BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

April 5, 2005

Mr. Todd M. Caffoe, P.E.
Project Manager
New York State Department of
Environmental Conservation
Div. of Environmental Remediation
6274 East Avon-Lima Road
Avon, New York 14414-9519

Re: Brainerd Manufacturing Site Voluntary Cleanup (#V00519-8)
IRM Groundwater Collection and Pretreatment System OM&M Plan
Response to NYSDEC March 22, 2005 Comments

Dear Mr. Caffoe:

Benchmark Environmental Engineering & Science, PLLC has reviewed NYSDEC's March 22, 2005 correspondence concerning the IRM Operation, Maintenance and Monitoring (OM&M) Plan for the above-referenced site. Our responses to each of the issues raised are presented below.

Comment 1: *For the first year, we would like to see quarterly monitoring reports of data generated by the IRM treatment system. Reporting frequency can be decreased upon evaluation of these data.*

Response: Sections 4.3 and 5.2 have been modified to reflect quarterly IRM reporting for the first year of monitoring, with a provision for Department review/consideration of a reduced reporting frequency following provision of the first four quarterly reports. Groundwater treatment system influent sampling will be performed on a semi-annual basis.

Comment 2: *Please provide a table to indicate maintenance and monitoring tasks and their frequencies.*

Response: A new Table 2 has been added to the OM&M Plan to summarize operation, maintenance and monitoring tasks and frequencies, as requested.

Comment 3: *MSDS sheets for each of the groundwater contaminants and Redux 300 should be available on-site.*

Response: The Redux 300 MSDS is presently maintained in the treatment room. Copies of MSDS information for chemicals historically detected in PW-1 groundwater

(i.e., trichloroethylene, tetrachloroethene and 1,1,1-trichloroethane) will be maintained in the treatment room as well.

Comment 4: *Figure 3- The process flow schematic does not show the sump, sump pump and piping discharge to the day tank as detailed in the plan.*

Response: Acknowledged. Figure 3 has been revised to show the sump, sump pump and piping return to the day tank.

We trust that these responses adequately address NYSDEC's and NYSDOH's concerns. Five (5) copies of the revised OM&M plan are enclosed for your distribution.

Benchmark is currently preparing the Site Investigation/Remedial Alternatives Report (SI/RAR) Work Plan and Quality Assurance Project Plan (QAPP), including a site-specific Health and Safety Plan (HASP). We anticipate that copies of these draft documents will be transmitted to the Department for review by the end of April 2005.

Please contact us if you have any questions.

Sincerely,
Benchmark Environmental Engineering & Science, PLLC

Thomas H. Forbes, P.E.
Project Manager

C:

A. Shaffer (Despatch)
F. Pavia (Boylan Brown)
B. Putzig (NYSDEC)
A. English (NYSDEC)
M. Desmond (NYSDEC)
J. Crua (NYSDOH)

IRM GROUNDWATER COLLECTION AND PRETREATMENT SYSTEM

OPERATION, MAINTENANCE AND MONITORING WORK PLAN

FORMER BRAINERD MANUFACTURING FACILITY
EAST ROCHESTER, NEW YORK

November 2004
Revised April 2005

0079-001-200

Prepared for:

Despatch Industries, Inc.
Pittsford, New York

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

726 Exchange Street, Suite 624 | Buffalo, NY 14210

OPERATION AND MAINTENANCE PLAN
FORMER BRAINERD MANUFACTURING FACILITY

Table of Contents

OPERATION AND MAINTENANCE PLAN
FORMER BRAINERD MANUFACTURING FACILITY

Table of Contents

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background and History

The former Brainerd Manufacturing Facility is situated at the intersection of North Washington and Monroe Streets in the City of East Rochester, New York (Figures 1 and 2). The property is composed of two parcels: an approximately 3.0-acre parcel located at 115 North Washington Street (Tax Map 139.69-1-17), improved with a 73,400 square foot industrial/manufacturing building with offices situated on the eastern side and an open gravel lot on the western side; and an approximately 0.4-acre parcel (Tax Map 139.69-1-19) that consists of an asphalt parking area. A Rochester Gas and Electric (RG&E) substation and a pre-cast concrete product manufacturing building owned by E.J. Delmonte border the property to the north. Monroe Street, Rochester Lumber Company, and A.J. Interiors are located south of the property, adjacent to the asphalt parking lot.

The property was operated as an industrial facility for nearly 100 years prior to relocation of Brainerd's operations in 1998 (Sear-Brown, February 2000). Historic operations conducted at the facility included the manufacture of hardware and decorative metal products. Production of these products involved stamping, cutting, drilling, burnishing, deburring, degreasing, lacquering, and electroplating. The property is currently being leased by a furniture reconditioning firm, which is occupying a portion of the warehouse facility.

The results of previous Phase I and Phase II investigations of soil and groundwater at the Site identified volatile organic compounds (VOCs), specifically trichloroethene (TCE) and tetrachloroethene (PCE), in groundwater above New York State Department of Environmental Conservation (NYSDEC) Class "GA" Groundwater Quality Standards at certain locations beneath the buildings (Ref. 1). The site investigation data supported the need for an interim remedial measure (IRM) to address groundwater impacts at the Site and to mitigate off-site migration of VOCs from the former Brainerd Manufacturing Facility. Accordingly, an IRM Work Plan (Ref. 2) was prepared by Benchmark in November 2002 to identify data collection procedures and testing necessary to define aquifer characteristics (e.g., hydraulic conductivity, transmissivity, storativity, pumping rates, etc.) at the Site.

An IRM Investigation Report was subsequently prepared by Benchmark (Ref. 3) to document the procedures and findings of the IRM Investigation and related activities at the former Brainerd Manufacturing Facility. The report describes the IRM investigation

activities; presents an interpretation of the collected aquifer pump test data; and identifies the recommended groundwater pump and treat IRM.

