REDISTRIBUTOR				
		03/09/93	0392015	2 of 2 / 0

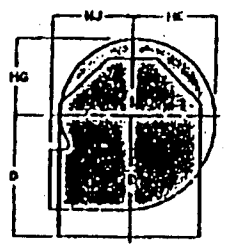
Post-it™ brand fax transmittal memo 7671 | # of pages ▸

To Wazir	From T. Schmidt
Co. Jaeger Prod.	Co.
Dept.	Phone #
Fax # 713-449-9480	Fax #

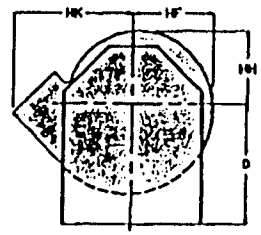
Fan Discharge Options



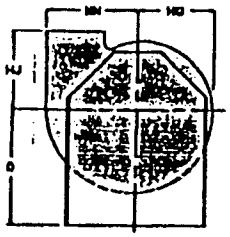
DBD



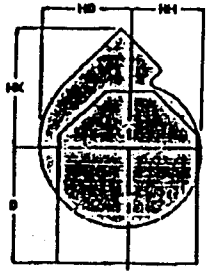
BHD



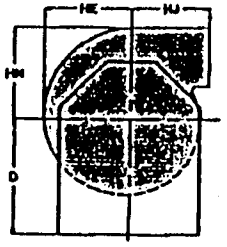
BAU



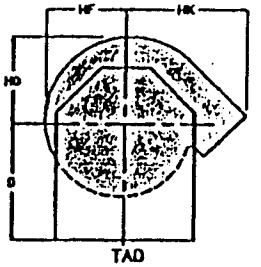
UBD



TAU



THD



TAD

SIZE	UNIT NO.	ROT.	DISCH.	MOTOR H.P.	T.S.
C.F.M.	S.P.	R.P.M.	B.H.P.	O.V.	

ACCESSORIES REQ'D

JRW INDUSTRIAL FANS ARR 9F ROTATABLE

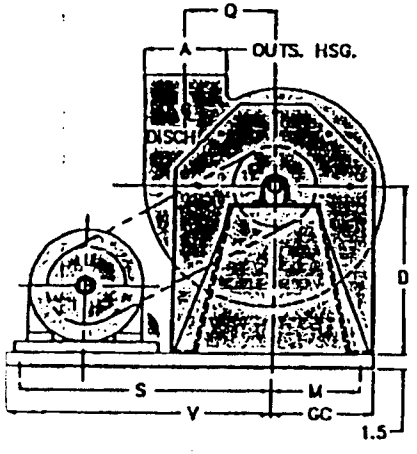
TWIN CITY FAN & BLOWER
MINNEAPOLIS, MINNESOTA 55414

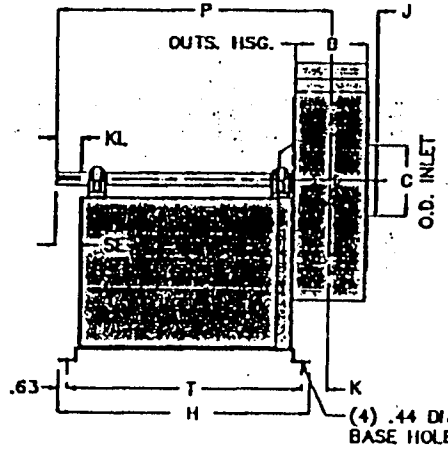
DRAWN 2-25-88
REVISED
DWG. No. AC-13400

JOB Village of Hiawatha

LOC.

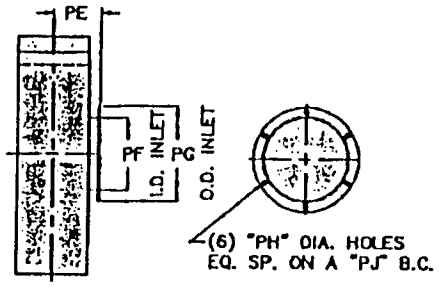
S.O. NO.



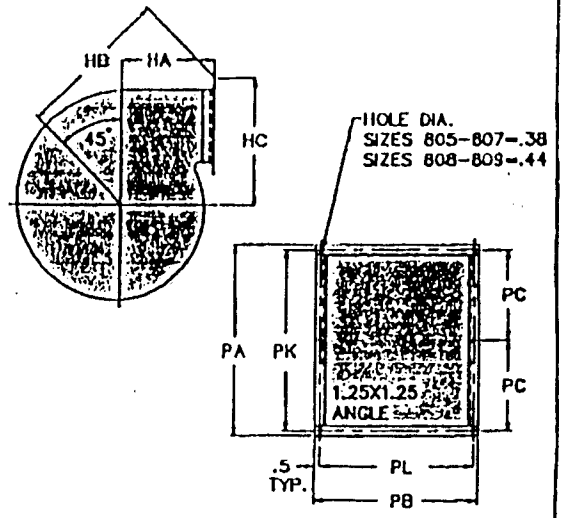


NOTES:

01. CW ROTATION SHOWN, CCW SIMILAR BUT OPPOSITE



OPTIONAL INLET FLANGE

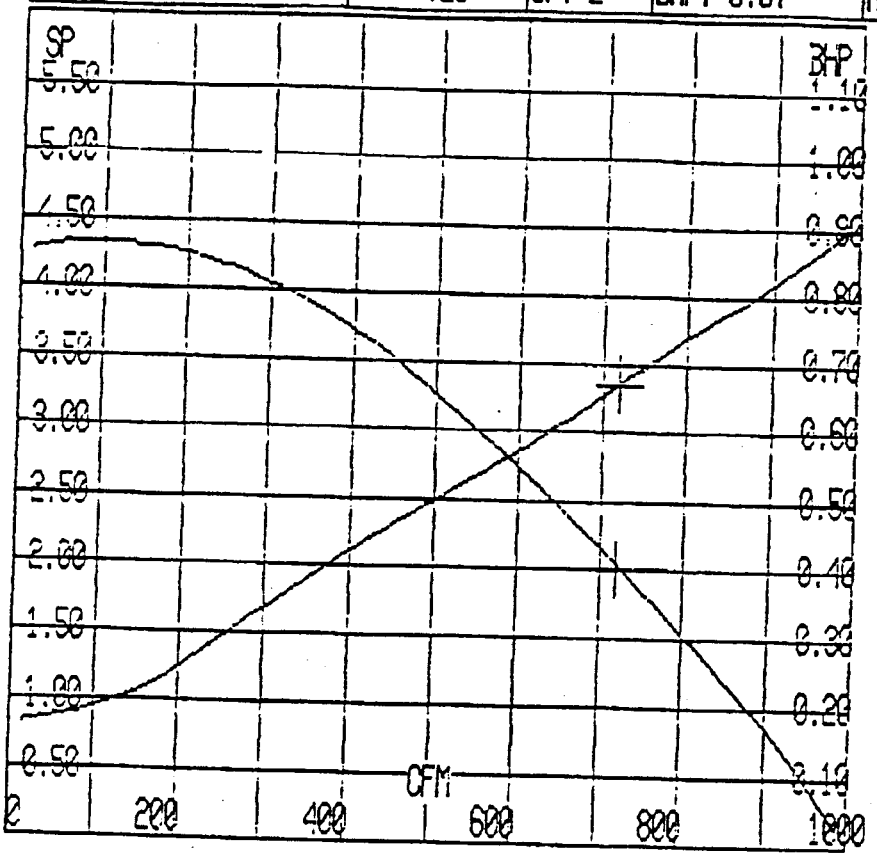


OPTIONAL OUTLET FLANGE

SIZE	A	B	C	D	G	H	J	K	L	M	N	P	Q	S	T	V	GC	HA	HB	HC	HD	HE	HF	HG	HH	HJ	HK	HN	SE	KL	MAX. WHEEL DIA.	BORE DIA.	KEYWAY	PA	PB	PC	PE	PF	PG	PH	PJ	PK	PL
15F	4.88	4.5	5	11.25	11.5	17	3.88	1.38	11.5	4.88	1	18.75	5.13	18.25	15.75	19.25	5.75	6.5	13	8.81	7.25	6.94	6.63	6.31	5.38	9	11.75	7.56	2.5	2.25	1431	1		7.38	7	—	4	5.06	7.06	.28	6.31	6.38	6
5M	5.88	4.31	6	13.5	13.5	20.38	3.81	1.31	14.88	5.88	1	22.56	6.13	21.38	19.13	22.38	6.75	9.5	.14	10.31	8.69	8.31	7.94	7.56	7.19	9	12.81	9.06	3	2.75	1451	1		8.38	6.81	—	3.94	6.09	8.06	.28	7.31	7.38	5.81
	5.88	5.25	6	13.5	13.5	20.38	4.25	1.75	14.88	5.88	1	23	6.13	21.38	19.13	22.38	6.75	9.5	.14	10.31	8.69	8.31	7.94	7.56	7.19	9	12.81	9.06	3	2.75	1821	1		8.38	7.75	—	4.38	6.09	8.09	.28	7.31	7.38	6.75
7M	6.81	4.31	7	13.5	16	20.38	3.81	1.31	14.88	7.13	1	22.56	7.13	22.63	19.13	23.63	8	9.5	15.13	11.81	10.13	9.69	9.25	8.81	8.38	9	13.88	10.56	3	2.75	1821	1.187		9.31	6.81	—	3.94	7.13	9.38	.38	8.5	8.31	5.81
7F	6.81	6.06	7	13.5	16	20.38	4.69	2.19	14.88	7.13	1	23.44	7.13	22.63	19.13	23.63	8	9.5	15.13	11.81	10.13	9.69	9.25	8.81	8.38	9	13.88	10.56	3	2.75	1841	1.187		9.31	6.56	—	4.81	7.13	9.38	.38	8.5	8.31	7.56
9M	7.75	4.31	8	13.75	19	20.38	3.81	1.31	14.88	8.63	1	22.56	8.19	24.13	19.13	25.13	9.5	11	17.25	13.31	11.56	11.06	10.56	10.06	9.56	10.5	16.0	12.06	3	2.75	1841	1.187		10.25	6.81	4.63	3.94	8.13	10.38	.38	9.56	9.25	5.81
9M	8.63	4.31	9	15.5	19	20	3.81	1.31	15.25	8.63	1	23.56	9.19	27.25	19.36	28.25	9.5	11	16.25	14.75	12.93	12.38	11.81	11.25	10.69	10.5	17.0	13.50	3.63	3.38	2131	1.187		11.13	6.81	5.06	3.94	9.13	11.63	.44	10.63	10.13	5.81

05/11/92 14:32 404 421 8188 TERRA VAC P.2

Twin City Fan & Blower	Fan ID:809N JRW	Customer:TOM SCHMITT	
Tag:	CFM: 720	SP: 2	BHP: 0.67	RPM: 1751



Density: 0.075

Modifiers:

Sound

OCT	SPL
1	97
2	95
3	94
4	87
5	78
6	70
7	63
8	56
LWA	89

ES-51-A
August 1986

CENTRIFUGAL FANS INSTALLATION & MAINTENANCE GUIDE — GENERAL INSTRUCTIONS

Installation:

All fans should be checked to make sure correct fan was received. The proper function should be provided depending on the operation requirement. Locate proper fan position. Base angles on the fan have holes drilled to mount stationary or resilient base as required, locate and fasten firmly in place. All components should be set level.