The IRM is comprised of a 4-inch pumping well and low profile air stripper to treat the collected groundwater, rendering it suitable for discharge to the Monroe County Pure Waters sewerage system for final treatment. Details of the IRM design are presented in the April 2004 IRM Design Report (Ref. 4). The IRM was constructed during July and August 2004.

1.2 Purpose and Scope

The purpose of this IRM Operation, Maintenance and Monitoring Work Plan (hereafter O&M Plan) is to provide information necessary to effectively operate, maintain and monitor the interim remedial measures at the former Brainerd Manufacturing Site. Specifically, this Plan identifies operation and maintenance requirements for the groundwater collection and pretreatment system and the environmental monitoring program that will be followed to assure the continued effectiveness of these systems. The Plan will be revised in the future, as necessary, to accommodate changes resulting from any revisions/modifications to the remedial measures implemented following completion of voluntary cleanup investigation work at the Site.

2.0 SITE CONTACTS AND RESPONSIBILITIES

Environmental maintenance, monitoring, and corrective measures concerns related to current NY State Voluntary Cleanup activities at the Site are the responsibility of Despatch Industries, Inc. The official contact person for matters pertaining to these issues is:

Mr. Alan Shaffer
Despatch Industries, Inc
21 Wolf Trapp
Pittsford, New York 14534
(585) 339-1283

Operation, maintenance and monitoring of the former Brainerd Manufacturing Facility will be performed by experienced personnel properly trained in accordance with 29CFR 1910.120 (HAZWOPPER). Operations will include activities and adjustments necessary to assure continued and reliable system function. Routine maintenance may include cleaning, reagent filling and miscellaneous minor repairs or preventative maintenance for existing equipment. Monitoring will include sample collection and recording of key process variables.

Despatch Industries has retained Benchmark Environmental Engineering & Science, PLLC as its contract provider of operation and maintenance services for the IRM. Benchmark's contact person is:

Mr. Thomas Forbes, P.E.
Benchmark Environmental Engineering & Science, PLLC
726 Exchange Street, Suite 624
Buffalo, New York 14210
(716) 856-0599

In addition, Despatch Industries' legal counsel for environmental matters is:

Mr. Frank Pavia
Boylan, Brown, Code, Fowler & Wilson, LLP
2400 Chase Square
Rochester, NY 14604

The NYSDEC will provide guidance concerning NY State regulatory issues and requirements, and the function of the IRM within the context of voluntary cleanup work at the Site. NYSDEC's project contact person is:

Mr. Todd Caffoe, P.E.
Project Manager
NYSDEC –Region 8
Div. of Solid/Hazardous Waste
6274 East Avon-Lima Road
Avon, New York 14414-9519
(585) 226-5350

Monroe County Department of Environmental Services, Division of Pure Waters governs discharge of pretreated effluent water to the sanitary sewer. The primary contact for the former Brainerd Manufacturing facility is:

Mr. Sean Keenan
Monroe County Department of Environmental Services
Division of Pure Waters
444 East Henrietta Road
Rochester, New York 14620
(585)760-7600, ext. 7143

3.0 IRM DESCRIPTION/PRINCIPLE OF OPERATION

The IRM groundwater collection and treatment system involves recovery of contaminated groundwater from a pumping well with concurrent on-site treatment of the recovered groundwater via low profile air stripping. Contaminants present in Site groundwater are predominantly: trichloroethene (also known as trichloroethylene, or TCE); tetrachloroethene (also known as tetrachloroethylene, perchloroethylene, or PCE); and to a lesser extent 1,1,1-tichloroethane (1,1,1-TCA). Concentrations of these constituents are typically present in untreated groundwater at low part per million levels.

Figure 3 presents a process flow schematic for the IRM pump and treat system. A description of the process components and their operating principles are presented below:

3.1 Pumping Well and Well Pump

The 4-inch diameter, 60-foot deep pumping well, designated PW-1, was installed near the northeast corner of the former Brainerd Manufacturing building in January 2003 (see Figure 3 for location). The pumping well was installed to allow for aquifer characteristic testing and serve as a full-scale recovery well. PW-1 was advanced into the Clayey Sand with Gravel (SC) unit using 6.25-inch hollow stem augers, located at the bottom of the borehole, and installed with a fully penetrating 37 foot sand filter pack extending the entire length of the saturated zone (23 to 60 feet below ground surface). The well was constructed with a 20-foot CircumSlot™ 0.020-inch continuous slot Schedule 40 PVC screen. A 2-foot sump was installed to determine the presence and thickness of free-phase dense non-aqueous phase liquid (none was present) and to facilitate pumping. The Schedule 40 PVC riser extends approximately 6 inches below ground surface and is completed with an 8-inch diameter steel flush mounted road box.

Untreated groundwater is pumped from PW-1 using a submersible well pump (Goulds Model 10GSO5R, single-phase, 115 VAC). Manufacturer's data for the pump is presented in Appendix A. Pumping well operation is controlled locally by level control sensors to maintain drawdown below static levels. The recovery well pump cycles between pump on (high level) at approximately 35 feet below grade and pump off (low level) at approximately 55 feet below grade to maintain an average groundwater elevation several feet below static levels based on pump testing performed during the design phase of work at the Site. Manufacturer's literature for the well sensors is presented in the air stripper O&M Manual in Appendix B. The groundwater recovered from pumping well PW-1 is pumped to

the treatment building via a 1-inch diameter, reinforced high-density polyethylene (HDPE) transfer pipe, expanded to a 1½-inch schedule 80 PVC pipe at floor level. The recovered groundwater is stored in a 1,000-gallon HDPE day tank. The well pump is tied to the treatment system process control panel. A hand/off/auto (HOA) switch on the treatment system panel allows the pump to be de-energized remotely (off mode), operated manually (i.e., in hand mode), or operated automatically (in auto mode). For safety reasons, a local disconnect is also provided near the pumping well. In auto mode, the air stripper control panel allows the well pump to start and stop automatically based on pumping well level sensors and other operational conditions within the treatment system, as discussed below.