Motor and drives are then assembled in their proper positions, if not already assembled on the fan. It is important that motor and blower pulleys be properly aligned so as to allow belts to run true and straight.

Pre-Operation Check:

Check all the set screws and bolts to make sure they have not loosened in transit. If necessary, retighten the set screws and bolts. Rotate the impeller by hand to make sure it has not shifted in transit or been damaged during shipment. If required shift the wheel in position. Check the belt tension which should have approximately ¾" to 1" deflection under 3 pounds pressure based on 2½ to 3 foot centers on drives. Check the belt and pulley alignment. On vent sets — adjustments of belt tension is done with the bolt which adjusts the motor base up and down.

Check to make sure that the fan pulley is on the fan, and motor pulley on the motor, as reversal may cause excessive speed and collapse the wheel.

Start the fan and observe the rotation of the impeller. Normally there is an arrow on the blower indicating proper rotation if impeller is rotating in the wrong direction, reverse rotation. With amp probe or ampmeter, take the amp and volt readings making sure the motor is not being overloaded.

Trouble-Shooting:

Following is a list of possible problems and their causes that may occur on start-up, or develop later during operation.

Noise: May be caused by

(a) Impeller hitting the inlet of the fan or cutoff plate, loose impeller
(b) Drives can cause noise if sheaves are not tight on the shaft, belts are too loose or too tight, wrong belt cross section, or mis-matched belts, also worn belts, oily belts or mis-aligned sheaves.
(c) If couplings are used they may be a source of noise by being unbalanced, misaligned, loose or dry of lubricant.
(d) Bad bearings are a common source of noise when defective, dry of lubricant, loose on the bearing support, loose on the shaft, seals mis-aligned, dirty lubricant, fretting corrosion between inner race and shaft, etc. See separate section on bearing care.
(e) There can be an electrical source of noise such as AC hum in motor or relay, starting relay chatter, noisy motor bearings, single phasing a 3 phase motor, etc.
(f) A bent or undersized shaft may be a noise source. *IF MORE THAN TWO BEARINGS ARE ON THE SAME SHAFT, THEY MUST BE CAREFULLY ALIGNED.*
(g) There may be other noise sources such as obstruction in high velocity air stream causing rattle or pure tone whistle, fan operating at undesirable design point, causing pulsation, cracks or holes in duct work, or whistles in fan housing.

TWIN CITY FAN & BLOWER CO.
550 KASOTA AVE. S.E., MPLS., MN 55414
612/331-4104

amca MEMBER

TCF AXIAL DIVISION, INC.

OHLMAN AND 23RD STREET • R.R. 4 • MITCHELL, SOUTH DAKOTA 57301 • PHONE: (605) 996-8081

IMPORTANT NOTICE

This shipment has been carefully inspected, checked and properly packaged at our company.

When it was delivered to the carrier it was in good condition and technically it became your property at that time. Thus, any damage, whether obvious or hidden, must be reported to the transportation company within five days of receipt of the shipment at your premises to avoid forfeiting claims for damages.

FOR ALL SHIPMENTS DAMAGED IN TRANSIT

Leave the items, packing material and carton "As Is". Notify your carrier's local office and ask for immediate inspection of the carton and the contents.

After inspection has been made by the carrier, and you have received acknowledgement in writing as to the damage, notify our Customer Service Department to make any required repair arrangements.

It is your responsibility to follow the above instructions or the carrier will not honor any claims for damage. Also, if there are any shortages or questions regarding this shipment, please notify us within 10 days.

Please note that we cannot be responsible for any service work or backcharges unless authorized by us in writing, before the work is performed.

W.E. Anderson

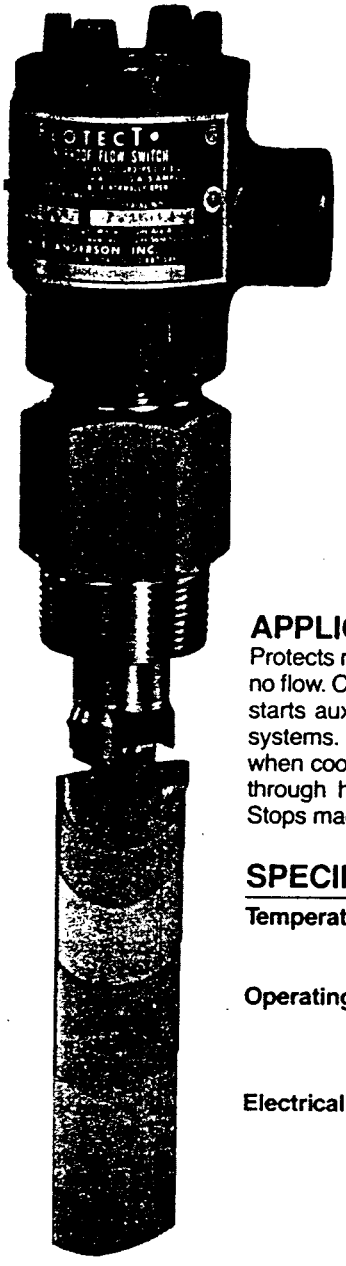
FLOTECT. Vane Operated Flow Switch

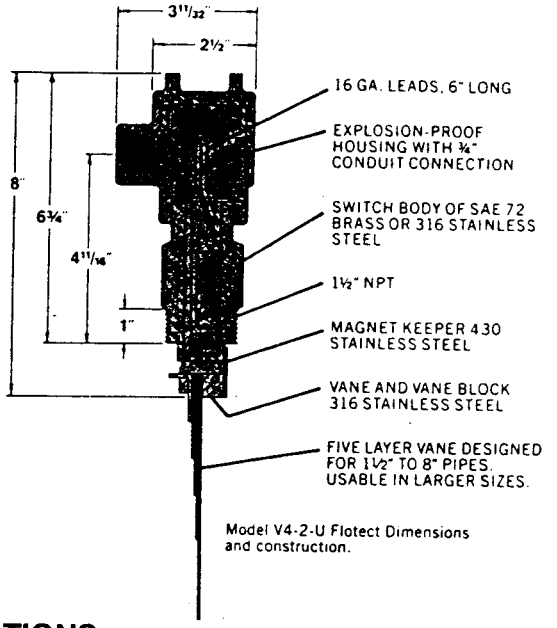
INSTALLATION AND OPERATING INSTRUCTIONS

Explosion-Proof; U.L. and C.S.A. listed – Class I, Groups C, D; Class II, Groups E, F, G.
CENELEC: EExd 11B T6.

Dependable protection against flow variation or stopping in pipelines for fluids, gasses and flowing solids.

Supplied with custom or universal multi-layer vanes for field installation in pipes from 1½".

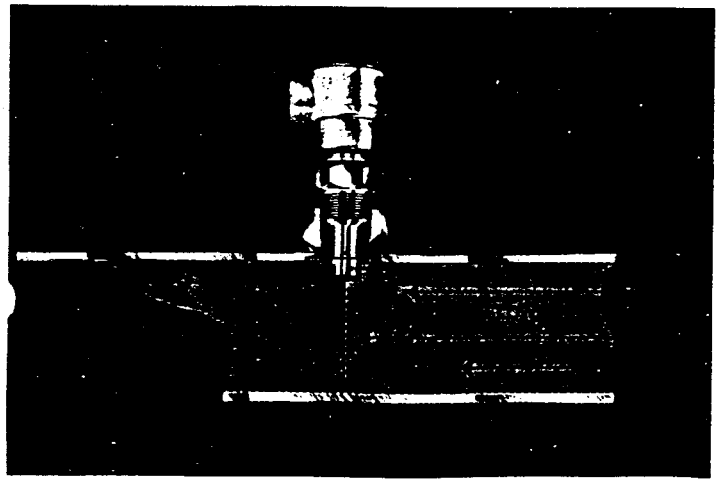




Model V4-2-U Flotect Dimensions and construction.

Compact and reliable, the Flotect V4 Flow switch operates automatically to protect equipment and pipeline systems against damage from reduction or loss of flow. Installed in thousands of pipelines and processing plants around the world, this unique magnetically actuated switching design gives superior performance. Universal multi-layer vane accommodates pipe sizes from 1½" up. Custom vanes are available with factory calibration. There are no bellows, springs, or seals to fail. Instead, the free-swinging vane attracts a magnet within the solid metal switch body above, actuating a snap switch by means of a simple lever arm.

Features include: Simplicity of design and a leak-proof switch body, machined from bar stock for pressures to 2000 psig, (138 bar), it eliminates the possibility of process fluid entering the switch compartment. The threaded conduit enclosure cover permits easy inspection or replacement of electrical assembly without shutting down the process, or removing electrical conduit. Power must be disconnected. The unit fits directly into pipeline with tee, thredolet or flange for easy installation. Pendulum-like vane action responds accurately to fluid flow rate. The custom vane or multi-layer vane is sensitive to low velocity flows, yet it is rugged enough to withstand high flow surges. If desired, a delay timer can be wired into the installation. All units are explosion-proof and listed with U.L. and C.S.A. for Class I, Groups C and D, Class II, Groups E, F, and G or are flame-proof to CENELEC EExd IIB T6.



APPLICATIONS

Protects motors, pumps and other equipment against low flow and no flow. Controls sequential operation of pumps, etc. Automatically starts auxiliary pumps and engines or actuates alarm and signal systems. Stops water cooled engines, machines and processes when coolant flow is interrupted. Shuts down burner when air flow through heating coil fails. Controls dampers according to flow. Stops machines if cooling oil flow ceases.