3.2 Day Tank

The day tank is a 1,000-gallon high-density polyethylene (HDPE) upright storage tank with a 16-inch diameter top opening with cover. Fittings are PVC with stainless steel bolts and EPDM gaskets. Tank dimensions are 64 inches in diameter by 84 inches high. Untreated groundwater is temporarily stored in the day tank to provide sufficient volume for batch treatment system operation. The day tank is fitted with the following float-type level control switches:

- A high level alarm switch, located approximately 6 inches from the top of the tank.
- A feed pump/air stripper start switch, located approximately 1 foot from the top of the tank.
- A feed pump/air stripper stop switch, located approximately 6 inches from the bottom of the tank.

The level in the day tank controls startup and shutdown of the air stripper system. When the tank fills to the point that the start switch is tripped, the air stripper blower and process feed pump are energized. Groundwater in the tank is then processed through the air stripper unit until the tank level drops to the stop switch, at which point the feed pump automatically shuts down. The air stripper blower continues to operate for approximately 5 minutes to assure complete treatment of remaining groundwater within the air stripper. In addition, safety interlocks within the air stripper control panel will shut down the feed pump and air stripper in the event of a process alarm condition affecting air stripper performance.

3.3 Process Feed Pump

The process transfer pump is an American Stainless Model C143255ET1 centrifugal transfer pump with a 1.5 hp, 230 VAC single phase TEFC motor. As described above, the transfer pump automatically starts and stops via float switches in the day tank, with automatic operation defeated by an alarm condition on the air stripper. The transfer pump is typically left in auto mode to allow automatic start/stop. Appendix B (contains transfer pump specifications.

3.4 Air Stripper

The air stripper is a North East Environmental Products (NEEP) two-tray Model 2321P polyethylene shallow tray aeration system. The air stripping unit is equipped with a 2 hp, 300 cfm, single phase, 230V, TEFC blower. Appendix B contains the air stripper O&M Manual.

Groundwater exits the day tank and enters the top of the stripper, where it is distributed through a series of baffles across the top tray. The groundwater then passes to the second tray in series, where the process is repeated, and flows into a reservoir at the bottom of the air stripper unit. The treated groundwater flows is pumped from this reservoir through a 1½-inch PVC line and discharged to the existing 4-inch sanitary sewer north of the treatment room. Once groundwater in the day tank has been pumped down to the level of the stop switch, the air stripper is de-energized and the system returns to remote standby mode. Shutdown of the air stripper blower is delayed for approximately 5 minutes to ensure that the remaining water within the unit is treated prior to discharge.

When the air stripper blower is active, it draws in ambient building air to create a negative pressure within the treatment room enclosure, thereby mitigating vapor release to the building atmosphere outside of the treatment room. In addition, a ventilation fan (150 cfm at 0.2 inches water gauge) and damper operate in line with the air stripper exhaust. The fan is activated by a relay from the air stripper control panel such that when the air stripper blower is not operating, the fan is activated to assure continuous ventilation of the enclosure. When the air stripper blower is in operation, the fan is deactivated and the damper is shut to prevent short-circuiting of blower emissions back into the building.

During operation, certain process alarms and interlocks are monitored by the air stripper control panel. Process faults that could cause damage, put personnel at risk, or compromise the quality of treatment will shut the system down. A listing of potential air

stripper alarm conditions and actions are presented on Table 1. All process alarm conditions result in immediate notification via the autodialer function on the system monitor, and activate a local panel alarm light.

It should be noted that the air stripper control panel provides controls for expansion of the system with up to two additional future well pumps (PW-2 and PW-3), if necessary.

3.5 Deposit Control Agent Feed System

A deposit control agent (Redux 300) is mixed with the untreated groundwater to mitigate scale build-up in the stripper due to oxidation of naturally occurring calcium and manganese in the groundwater. The deposit control agent is injected via a chemical feed pump directly into the influent line to the day tank only when the well pump is active. The chemical feed pump is an LMI Model A15 metering pump rated at 0.16 gph. The pump operates on a 110 VAC corded electrical supply, which is plugged into an outlet that is energized only when the well pump is active. Appendix C contains the Product Data Sheet for Redux 300.

3.6 Process Discharge Pump

The process transfer pump is an American Stainless Model C143255ET1 centrifugal transfer pump with a 1.5 hp, 230 VAC single phase TEFC motor. The treated groundwater is pumped from the air stripper reservoir through a 1½-inch PVC line and discharged to the existing sanitary sewer. Float switches in the air stripper sump control startup and shutdown of the discharge pump.

3.7 Flow Meter

The influent line to the air stripper unit is fitted with a flow meter that provides process flow monitoring. The meter is comprised of a GF Signet Model 515/2536 Rotor-X paddle-wheel insertion-type flow sensor and GF Signet Model 8550-1 panel-mounted flow indicator/transmitter. The meter monitors total and instantaneous flow. Power to the meter is from a regulated, low voltage DC source (24 volt) within the air stripper control panel.

3.8 Treatment Room Sump and Pump

The treatment room is fitted with a floor sump and sloped concrete floors to provide secondary containment in the event of a spill or leak. The building sump is a 24-inch diameter by 36-inch deep recessed FRP catch basin with a steel cover. The sump pump is a standard, residential-grade 1½-inch submersible pump and discharges to the day tank via a 1½-inch PVC line.

4.0 OPERATION, MAINTENANCE AND MONITORING

Recommended operation, maintenance and monitoring tasks and their frequencies are summarized on Table 2 and described below.

4.1 Normal Operations and Adjustments

The air stripper system operates in either batch or continuous mode, and is capable of treating flows of up to 30 gpm, which is greater than the projected maximum steady state flow rate (6 gpm) of PW-1.