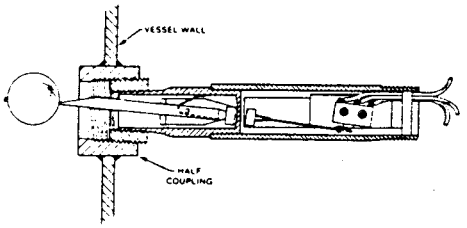
SPECIFICATIONS

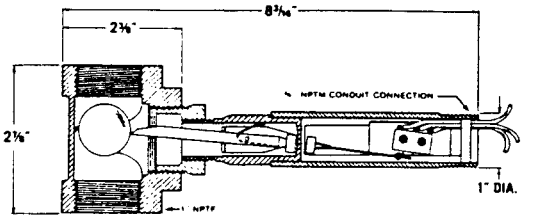
Temperature limits:	Standard 275°F (135°C). High temperature option (not U.L., C.S.A. or CENELEC), 400°F (205°C) max.
Operating Pressure:	Brass 1000psig (69bar) 316S.S. 2000psig(138bar) Ratings to 5000psig(345bar) available (SPDT only).
Electrical Rating:	U.L. and CENELEC: 10A@125/250 Vac C.S.A.; 5A@125/250 Vac, 5A resistive 3A inductive@30Vdc Optional ratings (not UL, CSA or CENELEC); MV option; Gold contacts, 1.0A@125 Vac MT option: 400°F (205°C), 5A@125/250Vac
Wiring:	U.L./C.S.A. unit; 16 gauge copper wire, 6" long, mechanically and solder bonded to switch. CENELEC unit: Terminal board.
Switch body:	One piece milled and bored Brass or 316 SS. Other materials on request.
Vane:	316 SS 1 9/16" (40mm) wide. Std. trim includes 430 SS and silver solder. Other materials on request.
Piping Connection:	1½" NPT std for mounting in 1½" thredolet. For other mounting see back page. Thredolet fittings available.
Installation:	Within 5° of vertical for proper operation. Units for horizontal installation (vertical pipes) on request.
Weight:	4lb.-5oz. (1.96Kg)
Options:	All 316SS wetted parts. Teflon coated wetted parts. DPDT circuits. Cartridge heater to melt paraffin, etc. Time delay relay.

W.E. Anderson
Div. of Dwyer Instr., Inc.

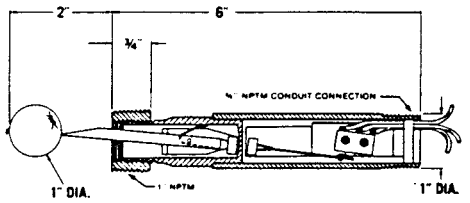
FLOTECT® Model L6 Level Switch

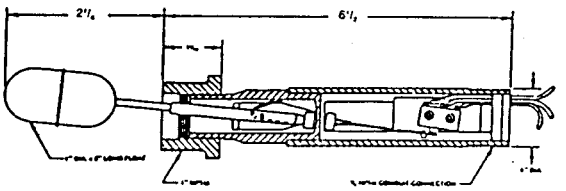
INSTALLATION AND OPERATING INSTRUCTIONS





L-6 WITH EXTERNAL FLOAT CHAMBER





L-6 FOR THRU—WALL INSTALLATION

INSTALLATION

1. Carefully unpack switch, making sure to remove any packing from inside float chamber and/or lower housing.
2. Switch must be indexed during installation, so that the arrow on the side of the switch points down.
3. If switch is installed "thru-wall", a 1" half-coupling must be welded in the vessel wall as shown above. Half-couplings must extend through the wall as shown above. Do not attempt to use thredolets, full couplings or other types of fittings.
4. Pass the connecting wires through external conduit and connect. Switch is deactivated and contacts are in normal condition when level is below switch.

   Black - Common
   Blue - N. O.
   Red - N. C.

   Note: Double pole, double throw switches have dual black, blue and red leads. These are connected in the same manner as single pole double throw switches as described above.
5. Make sure conduit and wiring meet appropriate codes for hazardous areas. Make sure conduit is properly sealed. Care must be taken in hot/cold or outdoor installations to prevent condensation inside conduit. Electrical components must be kept free of moisture at all times. CAUTION: To prevent ignition of hazardous atmosphere, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in operation.
6. Inspect and clean wetted parts at regular intervals.

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 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 the 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.

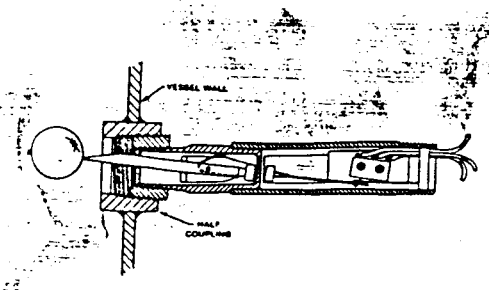
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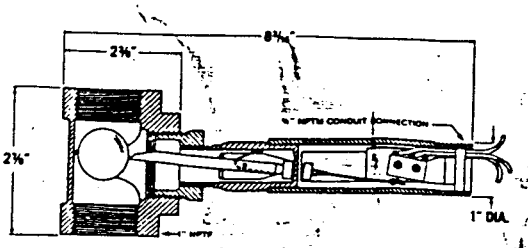
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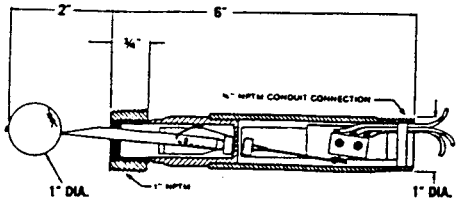
FLOTECT® Model L6 Level Switch

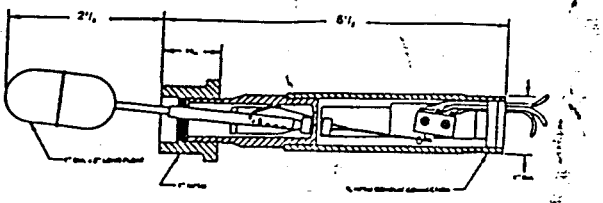
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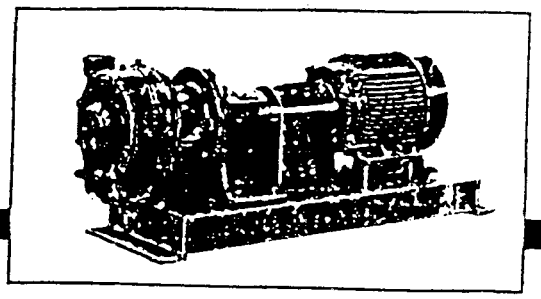
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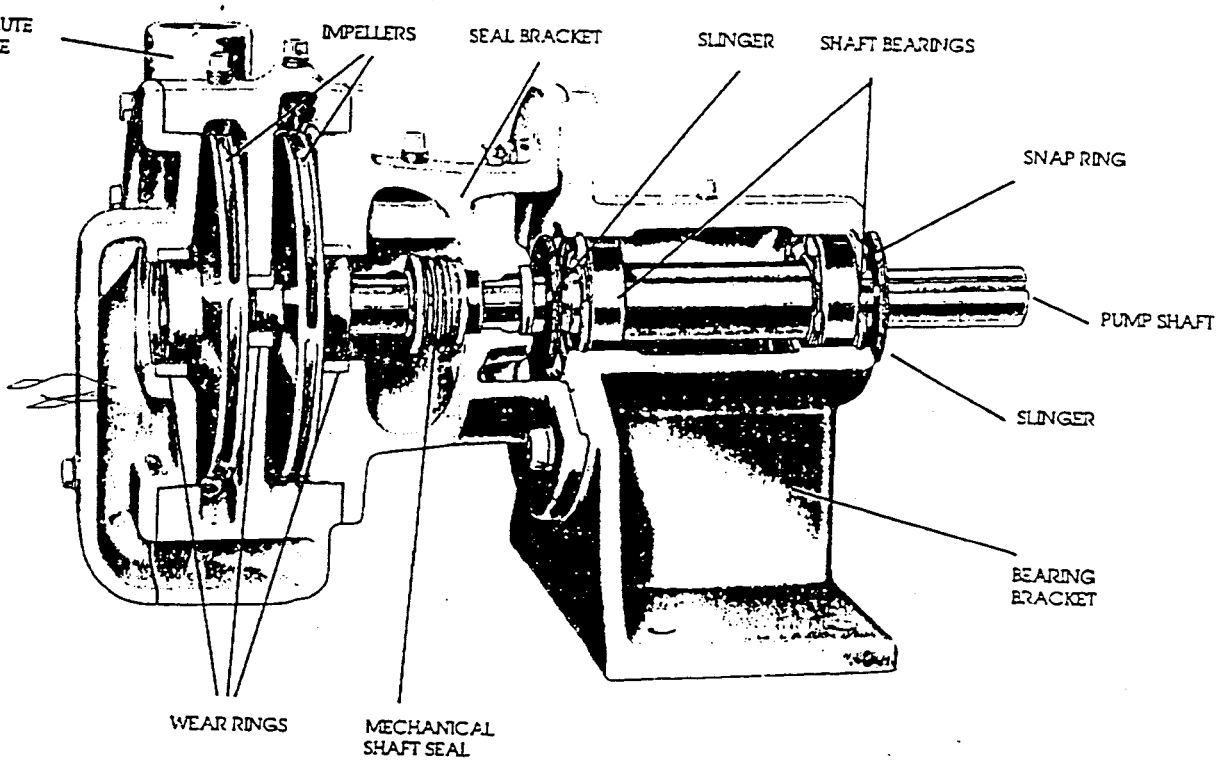
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W.E. ANDERSON DIV., DWYER INSTRUMENTS, INC., 320 W. 80th ST., KANSAS CITY, MO 64114 816-333-9882

XFER PUMP





Construction Materials

VOLUTE CASE
High tensile, gray iron casting with wear rings. Threaded discharge tapping rotates to 8 positions.

SEAL BRACKET
High tensile, gray iron casting with threaded suction tapping. Adjusts to 4 positions at 90° intervals. Seal bracket has oil chamber to lubricate and cool the seal face.

DRAIN PLUGS
Plugs are conveniently located so case can be completely drained in any discharge position.

BEARING BRACKET
Heavy duty bracket provides rigid support for liquid end. Holds shaft bearings in perfect alignment with pump case for quiet operation.

SHAFT BEARINGS
Regreasable heavy duty ball bearings, sealed on outboard side, lubricated at the factory.

IMPELLERS
Dual enclosed impellers are hydraulically and dynamically balanced. Mounted back-to-back for reduced axial thrust, results in vibration free operation and minimum bearing load. I2C has bronze impellers. I2CI has epoxy coated, high tensile gray iron impellers

WEAR RINGS
Replaceable wear rings and interstage bushings help to eliminate wear of the casting in the impeller hub and ring area. Bronze in I2C. Ni-Resist in I2CI.

MECHANICAL SHAFT SEAL
Located on suction side to provide lower pressure differential and longer seal life and maximum positive inlet pressure of 75 PSI. Standard seal will accomodate 220°F. Please consult factory for special seal applications.

PUMP SHAFT
Manufactured from tough, corrosion resistant stainless steel.

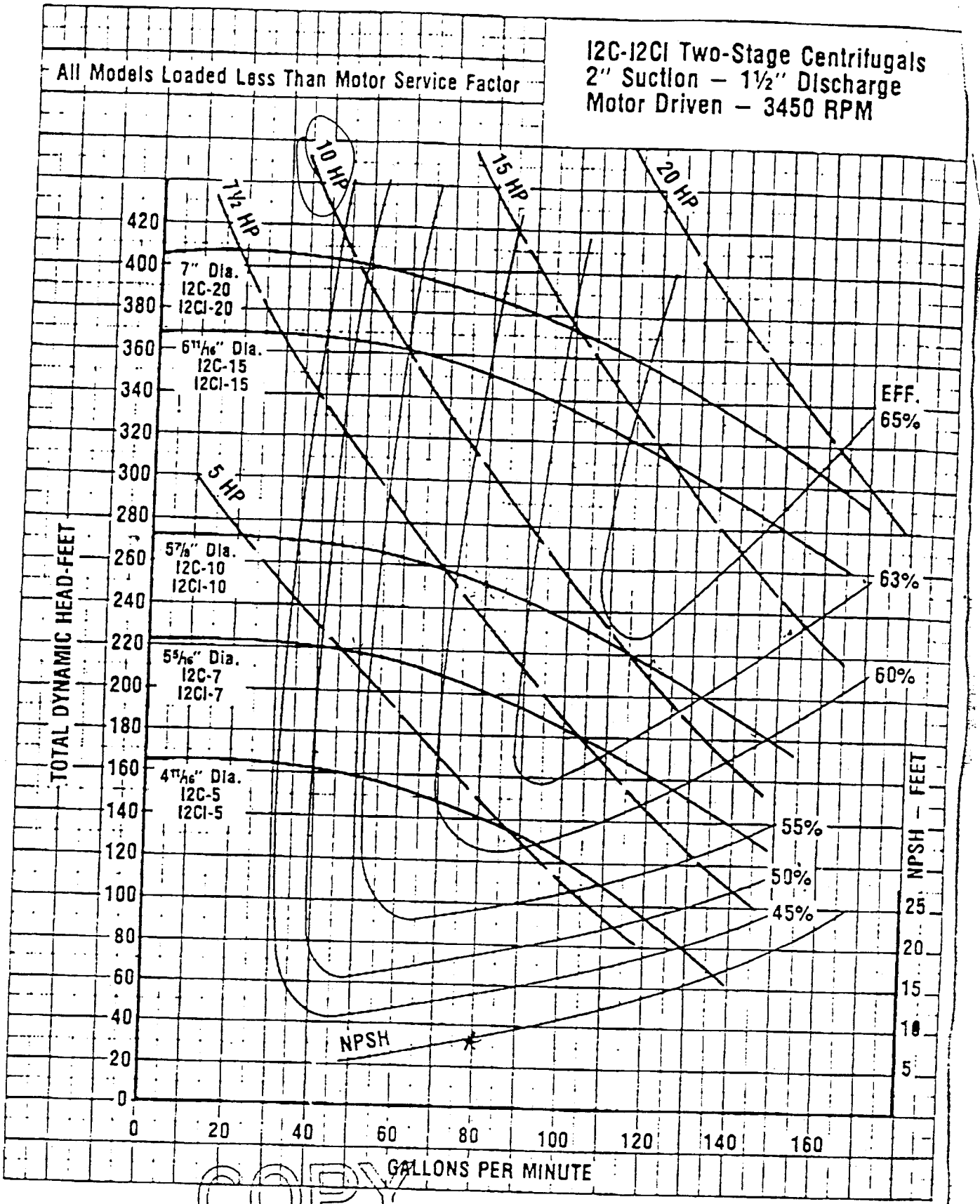
SLINGER
Molded rubber slinger protects bearings from moisture and dirt

SNAP RING
Carbon steel ring holds each bearing in place, prevents axial movement of the bearings and shaft.

MOTOR (FRAME MOUNTED UNITS)
General purpose, 3450 RPM, open drip proof, 230/460 volt motor is standard. Special motors on request. Frame mounted units use a flexible coupling for easy motor or pump replacement. Mounted on a heavy duty welded steel base.

Weight 125#

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COPY

Myers®

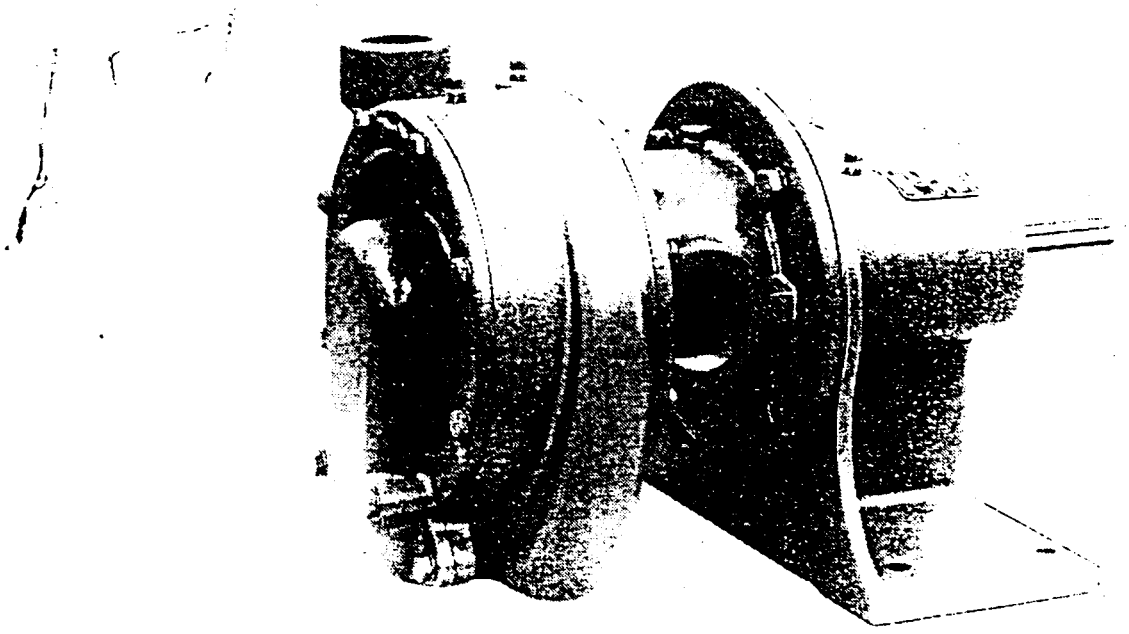
F.E.Myers, A Pentair Company
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Ashland, Ohio 44805-1923

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Transfer pump

I2C & I2CI/2C95 Two-Stage Centrifugal Pump Installation, Servicing and Parts List



Myers®

13800A429

INDUSTRIAL HIGH CAPACITY – HIGH PRESSURE TWO STAGE CENTRIFUGAL PUMP "12C" – PUMP UNIT ONLY – "12CB" – BASE MOUNTED, DIRECT CONNECTED "12CB-M" – BASE MOUNTED, DIRECT CONNECTED, COMPLETE WITH MOTOR

Location

The pump should be located in an easily accessible place as close to the liquid source as possible. It should be installed in a clean, dry, well ventilated place, allowing room to inspect and service pump and driver.

Foundation

The pump should be bolted securely to a rigid foundation, either concrete or steel. The **2" N.P.T. Suction** can be rotated at 90° intervals to 4 different positions. As standard, the suction will be on the right side when facing the pump end. The **1½" N.P.T. Discharge** can be rotated at 45° intervals to 8 different positions. As standard, the discharge will point up.

Direct connected pumps should always be mounted in a horizontal position on a level foundation. It is the best practice on permanent installations to grout the baseplate in place, this is particularly important with the larger motors. The unit should be set in place with wedges under each corner, near the foundation bolts. Adjust wedges and foundation bolts until the baseplate is level, in proper relation to the piping so the flexible coupling halves are aligned. About ¾" should be allowed under the baseplate for grouting. The foundation bolts should be drawn up evenly until snug. When the alignment is correct grout the unit in place. Do not tighten foundation bolts or connect piping until grout is thoroughly set.

Alignment

Direct connected units are accurately aligned at the factory but all baseplates are flexible to some extent and, therefore, must not be relied upon to maintain the factory alignment. A flexible coupling is intended to take care of only slight misalignment. Therefore the pump and driver must be carefully aligned at the installation. Parallel alignment can be checked by placing a straight edge across the coupling halves. It must rest evenly on both halves at four positions spaced at approximately 90° intervals around the coupling. Angular alignment can be checked with a feeler gauge between the coupling halves at four points at approximately 90° intervals around the coupling. The coupling halves are positioned on the shafts so there is a gap of 1/32" between the jaw of one half and the body of the other half.

On belt driven units the pump and driver shafts should be parallel; the pulleys or sheaves must be aligned also. This can be checked by placing a long straight edge or tight string across the edges of the pulley or sheaves. The pulley or sheave on both pump and driver should be mounted as close to the bearing housing as possible to minimize the overhang, allowing sufficient clearance for rotor end play.

Belt Drives

Avoid a vertical drive on flat belt drives; an angle of 45° or less between the line of shaft centers and the horizontal is desirable. Normaliy 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. Wide, single ply flat belts are preferable to double ply belts due to the lower bearing pressures that result. Adjust belt tension just tight enough to prevent slippage; excess tension unnecessarily loads the bearings. V-belts do not require as much tension as flat belts.

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 pump tappings or larger 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, which would make it 2½" minimum. It 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 can 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 to serve as a shut-off or throttling valve if capacity is not correct. To protect the pump and foot valve 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 correct for voltage being used. Always use separate fused switch for pump, and wire of sufficient size 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. This switch to be supplied by customer. Never install a pump without proper overload protection. Check local code requirements.

When the motor is mounted on a baseplate 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. Be sure pump case is filled with water before operating. The mechanical shaft seal must never be run dry. Remove the three top ¼" pipe plugs while priming (one in each chamber) to assure that all air is evacuated. The three individual chambers of the pump and the suction piping must be completely filled before starting motor.

If pump does not start immediately, stop and reprime.

Rotation

The pump must run in direction of arrow on pump case. Three phase motors may run either direction so if rotation is wrong when first starting motor, interchange any two line leads to change rotation.

Starting

With all piping connected to the pump and the unit tightened down in place, check the alignment. If misalignment is apparent after grout has set, it must be corrected by placing shims under pump or driver. If the alignment is correct and the pump turns freely by hand, the unit is ready to start after it is primed.

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.

Stopping

Before stopping pump, close the discharge valve. This will prevent water hammer and is especially important on high head pumps.