The system is balanced such that groundwater is transferred from the day tank to the air stripper at a flow rate greater than the average rate of groundwater recovery from the pumping well. Flow rates from PW-are less than the design operating flow rate of the groundwater treatment system; therefore, throttling of the pump flows is not necessary. Based on typical operating conditions, the flow rate from the day tank to the air stripper system should be adjusted to approximately 10 gpm. This will generally assure that the treatment system stays ahead of the groundwater collection system, and that the air stripper system is able to effectively treat organic constituents present in the groundwater. The groundwater treatment rate is controlled by adjusting the ball valve located downstream of the transfer pump. The flow rate is measured on the air stripper unit flow meter.

In addition to groundwater flows, key process operating variables include deposit control agent dosage rate and air stripper blower adjustment.

4.1.1 Deposit Control Agent Refill/Dosage Adjustment

The deposit control agent feed pump is tied to the well pump power supply and operates only when the well pump is active. The metering pump is mounted externally on top of a dedicated 60-gallon feed tank of Redux 300, with the suction line and foot valve located within the tank. Redux 300 is purchased in 55-gallon drums and transferred to the 60 gallon feed tank via a portable centrifugal pump. Spent drums of Redux 300 are rinsed with potable water and recycled. Proper safety precautions must be followed for handling the mildly corrosive Redux 300, including, but not limited, to eye protection, gloves, and long sleeve shirts.

Redux 300 is metered to the influent line proportional to the flow, thereby assuring an appropriate chemical dosage. Table 3 presents the target dosage and metering pump settings as a function of estimated well pump flow rate. Dosage is modified by adjusting the

stroke rate and/or stroke length dials on the metering pump. The deposit control agent dosage rate should be adjusted whenever there is a significant change in the well flow rate.

4.1.2 Air Stripper Blower Adjustment

The influent storage tank is fitted with level controls tied to the air stripper feed pump and blower starters. At high level, the blower starts and the feed pump is activated. Upon reaching low level in the day tank, the air stripper feed pump shuts down. The blower remains on to complete treatment of the remaining groundwater in the air stripper.

It may be necessary to periodically adjust the blower damper on the air stripper to maintain sufficient airflow for treatment. Adjustment may be necessary as scale build-up begins to restrict the opening size of the perforations. Appendix D presents the conversion from differential pressure in the air stripper to air flow in the air stripper stack. A minimum differential pressure of 0.15 inches of water measured by the pitot tube is required to maintain the target air flow rate of 300 cfm.

4.2 Equipment Monitoring and Maintenance

Routine monitoring of the remediation system equipment involves measuring and recording key operating variables on a regular basis throughout the life of the system. A summary of key operating variables is presented on the process monitoring log in Appendix E. It is recommended that these variables be recorded on a monthly basis, as they will be used both to assist in tracking system performance as well as maintenance requirements. Specific routine maintenance activities that are indicated based on the monitoring variables include:

- Deposit control agent refill, based on volume remaining in drum and typical consumption rates, and dosage adjustment (if necessary due to changed influent conditions or process flow rate).

- Air stripper tray cleaning, based on degree of scale present on the trays (approximately every 6 to 12 months). Scale buildup is monitored by observed changes (drop) in pressure on the air stripper blower exhaust. In addition, snap lock fasteners on the side of the stripper trays facilitate removal to check for scale buildup.

4.2.1 Air Stripper Tray Cleaning

Prior to cleaning the air stripper, the unit must be shut down and flow through the unit temporarily stopped. Begin by removing the flexible coupling holding the top tray to the stripper stack and disconnecting the union fitting on the air stripper groundwater feed line. Next, disconnect the trays by unfastening the side-mounted snap-locks on the stripper trays. The air stripper trays are then manually lifted from the unit. At the former Brainerd Manufacturing site, scale is comprised primarily of oxidized calcium (calcite), which is most easily removed after it is allowed to dry. Scale removal is best accomplished by using a vibrating scraper (typically used for paint or finish removal). Excess scale remaining in the tray orifices can be removed using a drill with a bit sized with the same or lesser diameter than the holes; however, care must be taken not to ream the holes larger than their original diameter. Replace the cleaned trays and reconnect the exhaust and feed lines prior to restarting the system.

4.2.2 Other Maintenance

Other maintenance activities that may be required on an infrequent basis (i.e., every 5-10 years) throughout the duration of the treatment system life include transfer pump stator/seal repair; and well pump, metering pump, and/or sump pump replacement.

4.2.3 Remote Monitoring

Remote system monitoring is performed through a dial-in (modem) function on a Sensaphone® 2000 combination remote system monitor/autodialer unit. The monitor/autodialer unit has 8 universal inputs and 8 relay outputs to allow for real-time monitoring of multiple process conditions. A battery backup provides continued monitoring/notification in the event of a power failure.

Conditions that are remotely monitored are listed below. All are normally closed contacts.

- High level alarm in the process day tank.
- Low level alarm in the deposit control agent tank.
- Low air pressure in the air stripper.

- High water level in the air stripper sump.
- High water level alarm in building sump.
- Power failure (automatic alarm integrated in the autodialer/monitor).

Table 1 describes the air stripper process alarm conditions. Non-alarm conditions (e.g., process flow rate) are periodically monitored by Benchmark's environmental scientists throughout operation of the groundwater pretreatment system. All process and building alarm conditions will result in immediate notification via the autodialer function on the system monitor. Upon detection of any alarm or status change, the system will commence dialing telephone numbers programmed into the autodialer. The system will continue to call telephone numbers in succession until all destinations have been notified or acknowledgement of the alarm message is received.

4.3 Environmental Monitoring

Environmental monitoring will be performed at the former Brainerd Manufacturing Facility to monitor the effectiveness of the interim remedial measures. Specifically, environmental monitoring will include the following tasks:

- Collection of pretreated effluent samples as required by Despatch Industries' Industrial Discharge Permit (Appendix F). Presently, pretreated effluent samples are collected on a monthly basis as stipulated by Monroe County Pure Waters. Samples will be analyzed for priority pollutant volatile organic compounds in accordance with EPA Method 624.
- Preparation of a monthly compliance report for Monroe County Pure Waters. The report will summarize the sampling event, compare effluent analytical results to industrial discharge limits, and document total monthly flows and average daily flows to the sanitary sewer. NYSDEC will be copied on these reports.
- Collection of untreated water samples on a semi-annual basis to provide an indication of collection system efficiency. Samples will be analyzed for priority pollutant volatile organic compounds in accordance with EPA Method 624. Untreated water data will also allow calculation of estimated air emissions from the system to check for conformance with Air-Guide 1 limits. Untreated sample data and Air-Guide 1 compliance confirmation will be transmitted to NYSDEC for review following the sampling event

- Collection of groundwater elevation data from collection system observation wells on a quarterly basis to confirm area of influence from the collection system.