Mechanical Seal Lubrication

The pump is provided with an oil chamber which lubricates the seal face of the mechanical seal. The oil level should be checked every 50 hours. Fill cavity through the oil cup (item 30) with S.A.E. No. 30 oil.

NOTE: Warning tag is attached to the oil cup, which reads "If the suction bracket is rotated to a different position, this oil cup must be removed and rotated so it will remain in a vertical position."

Bearings — Lubrication

Lubricate electric motor bearings in accordance with the manufacturer's instructions.

Pump bearings are sealed one side, open one side ball bearings that are lubricated by grease in the bearing bracket. Normally, these bearings require no further attention. This grease cavity must not be overloaded and should not be filled more than about half full. Dolium R or equivalent grease must be used.

If, due to unusual operation conditions, it becomes necessary to revitalize the grease, proceed as follows:

(1) Remove bearings and shaft. (See instructions on "To Replace Bearings.")
(2) Clean out cavity between bearings
(3) Replace bearings and pump shaft. NOTE: Bearing open sides should face in toward grease cavity with seals facing out.
(4) Fill cavity about ½ full (approx. ½ pound) of Dolium R or equivalent through top ¼"NPT.

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 when not in operation.

Three individual chambers must be drained. These chambers include the suction (seal bracket) and the first and second stage impeller chambers.

A - To drain the suction chamber, remove the ¼" pipe plug that is in the bottom position, unless the suction pipe is pointing down. If this is the case, drainage means must be provided in suction piping leading to the pump.

B — To drain the first and second stage impeller chambers, remove the two ¼" pipe plugs which are in the lower position of the case and the ⅛" pipe plug in the crossover casting.

To Remove and Replace Worn Impeller and Wearing Rings

To service pump, the suction and discharge piping must first be disconnected.

A -- Remove backplate (25). Remove impeller cap screw (17) and washer in outer impeller eye. Remove tap bolts which hold volute case (21) to bracket (7). With two large screwdrivers on opposite sides of volute case, pry evenly and carefully to get volute case and outer impeller off. Care must be exercised to avoid bending pump shaft. In the event that the impeller is extremely difficult to pull, it can be expanded by warming with a torch. Be careful not to get it really hot. Then, before it has time to conduct heat to shaft, the impeller can be pried off with two screwdrivers, as described previously.

B — Remove inner impeller (13) using two screwdrivers and heat, if necessary. Be careful not to get shaft hot. Remove snap ring (12). Slide old seal (11) off shaft. Remove tap bolts (5) holding bracket (7) to bearing bracket (1) and pull bracket off shaft. Remove old floating seat and seat cup from bracket.

C — Make sure the synthetic seat cup of the new seal is tight against the shoulder of the floating seat, with rounded edge at the rear to facilitate insertion. The seal is assembled this way when shipped. Wipe the lapped sealing face of the floating seat perfectly clean and oil face with a clean, light oil.

D — Oil outer surface of the seat cup, using light oil (not grease) and push this assembly into the cavity of the bracket, seating it firmly and squarely. If necessary to use a piece of tubing to push it in, bear on the outer edge of the floating seat, never on the lapped sealing face.

E - Replace oil seal (2) and lubricate oil seal face with S.A.E. No. 30 oil. Clean and oil the surface of the shaft with a light oil. Make sure slinger (10) is in place. Bolt bracket (less impellers) back to bearing bracket, being careful not to strike floating seat with shaft. Wipe the face of the sealing washer perfectly clean, and oil with clean light oil. It is extremely important that only clean oil be used on the sealing faces. Any dirt whatsoever may cause seal failure. Put the sealing washer and bellows assembly on the shaft. Be sure sealing washer is in proper position. The notches on the washer should mate with lugs on the retainer. Use a sleeve of proper diameter to slide assembly into place. Note: When sliding seal assembly on shaft, be sure to press only on tail sections of bellows and driving band. A smooth sleeve of about 1 9/32" diameter (1/32" larger than shaft), with a wall thickness of about 1/8" is suitable. Press assembly on until it is tight against floating seat.

F - Slip shaft seal spring over shaft, making sure that it, and the spring holding plate, are seated properly. Slip snap ring over shaft and slide it forward until it drops into place. Install inner impeller, with suction opening toward bearing bracket, making sure that key is in place on shaft. The inner and outer impellers have different wearing ring diameters. Therefore, it is impossible to assemble impellers in reverse order.

G - Place volute case back and bolt it to bracket. Install outer impeller with suction opening away from bearing bracket. Ring the beveled washer (shaft side) with a bead of Permatex to seal keyway and impeller shaft from corrosion. Assemble the impeller cap screw, with a 3/8" helical spring lock washer (302 stainless steel), Myers part number 5454A15. Tighten the cap screw to 35 foot/pounds.

H - Be sure pump case is filled with water before operating. Seal must never be run dry.

Replacing Wearing Rings

With impellers removed, the wearing rings can be examined for wear. Replace wearing rings if clearance on diameter is over .030".

To remove and replace wearing rings:

(1) Cut worn rings from casing with cold chisel. Be careful not to cut or damage the iron castings when removing rings. Cut rings nearly in half on opposite sides, then they can be easily bumped out.

(2) Put new rings in place and bump in with a hardwood block. New impeller wearing rings should always be installed in a pump at the same time a new impeller is installed. Worn wearing rings will cause excessive wear on the new impeller, thereby reducing the amount of service obtained from a new impeller.

To Replace Bearings

Pump end must be removed. Pry pulley and bearing retaining ring out with a screwdriver. Press shaft and outer bearing through pulley end of bearing bracket. Press pulley end bearing off shaft. Pump end bearing will probably remain in bearing bracket and can be removed by removing pump end snap ring and pressing pump end bearing out of bearing bracket.

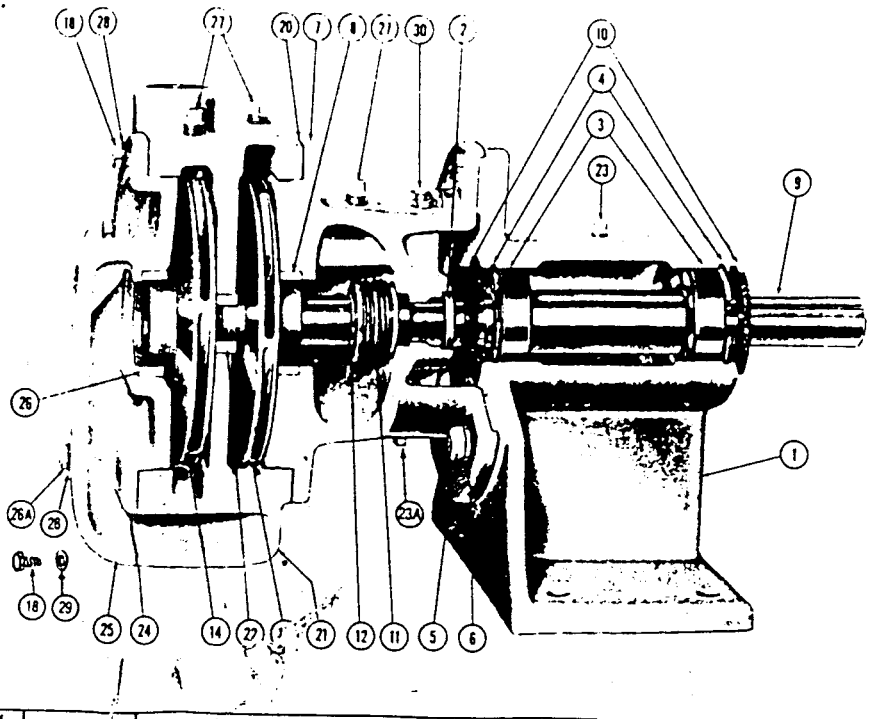
To reassemble: Press new pump end bearing into bearing bracket and replace snap ring. Press new pulley end bearing on shaft, pressing only on inner race of bearings. Press shaft and pulley bearing into housing. Note: Be sure that pump end bearing is supported on the inner race and pulley end bearing is supported on both inner and outer race during this operation. Also seals on bearings must face out on installation with open sides facing in (toward grease cavity).

SERVICE CHART TROUBLESHOOTING GUIDE

A No water delivered
B Not enough water delivered
C Not enough pressure
D Pump runs for short while, then loses prime

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 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. When pumping hot water recheck NPSH.	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 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 wearing rings badly worn. Disassemble pump and replace impeller and wearing rings if clearance on diameter is over .030".		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.				

I2C & I2CI/2C95 Pumps Parts List



Ref. No.	Part No.	Description
1	15035C	BRACKET, BEARING
2	5710A22	SEAL, LIP
3	11729A8	BEARING, BALL — 2 REQ'D
4	7756A7	RING, RETAINING — 2 REQ'D
5	19103A4	SCREW, ½ - 13UNC x 1¼ HEX HD. — 4 REQ'D
6	5454A4	WASHER, ½ LOCK — 4 REQ'D
7	17548D1	BRACKET, SEAL — WITH BRASS WEAR RING — I2C UNITS
7	17548D10	BRACKET, SEAL — WITH NI-RESIST WEAR RING — I2CI UNITS — REPLACES 17548D1 ON 2C95
8	12934A	RING, WEAR — BRASS — I2C UNITS
8	12934A1	RING, WEAR — NI-RESIST — I2CI UNITS — REPLACES 12934A ON 2C95
9	15037C	SHAFT
10	5059A263	SLINGER — 2 REQ'D
11	21181A16	SEAL, ROTARY — REPLACES 15218A & 15218A10 ON I2C, I2CI, & 2C95 — REPLACES 21181A8 ON I2CH. UNITS
12	12558A8	RING, RETAINING
13	17549C4	IMPELLER, 4 1/16 DIA. BRASS — I2C-5
13	17549C3	IMPELLER, 5 5/16 DIA. BRASS — I2C-7
13	17549C2	IMPELLER, 5 7/8 DIA. BRASS — I2C-10
13	17549C1	IMPELLER, 6 1/16 DIA. BRASS — I2C-15
13	17549C	IMPELLER, 7 DIA. BRASS — I2C-20
13	15038C4	IMPELLER, 4 1/16 DIA. C.I. — I2 CI-5
13	15038C3	IMPELLER, 5 5/16 DIA. C.I. — I2CI-7
13	15038C2	IMPELLER, 5 7/8 DIA. C.I. — I2CI-10
13	15038C1	IMPELLER, 6 1/16 DIA. C.I. — I2CI-15
13	15038C	IMPELLER, 7 DIA. C.I. — I2CI-20/2C95
14	17550C4	IMPELLER, 4 1/16 DIA. BRASS — I2C-5
14	17550C3	IMPELLER, 5 5/16 DIA. BRASS — I2C-7
14	17550C2	IMPELLER, 5 7/8 DIA. BRASS — I2C-10
14	17550C1	IMPELLER, 6 1/16 DIA. BRASS — I2C-15
14	17550C	IMPELLER, 7 DIA. BRASS — I2C-20
14	15039C4	IMPELLER, 4 1/16 DIA. C.I. — I2CI-5
14	15039C3	IMPELLER, 5 5/16 DIA. C.I. — I2CI-7
14	15039C2	IMPELLER, 5 7/8 DIA. C.I. — I2CI-10
14	15039C1	IMPELLER, 6 1/16 DIA. C.I. — I2CI-15
14	15039C	IMPELLER, 7 DIA. C.I. — I2CI-20/2C95
	5818A46	KEY, 3/16 SQ. x 2" SST
	8818A2	WASHER, 3/8 SST SPECIAL
	5454A15	WASHER, 3/8 SST LOCK
	17050A1	SCREW, 3/8 - 16 UNC x 1" SST NYLOK HEX HD.

Ref. No.	Part No.	Description
18	19101A8	SCREW, 3/8 - 16 UNC x 7/8" HEX HD. — 16 REQ'D.
20	5863A18	GASKET
21	17547D1	CASE, VOLUTE — WITH BRASS WEAR RING — I2C UNITS
21	17547D10	CASE, VOLUTE — NI-RESIST WEAR RING — I2CI-5, I2CI-7 I2CI-10, I2CI-15
21	17547D11	CASE, VOLUTE — WITH NI-RESIST WEAR RING — I2CI-20/2C95 — REPLACES 17547D1 ON 2C95
22	15044A	RING, WEAR — BRASS — I2C UNITS
22	15044A1	RING, WEAR — NI-RESIST — I2CI UNITS — REPLACES 15044A ON 2C95
23	5022A9	PLUG, ¼ NPT GALV. PIPE
23A	5022A21	PLUG, ⅛ NPT GALV. PIPE
24	15041B	GASKET
25	15042D1	PLATE, BACK — WITH BRASS WEAR RING — I2C UNITS
25	15042D10	PLATE, BACK — WITH NI-RESIST WEAR RING — I2CI UNITS — REPLACES 15042D1 ON 2C95
26	15043A	RING, WEAR — BRASS — I2C UNITS
26	15043A1	RING, WEAR — NI-RESIST — I2CI UNITS — REPLACES 15043A ON 2C95
26A	19101A28	SCREW, 3/8 - 16 UNC x 2" HEX HD — 2 REQ'D — REPLACES 19101A29
27	B2164A	PLUG, ⅛ NPT BRASS PIPE — 7 REQ'D ON I2C UNITS — 11 REQ'D ON I2CI-20/2C95
27	5022A6	PLUG, ⅛ NPT STEEL PIPE — 7 REQ'D ON I2CI-5, I2CI-7, I2CI-10, I2CI-15
28	14946A3	WASHER, ⅜ SPECIAL SEALING — 16 REQ'D
29	5454A7	WASHER, ⅜ LOCK — 2 REQ'D
30	20362A1	CUP, OIL ⅛ NPT

MYERS
LIMITED WARRANTY
INDUSTRIAL PRODUCTS
CENTRIFUGAL AND RECIPROCATING PUMPS

The **F.E.MYERS**, A Pentair Company, warrants that its products are free from defects in material and workmanship for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of manufacture, whichever occurs first.

During the warranty period and subject to the conditions hereinafter set forth, **MYERS**, will repair or replace to the original user or consumer parts which prove defective due to defective materials or workmanship of **MYERS**. Contact your nearest authorized **MYERS** distributor or **MYERS** for warranty service. At all times, **MYERS** shall have and possess the sole right and option to determine whether to repair or replace defective equipment, parts or components.

WARRANTY EXCEPTIONS: Seals, piston cups, packing and liners are covered for a period of ninety (90) days. All engines and motors are warranted only to the extent of the warranty given by the engine and motor manufacturer.

LABOR, ETC. COSTS: **MYERS** shall IN NO EVENT be responsible or liable for the cost of field labor or other charges incurred by any customer in removing and/or reaffixing any **MYERS** product, part of component thereof.

THIS WARRANTY WILL NOT APPLY: (a)to defects or malfunctions resulting from failure to properly install, operate or maintain the unit in accordance with printing instructions provided; (b) to failures resulting from abuse, accident, or negligence; (c) to normal maintenance services and the parts used in connection with such service; (d) to units which are not installed in accordance with applicable codes, ordinances and good trade practices; or (e) if the unit is moved from its original installation location and (f) unit is used for purposes other than for what it was designed and manufactured.

RETURN OR REPLACED COMPONENTS: any item to be replaced under this Warranty must be returned to **MYERS** at Ashland, Ohio, or such other places as **MYERS** may designate, freight prepaid.

PRODUCT IMPROVEMENTS: **MYERS** reserves the right to change or improve its products or any portions thereof without being obligated to provide such a change or improvement for units sold and/or shipped prior to such change or improvement.

WARRANTY EXCLUSIONS: as to any specific **MYERS** Product, after the expiration of the time period of the warranty applicable thereto as set forth above. THERE WILL BE NO WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OF FITNESS FOR ANY PARTICULAR PURPOSE.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. No warrranties or representatives at any time made by any representative of **MYERS** shall vary or expand the provision hereof.

LIABILITY LIMITATION: IN NO EVENT SHALL **MYERS** BE LIABLE OR RESPONSIBLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES RESULTING FROM OR RELATED IN ANY MANNER TO ANY **MYERS** PRODUCT OR PARTS THEREOF.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

In the absence of other suitable proof of this installation date, the effective date of this warranty will be based upon the date of manufacture plus 30 days.

Direct ALL notices, etc. to:

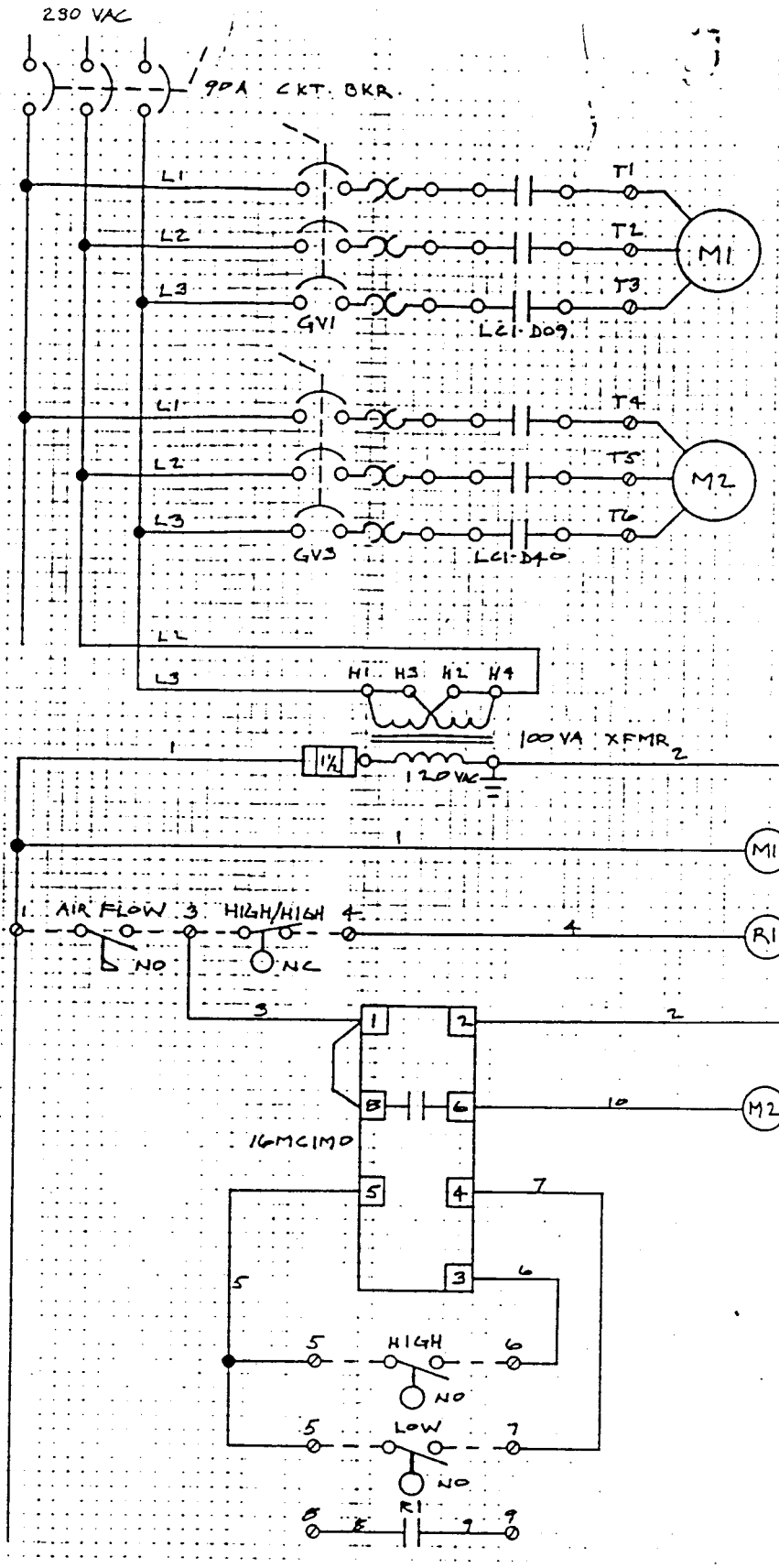
Service Department, **F.E.MYERS**, A Pentair Company, 1101 Myers Parkway, Ashland, Ohio 44805-1923.