5.0 DOCUMENTATION AND NOTIFICATION REQUIREMENTS

5.1 Treatment System Reporting

Treatment system compliance monitoring will be presented in a report submitted to Monroe County Pure Waters on a monthly basis approximately 30 days after completion of sampling activities. The report will summarize the sampling event, compare effluent analytical results to industrial discharge limits, and document total monthly flows and average daily flows to the sanitary sewer. NYSDEC will be copied on these reports.

Air emissions from the system will be estimated annually to check for conformance with Air Guide 1 limits. The untreated water sample data and Air-Guide 1 compliance confirmation will be transmitted to NYSDEC for review following the sampling event.

5.2 Groundwater Monitoring Event Reporting

As part of this O&M Plan, groundwater elevation data from the collection system observation wells will be recorded on a quarterly basis to confirm area of influence from the collection system. A Monitoring and Maintenance Summary Report will be prepared and submitted to the Site contacts listed in Section 2.0 following the completion of the quarterly monitoring event and will include the following:

- A discussion of Site maintenance activities (if applicable).
- A tabulated summary of groundwater elevation measurements from the collection system observation wells and a groundwater isopotential contour map prepared from those elevations.
- A tabulated summary of untreated water sample analytical results (if collected during the period) to provide an indication of collection system efficiency.
- A discussion of changes in groundwater quality that has occurred since the last monitoring event.
- Any proposed changes to the Environmental Monitoring described in Section 4.3.

Following provision of the first four quarterly monitoring reports, NYSDEC will consider a reduced reporting frequency.

5.3 Notifications

NYSDEC and Monroe County Pure Waters will be notified in advance of any changes to the IRM collection or treatment system process that could materially affect the quality or character of system emissions or discharges. NYSDEC will be notified within 24 hours of any interruption or termination of IRM operations.

6.0 REFERENCES

1. Sear-Brown Group, February 2000, *Phase I Environmental Site Assessment and Limited Phase II Environmental Investigation - Former Brainerd Manufacturing Facility.*

2. Benchmark Environmental Engineering and Science, PLLC, March 2002 (revised November 2002), *Voluntary Cleanup IRM Investigation Work Plan – Former Brainerd Manufacturing Facility.*

3. Benchmark Environmental Engineering and Science, PLLC, March 2003, *Voluntary Cleanup IRM Investigation Report – Former Brainerd Manufacturing Facility.*

4. Benchmark Environmental Engineering and Science, PLLC, April 2004, *IRM Design Report for IRM Groundwater Collection and Pretreatment System – Former Brainerd Manufacturing Facility.*

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

TABLES

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

TABLE 1

AIR STRIPPER PROCESS ALARM CONDITIONS, DESCRIPTIONS, AND ACTIONS

DESPATCH INDUSTRIES, INC.
FORMER BRAINERD MANUFACTURING FACILITY
EAST ROCHESTER, NEW YORK

ALARM CONDITION	DESCRIPTION/POSSIBLE CAUSE	ACTION[1]
Day Tank High Water Level	Water level in day tank reaches high-level float switch. *Possible cause: feed pump failure or alarm condition on air stripper that de-energizes feed pump.*	Shutdown well pump.
Deposit Control Agent Low Level	Level of Redux 300 in 60-gallon tank reaches low-level sensor. *Possible cause: product consumed or leaking storage tank.*	Shutdown well pump.
Building Sump High Water Level	Water level in building sump reaches high-level. *Possible cause: leak in the treatment system process train.*	Shutdown well pump.
Air Stripper Low Air Pressure	Air pressure drops below 0.10 inches w.c. *Possible cause: inappropriate damper setting, intake air restriction, or air stripper scale build-up*	Shutdown air stripper blower and feed pump.
Air Stripper High Water Level	Water level in bottom (effluent) sump approaches blower elevation. *Possible cause: clogged discharge line.*	Shutdown feed pump.

1. All actions trigger autodialer and local warning light.

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

TABLE 2

IRM OM&M TASKS AND RECOMMENDED FREQUENCY

DESPATCH INDUSTRIES, INC.
FORMER BRAINERD MANUFACTURING FACILITY
EAST ROCHESTER, NEW YORK

TASK	RECOMMENDED FREQUENCY[1]
Normal Operational Adjustments:	
Adjust Air Stripper Feed Rate to Approximately 10 GPM	Monthly
Adjust Sequestering Agent Feed Rate (proportional to well pumping rate)	Monthly
Adjust Air Stripper Blower Damper to Achieve 300 CFM Target Air Flow Rate	Monthly
Equipment Maintenance and Monitoring	
Fill Deposit Control Agent Feed Drum	As Needed[1]
Check Air Stripper Trays for Scale Build-Up	Every 3 months
Clean Air Stripper Trays to Remove Scale	Annually[2]
Transfer Pump Stator/Seal Replacement	Every 5 years
Well Pump Replacement	Every 10 years
Metering Pump Replacement	Every 10 years
System Performance Monitoring	
Discharge Compliance Sampling/Reporting to Monroe County Pure Waters	Monthly
Prereatment System Influent Sampling/Reporting to NYSDEC	Semi-Annually
Groundwater Elevation Monitoring/Reporting to NYSDEC	Quarterly

1. Projected usage 55 gals/year
2. More frequent cleaning may be necessary based on observations of scale build-up and/or decreasing blower exhaust pressure

TABLE 3

Former Brainerd Manufacturing Site

Remede Products Deposit Control Agent

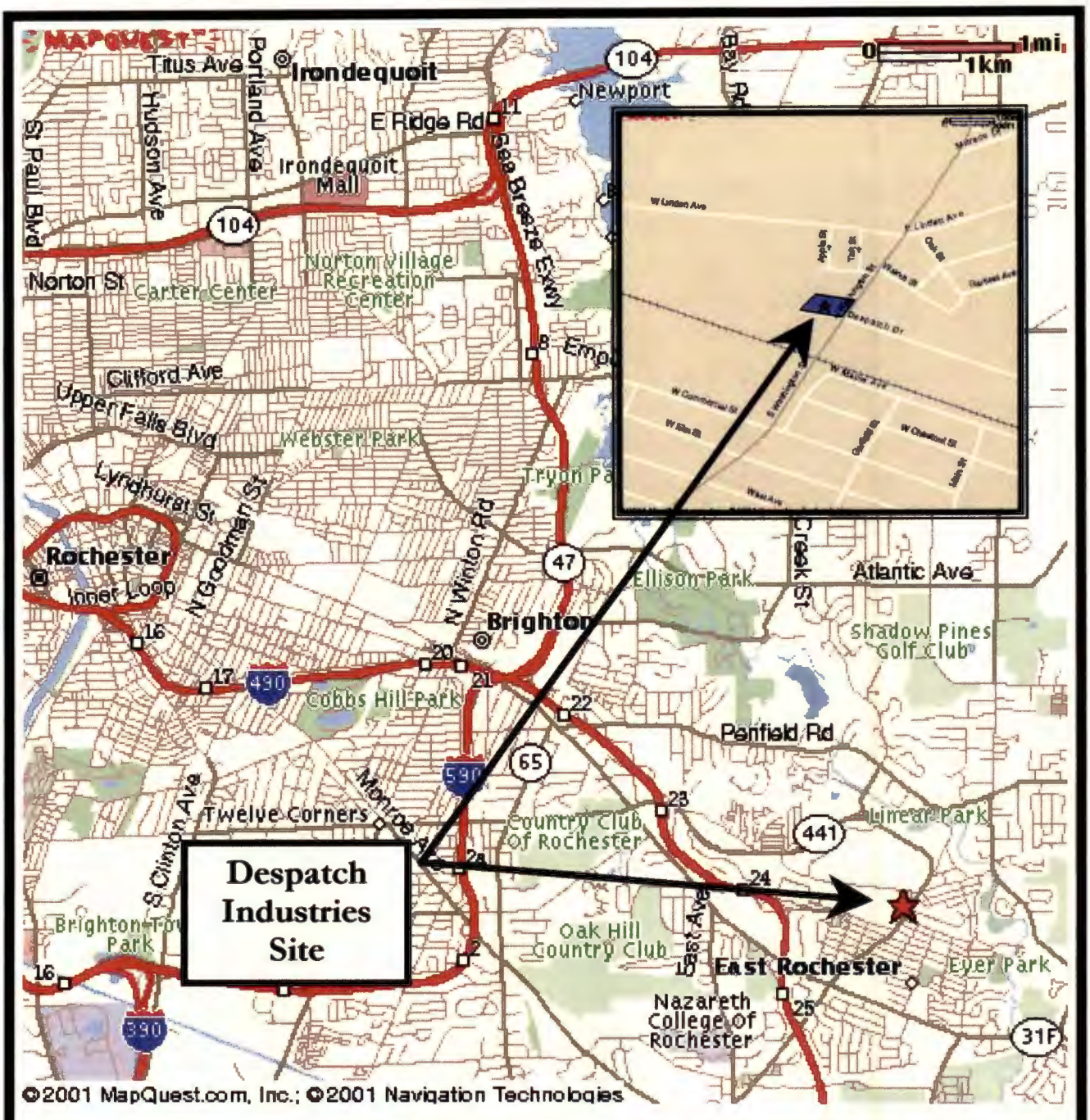
Target Dosage and LMI Model A15 Metering Pump Settings

Est. Well Pump Flow Rate (gpm)	Metering Pump Max Capacity (gph)	Recommended Agent Dosage (ppm)	Target Agent Dosage (gph)	Target Stroke Length	Target Stroke Rate
5.0	1	40	0.0120	20%	6.0%
5.5	1	40	0.0132	20%	6.6%
6.0	1	40	0.0144	20%	7.2%
6.5	1	40	0.0156	20%	7.8%
7.0	1	40	0.0168	20%	8.4%
7.5	1	40	0.0180	25%	7.2%
8.0	1	40	0.0192	25%	7.7%
8.5	1	40	0.0204	25%	8.2%
9.0	1	40	0.0216	25%	8.6%
9.5	1	40	0.0228	25%	9.1%
10.0	1	40	0.0240	25%	9.6%
10.5	1	40	0.0252	25%	10.1%
11.0	1	40	0.0264	25%	10.6%
11.5	1	40	0.0276	25%	11.0%
12.0	1	40	0.0288	25%	11.5%
12.5	1	40	0.0300	25%	12.0%
13.0	1	40	0.0312	25%	12.5%
13.5	1	40	0.0324	25%	13.0%
14.0	1	40	0.0336	25%	13.4%
14.5	1	40	0.0348	25%	13.9%
15.0	1	40	0.0360	25%	14.4%
15.5	1	40	0.0372	30%	12.4%
16.0	1	40	0.0384	30%	12.8%
16.5	1	40	0.0396	30%	13.2%
17.0	1	40	0.0408	30%	13.6%
17.5	1	40	0.0420	30%	14.0%
18.0	1	40	0.0432	30%	14.4%
18.5	1	40	0.0444	30%	14.8%
19.0	1	40	0.0456	30%	15.2%
19.5	1	40	0.0468	30%	15.6%
20.0	1	40	0.0480	30%	16.0%