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AUTOMATIC CONTROLS CO.
6720 Best Friend Road, Norcross, Ga. 30071-2919 (404)447-5644



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GENERAL CONTROLS

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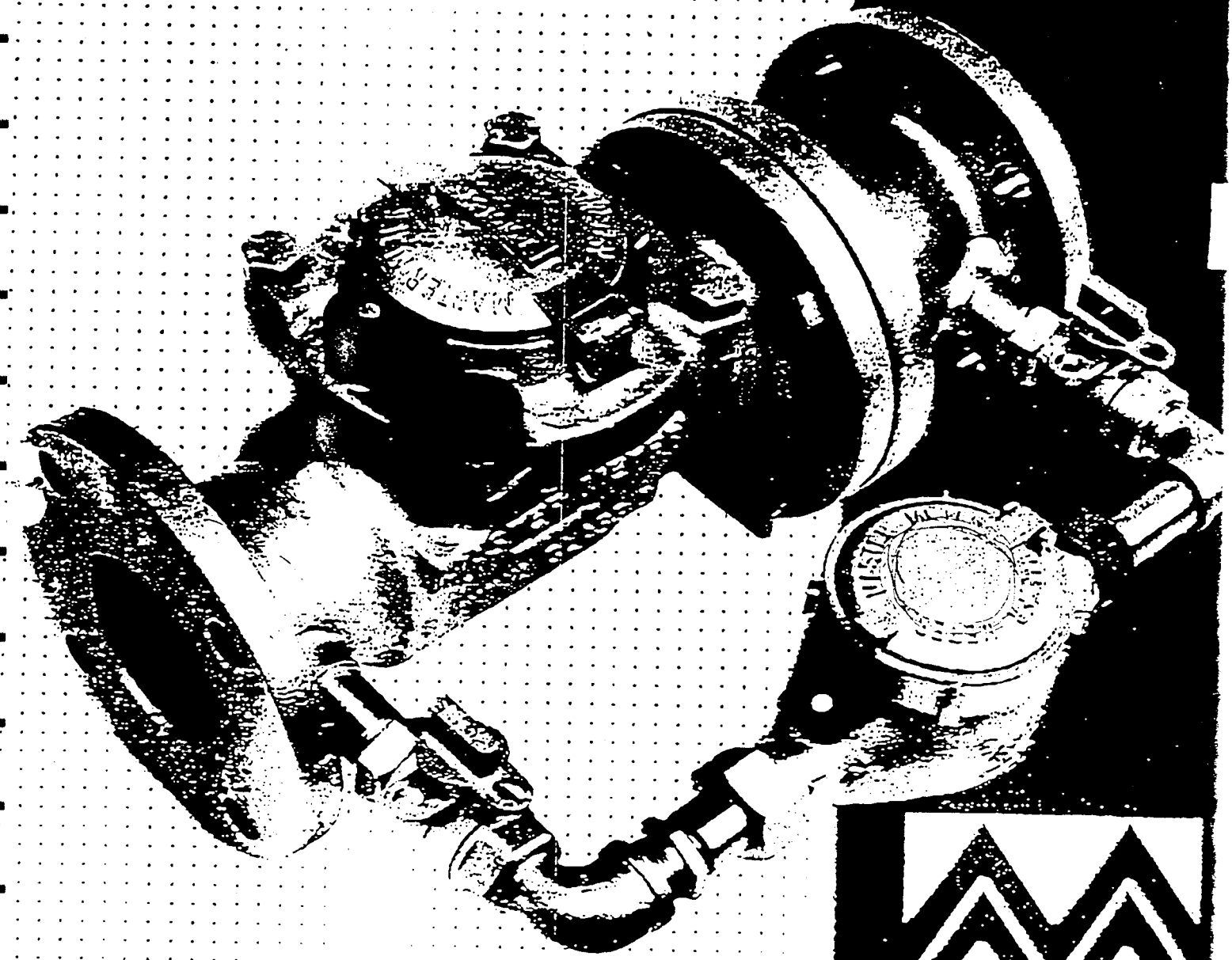
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D B Compound

Dual Body Compound Me



MASTER METER

Reliable Measurement For A Wide Range Of Flows

The Master Meter DB (Dual Body) Compound Meter is designed to provide utilities with highly accurate measurement over a wide flow range. By incorporating a Master Meter multi-jet meter and turbine meter in one assembly, the DB Compound relies on proven velocity measurement to produce high and sustained accuracy over a broad range of flows.

	AWWA C-702	DB Compound
2" Compound Meter		
Minimum Flow	1/4 gpm	1/4 gpm
Continuous Operating Range	2-80 gpm	1-175 gpm
Maximum Flow	160 gpm	285 gpm
3" Compound Meter		
Minimum Flow	1/2 gpm	1/4 gpm
Continuous Operating Range	4-160 gpm	1-330 gpm
Maximum Flow	320 gpm	480 gpm
4" Compound Meter		
Minimum Flow	3/4 gpm	1/2 gpm
Continuous Operating Range	6-250 gpm	2-440 gpm
Maximum Flow	500 gpm	880 gpm

Design and Operation

The Master Meter compound meter combines a Master Meter turbine meter on the main flow line and appropriately-sized multi-jet meter on the low flow or by-pass line. A differential pressure valve controls the flow of water through the appropriate measuring device. Piping sized to the bypass line connects the meters in a single assembly.

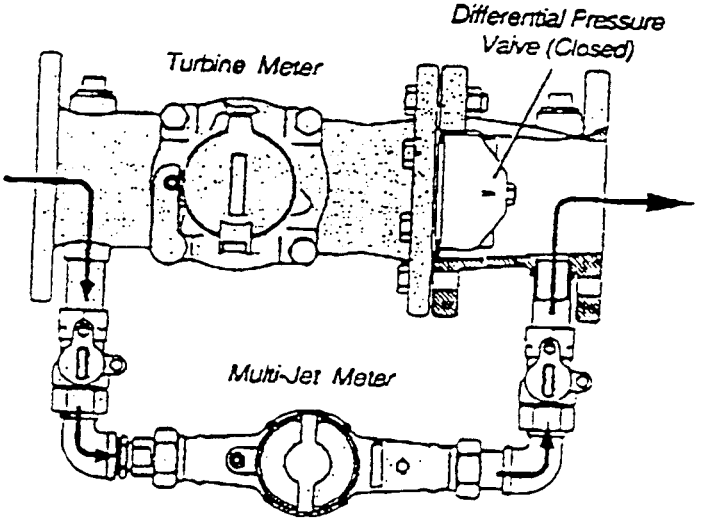
Water flows through a bypass meter, and usage is recorded on its register, until the flow rate reaches approximately one half the capacity of the bypass meter. At that point, the drop in pressure causes the differential pressure valve to open, and water flows through both the mainline and by-pass meters. In its full open position, the valve allows unimpeded flow through both chambers and registration is recorded on both meters. When flow is decreasing the process is reversed, directing low flows through the multi-jet chamber.

Broad Flow Range

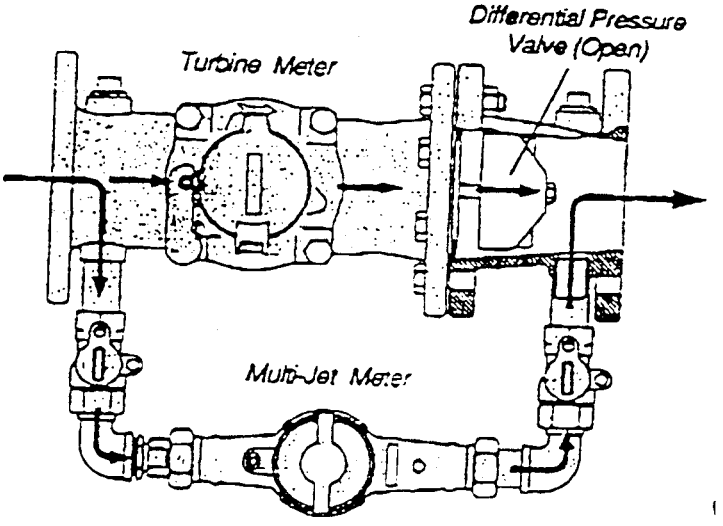
The Master Meter DB Compound Meter provides utilities accurate measurement over a significantly broader flow range than specified in AWWA C-702, as shown in the chart above, and beyond that available with many other compound designs. In addition, Master Meter guarantees the accuracy of its meters in these broader flow ranges.

High Accuracy At Crossover

With the DB Compound Meter, utilities need not fear revenue loss from meters operating in the crossover range. At crossover, when primary measurement of water flow shifts from one chamber to the other, the Master Meter DB Compound accurately measures at least 97 percent of flows, well above the AWWA specified 90%. Master Meter can provide high accuracy because of the DB Compound



DB Compound Meter Operation At Low Flows

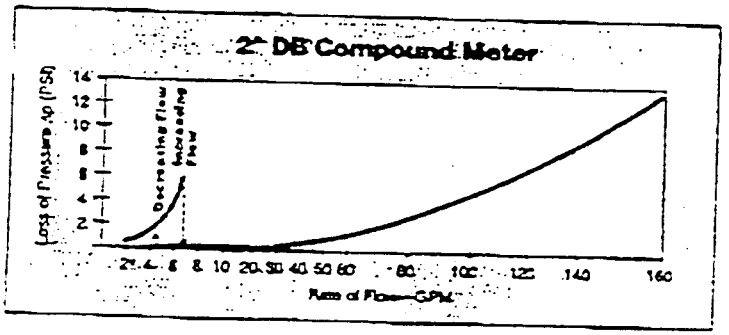


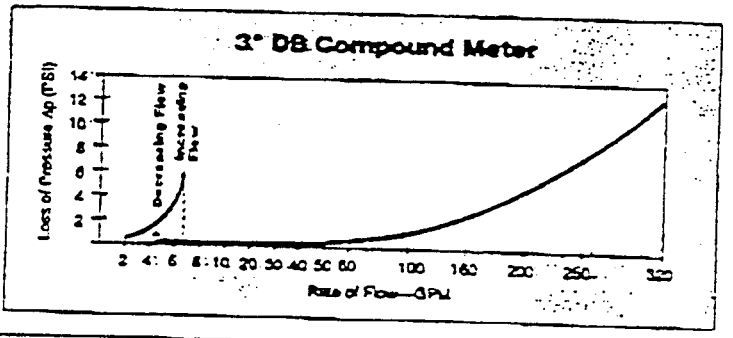
DB Compound Meter Operation At High Flows

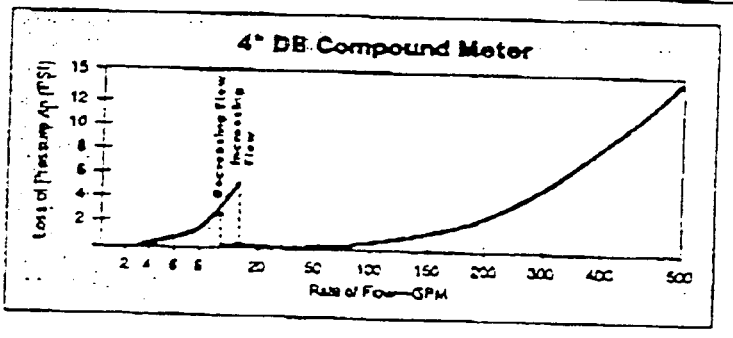
METER OPERATING CHARACTERISTICS AND DIMENSIONS

Characteristic/Dimension	2"	3"	4"
Continuous Operating Range (gpm)	1 - 175	1 - 330	2 - 440
Low Flow (gpm)	1/4	1/4	1/2
Maximum Flow - Intermittent (gpm)	285	480	880
Changeover (gpm): Increasing Flow	8.5	8.5	17.0
Decreasing Flow	4.5	5.3	13.0
Maximum Working Pressure (psi)	150	150	150
Maximum Working Temperature (F)	120°	120°	120°
Low Flow Meter Size	5/8"	5/8"	1"
Accuracy: Low Flow	±3%	±3%	±3%
Changeover	±3%	±3%	±3%
Normal Operating Range	±2%	±2%	±2%
Length	15-1/4"	17"	20"
Height	9-3/4"	8-3/4"	9-1/4"
Height - Bottom to Center Line	2-7/8"	4-1/4"	4-3/4"
Width	11-1/4"	13-1/4"	16-1/4"
Weight (lbs.)	44	66	90