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

FIGURES

Figure 1



SITE VICINITY MAP

DESIGN REPORT FOR IRM GROUNDWATER COLLECTION AND PRETREATMENT SYSTEM FORMER BRAINERD MANUFACURING FACILITY

LEGEND

- PW-1 — PUMPING WELL
- OW-1 — OBSERVATION WELL
- MW-4 — EXISTING MONITORING/OBSERVATION WELL
- MW-201 — ABANDONED MONITORING WELL
- PROPERTY BOUNDARY

TAX I.D. NO. 139.69-1-17
APPROX. 2.9 ACRES

MW-5
OW-1
PW-1
MW-4
OW-2
MW-203
MW-201
MW-1
MW-202
MW-3
MW-2

ASSEMBLY
WAREHOUSE
PLATING
ANTIQUE
BLANKING
METAL ROOM
STORAGE
ASSEMBLY
STOCK ROOM
STORAGE
SHIPPING 2
SHIPPING 1
SHIPPING 3
DEGREASER
BUFFING LINE
CLAIR ROOM
MAINTENANCE
LUNCH ROOM
TOOL ROOM
OFFICES

N. WASHINGTON STREET

LOCATION OF PRETREATMENT SYSTEM

MONROE STREET

BM-1
FIRE HYDRANT
SET CHIS'D "X" N'LY
B. BOLT ON FIRE HYD.
ELEV. = 100.00 FEET

TAX I.D. NO. 139.69-1-19
APPROX. 0.4 ACRES

DESPATCH DRIVE

60' 0' 60' 120'

SCALE: 1 INCH = 60 FEET

DATE: NOVEMBER 2004
DRAFTED BY: GPH/BCH
FILEPATH: f:\benchmark\cad\despatch\o&m plan\figure 2; site plan.dwg

BENCHMARK
ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
50 FOUNTAIN PLAZA
SUITE 1350
BUFFALO, NEW YORK 14202
(716) 856-0599

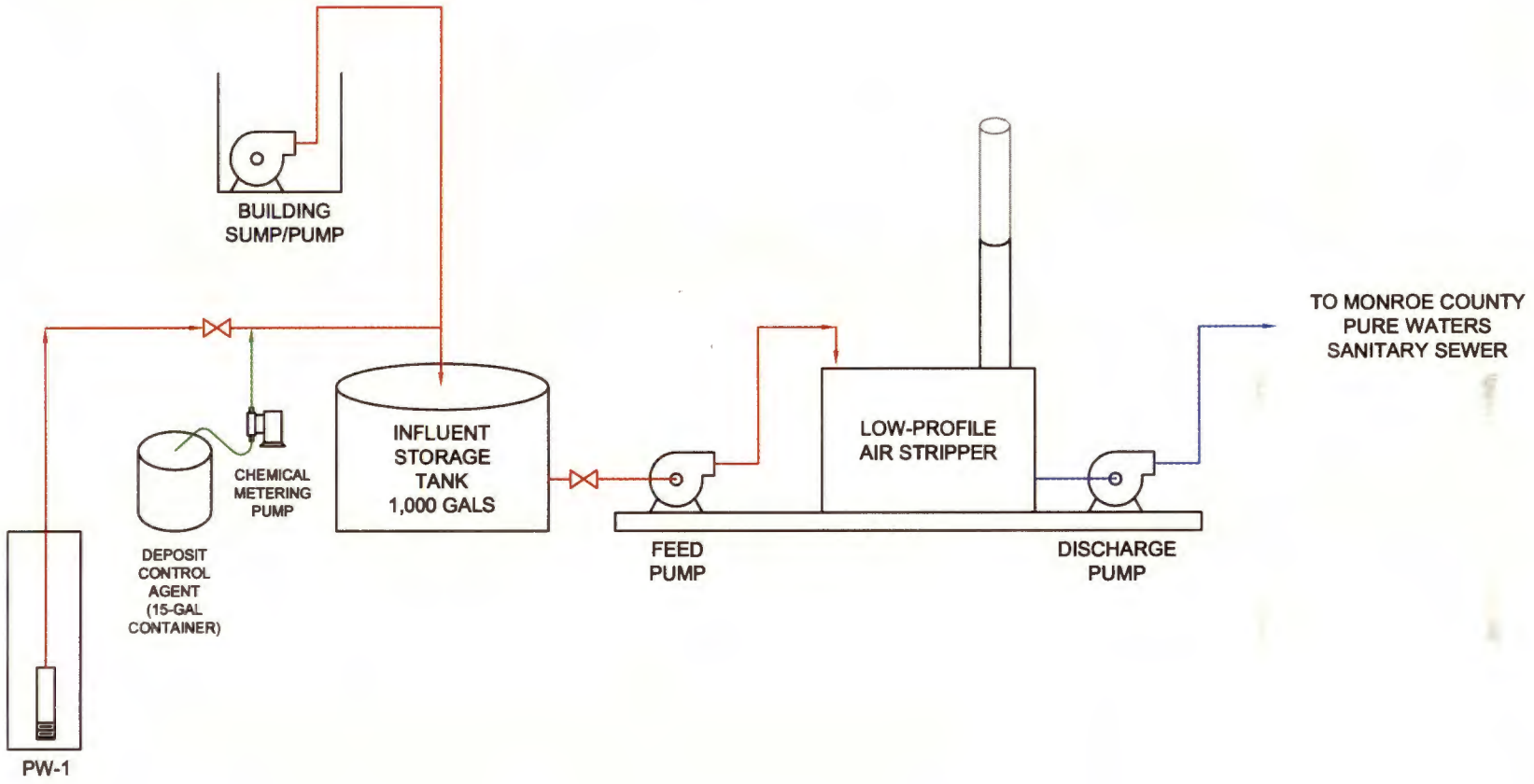
JOB NO.: 0079-001-200

SITE PLAN

VOLUNTARY CLEANUP - IRM O&M PLAN
FORMER BRAINERD MANUFACTURING FACILITY
EAST ROCHESTER, NEW YORK

PREPARED FOR
DESPATCH INDUSTRIES, INC.