HEAD LOSS CURVES



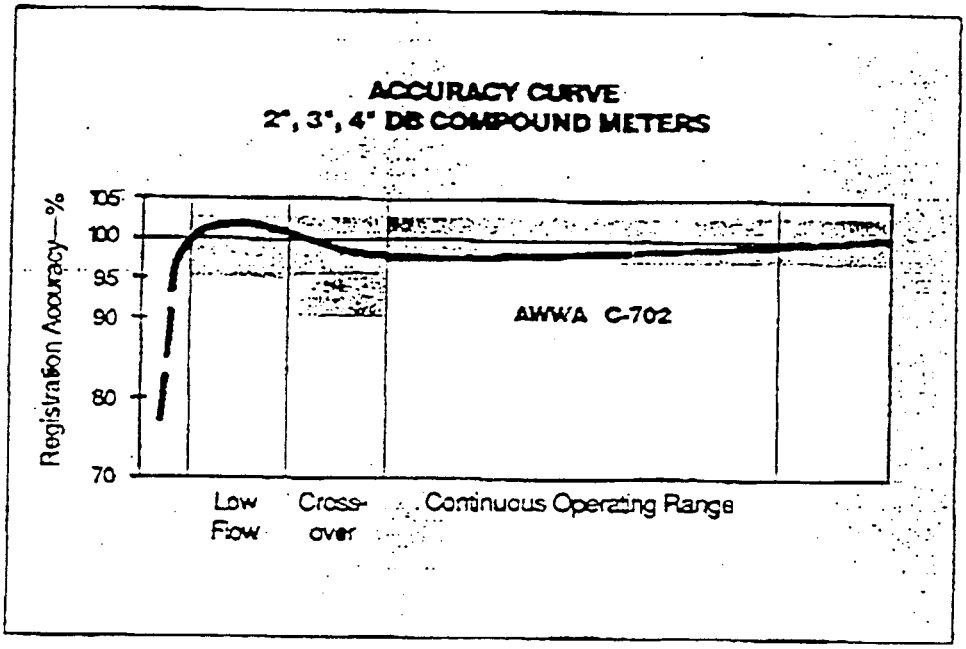




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MASTER METER



design, where flow through the by-pass chamber continues to be measured, even once the turbine chamber is operating.

Installation and Service Flexibility

Master Meter compound meters are designed to maximize installation flexibility. Meters are designed to fit comfortably in any current compound meter installation, with dimensions smaller than currently installed models. For even greater flexibility, the by-pass meter can be installed on either side of the main line meter, to accommodate installations that may be close to walls of buildings or meter vaults.

To simplify service, shut-off valves are installed upstream and downstream of the multi-jet meter on the by-pass line. When necessary, flow can be directed through the turbine chamber while the multi-jet is repaired in-line or replaced with another meter. The Master Meter Turbine Meter can also be serviced without removal from the line. Lock wings are provided on the shut-off valves, should a utility desire to install locks to prevent customer diversion of low flows through the turbine chamber.

Both meters are sealed after factory calibration. For utility recalibration, to compensate for wear without parts replacement, external adjusting ports are available on both the main line and by-pass meters. External adjusting ports are sealed to prevent tampering and provide visual indication of tampering attempts.

Long-Life Design

To insure many years of dependable performance Master Meter's compound meter relies on proven materials and proven measurement designs.

The main cases housing both turbine and multi-jet measurement chambers are 81 percent copper composition; bronze register retaining rings and lids are standard. All piping and connections are bronze meeting AWWA Standard C-800. The bronze housing of the differential pressure valve surrounds an engineered plastic clapper with stainless steel shaft and rubber valve seat. The multi-jet and turbine chamber housings and impellers are constructed of rugged engineered plastics.

A reliable magnetic drive provides direct linkage between measurement elements and registers. No intermediate gearing is required; no gearing is exposed to water.

A flow straightener is housed upstream of the turbine chamber to condition flows for accurate measurement. And as is standard on all Master Meter Multi-jet Meters, the by-pass meter of the DB Compound Meter incorporates a full 360° strainer. Debris passing through the strainer will flow through the measuring chamber without damage to the impeller, allowing both survival and accurate measurement in installations in which other designs would stop. A non-return valve is installed in the outlet of the multi-jet meter to prevent a backward flow of water through the low-flow meter. As with all meters 2" and above, a separate strainer is recommended to protect the critical measurement element from line-debris damage.

Reading Flexibility

Standard direct read, DIALOG™ Automated Meter Reading System and Electrical Contact registers are available for the DB Compound Meter. DIALOG registers are compatible with either on-site automated reading with a portable hand-held computer or telephone Automatic Meter Reading (AMR). Direct read and DIALOG registers are permanently sealed with a tempered glass lens, stainless steel base and wrap-around gasket to prevent intrusion of dirt or moisture.

For efficient on-site automated reading, DIALOG's capabilities enable the reading of both turbine and multi-jet registers from *one* ScanDisc™ mounted remote from the meter or in the top of a meter box lid.

Extended Warranties

Master Meter guarantees the DB Compound Meter for two full years. In addition, performance of the Master Meter Multi-jet Meter installed on the by-pass line is guaranteed for fifteen years – to operate to AWWA C-708 new meter accuracy for two full years and to repaired meter accuracy thru the fifteenth year (or specified registration limits.)

Master Meter DB Compound Meter: Accurate, Dependable, Flexible. Why Settle For Less.

DIALOG is a trademark of Master Meter Inc. ScanDisc is a trademark of Metrigram, Inc.

******* A N A L Y S I S OF S T R I P P I N G T O W E R *******

PROJECT : Village of Harriman

DATE : 3/12/1992

ENGINEER : Terra Vac

PAGE : 1/2

PHYSICAL CONSTANTS

Design temperature	:	50.0 degrees F.
Density of water	:	62.4 lb/ft^3
Density of air	:	0.0778 lb/ft^3
Viscosity of water	:	8.80E-04 lb/ft.s
Viscosity of air	:	1.16E-05 lb/ft.s
Surface tension of water	:	74 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

Name	:	Trichloroethylene
Molecular weight	:	131.3 g/mol
Boiling point	:	189 degrees F.
Molal volume at boiling point	:	0.1071 L/mol
Henry's Constant	:	0.38000
Temperature constant	:	1909 deg K
Molecular diffusivity in air	:	8.52E-05 ft^2/s
Molecular diffusivity in water	:	6.65E-09 ft^2/s

PACKING PROPERTIES

Name	:	Jaeger Tripacks
Packing Material	:	Plastic
Nominal Size	:	3.50 inch
Specific Area	:	38.1 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	29.0 ft
Air friction factor	:	14

******* A N A L Y S I S OF S T R I P P I N G T O W E R *******

PROJECT : Village of Harriman DATE : 3/12/1992

ENGINEER : Terra Vac PAGE : 2/2

LOADING RATES

Water mass loading rate	:	1.6 lb/ft^2.s	*
Air mass loading rate	:	0.098 lb/ft^2.s	*
Water volumetric loading rate	:	11.30 gpm/ft^2	*
Air volumetric loading rate	:	565 gpm/ft^2	*
Air pressure gradient	:	<.06 " H2O/ft	#
Volumetric air/water ratio	:	50.0	
Stripping factor	:	11.6	

MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	45.3 %	
Wetted packing area	:	17.3 ft^2/ft^3	*
Transfer rate constant in water	:	0.000491 ft/s	
Transfer rate constant in air	:	0.007275 ft/s	
Overall transfer rate constant	:	0.000380 ft/s	
Overall mass transfer coefficient	:	0.0066 1/s	
NTU	:	7.5694	
HTU	:	3.8312 ft	

CONTAMINANT REMOVAL

Influent concentration	:	30.0 ug/L	
Effluent concentration	:	0.0 ug/L	
Fraction removed	:	99.9 %	
Mass of contaminant removed	:	0.00407 lb/ft^2.day	*
Concentration in airstream	:	0.00158 mg/ft^2.ft^3	

* Expressed per unit of stripping tower cross-sectional area

\# Expressed per unit of tower length

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PHYSICAL CONSTANTS

Design temperature	:	50.0 degrees F.
Density of water	:	62.4 lb/ft^3
Density of air	:	0.0778 lb/ft^3
Viscosity of water	:	8.80E-04 lb/ft.s
Viscosity of air	:	1.16E-05 lb/ft.s
Surface tension of water	:	74 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

Name	:	1,1,1-Trichloroethane
Molecular weight	:	133.4 g/mol
Boiling point	:	165 degrees F.
Molal volume at boiling point	:	0.1145 L/mol
Henry's Constant	:	0.56000
Temperature constant	:	1636 deg K
Molecular diffusivity in air	:	8.35E-05 ft^2/s
Molecular diffusivity in water	:	6.39E-09 ft^2/s

PACKING PROPERTIES

Name	:	Jaeger Tripacks
Packing Material	:	Plastic
Nominal Size	:	3.50 inch
Specific Area	:	38.1 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	29.0 ft
Air friction factor	:	14

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***** Thomas Jay Schmitt, P.G. *****

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LOADING RATES

Water mass loading rate	:	1.6	lb/ft^2.s *
Air mass loading rate	:	0.098	lb/ft^2.s *
Water volumetric loading rate	:	11.30	gpm/ft^2 *
Air volumetric loading rate	:	565	gpm/ft^2 *
Air pressure gradient	:	<.06	" H20/ft #
Volumetric air/water ratio	:	50.0	
Stripping factor	:	18.4	

MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	45.3	%
Wetted packing area	:	17.3	ft^2/ft^3 *
Transfer rate constant in water	:	0.000482	ft/s
Transfer rate constant in air	:	0.007174	ft/s
Overall transfer rate constant	:	0.000407	ft/s
Overall mass transfer coefficient	:	0.0070	1/s
NTU	:	8.1058	
HTU	:	3.5777	ft

CONTAMINANT REMOVAL

Influent concentration	:	10.0	ug/L
Effluent concentration	:	0.0	ug/L
Fraction removed	:	100.0	%
Mass of contaminant removed	:	0.00136	lb/ft^2.day *
Concentration in airstream	:	0.00053	mg/ft^2.ft^3

* Expressed per unit of stripping tower cross-sectional area
\# Expressed per unit of tower length