FIGURE 2



BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

726 EXCHANGE STREET
SUITE 624
BUFFALO, NEW YORK 14210
(716) 856-0599

PROJECT NO.: 0040-002-200

DATE: Rev 1. APRIL 2005

PROCESS FLOW SCHEMATIC

OM&M PLAN FOR IRM GROUNDWATER COLLECTION AND PRETREATMENT SYSTEM

FORMER BRAINERD MANUFACTURING FACILITY
EAST ROCHESTER, NEW YORK

PREPARED FOR
DESPATCH INDUSTRIES, INC.

FIGURE 3

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

APPENDIX A

MANUFACTURER'S EQUIPMENT LITERATURE

GOULDS PUMPS

60 Hz
4" Submersible Pumps

MODEL GS

5GS, 7GS, 10GS, 13GS, 18GS, 25GS

SPECIFICATIONS

Model	Flow Range GPM	Horsepower Range	Best Eff. GPM	Discharge Connection	Minimum Well Size	Rotation①
5GS	1.2 – 7.5	½ – 2	5	1¼	4"	CCW
7GS	1.5 – 10	½ – 3	7	1¼	4"	CCW
10GS	3 – 16	½ – 5	10	1¼	4"	CCW
13GS	4 – 20	½ – 3	13	1¼	4"	CCW
18GS	6 – 28	¾ – 5	18	1¼	4"	CCW
25GS	8 – 33	1 – 5	25	1¼	4"	CCW

① Rotation is counterclockwise when observed from pump discharge end

FEATURES

■ **Powered for Continuous Operation:** All ratings are within the working limits of the motor as recommended by the motor manufacturer. Pump can be operated continuously without damage to the motor.

■ **Field Serviceable:** Pump can be rebuilt in the field to like new condition with common tools and readily available spare parts. **NOTE: The Model GS has left hand casing threads.**

■ **Sand Resistant Construction:** Field proven over almost four decades, face clearance design and floating impellers for an extremely abrasion resistant configuration.

■ **Stainless Steel Metal Parts:** AISI types 302, 303 and 304 are corrosion resistant, non-toxic and non-leaching.

■ **FDA Compliant Non-Metallic Parts:** Impellers, diffusers and bearing spiders are constructed of a glass filled engineered composite. This material is corrosion resistant and non-toxic.

■ **Discharge Head:** High profile precision cast 303 stainless steel for superior strength and durability. Cast in loop for safety line.

■ **Motor Adapter:** Precision cast 303 stainless steel is extremely rigid for accurate alignment of liquid end to motor. Generous space for removal of motor mounting nuts with regular open-end wrench.

■ **Bowls:** Stainless steel for strength and abrasive resistance.

■ **Check Valve:** Built in check valve constructed of stainless steel and low compression, FDA compliant, BUNA rubber for excellent abrasive resistance and quiet, efficient operation.

■ **Stainless Steel Casing:** Polished stainless steel is attractive and durable in the most corrosive water.

■ **Hex Shaft Design:** Six sided shafts for positive impeller drive.

■ **Shaft Coupling:** Exposed for ease of field alignment to motor shaft and to check pump rotation.

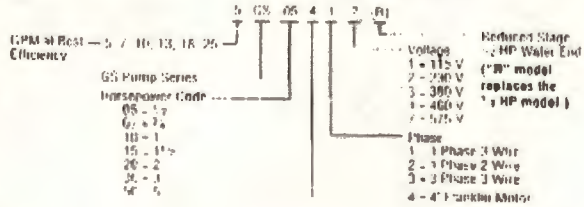
■ **Urethane Upper and Middle Bearings:** Fluted design for free passage of abrasives and excellent resistance to sand damage.

■ **Franklin Electric Motor:**

- Corrosion resistant stainless steel construction through 2 HP, stainless steel casing with nickel plated gray iron end bells on motors over 2 HP.
- Built-in surge arrestor is provided on single phase motors through 5 HP.
- Stainless steel splined shaft.
- Hermetically sealed windings.
- Replaceable motor lead assembly.
- UL 778 recognized.
- NEMA mounting dimensions.
- Control box is required with 3 wire single phase units.
- Three phase units require a magnetic starter with three leg protection. Magnetic starter and heaters must be ordered separately.

■ **Agency Listings:** All complete pump/motor assemblies are UL778 and CSA listed and complies with ANSI/NSF std. 61. All 4" Franklin Electric Motors are UL778 recognized.

ORDER NUMBER CODE



"GS" SERIES MATERIALS OF CONSTRUCTION

Part Name	Material
Discharge Head	AISI 303 SS
Check Valve Cage	AISI 304 SS
Check Valve Seal	BUNA, FDA compliant
Check Valve Seat	AISI 304 SS
Check Valve Retaining Ring	AISI 302 SS
Bearing Spider – Upper	Glass Filled Engineered Composite
Bearing	Urethane, FDA compliant
Klipring	AISI 301 SS
Diffuser	Glass Filled Engineered Composite
Impeller	
Bowl	AISI 304 SS
Intermediate Sleeve①	AISI 304 SS, Powder Metal
Intermediate Shaft Coupling②	AISI 304 SS, Powder Metal
Intermediate Bearing Spider①	Glass Filled Engineered Composite
Intermediate Bearing Spider②	AISI 303 SS
Bearing	Urethane, FDA compliant
Shim	AISI 304 SS
Spacer	AISI 304 SS, Powder Metal
Screws Cable Guard	AISI 304 SS
Motor Adapter	AISI 303 SS
Casing	AISI 304 SS
Shaft	
Coupling	AISI 304 SS, Powder Metal
Cable Guard	AISI 304 SS
Suction Screen	AISI 304 SS

① Used on pumps over 24 stages
② Used on models with 27 stages or larger

AGENCY LISTINGS

CSA Canadian Standards Association

UL Underwriters Laboratories

Classified ANSI/NSF 61-1992

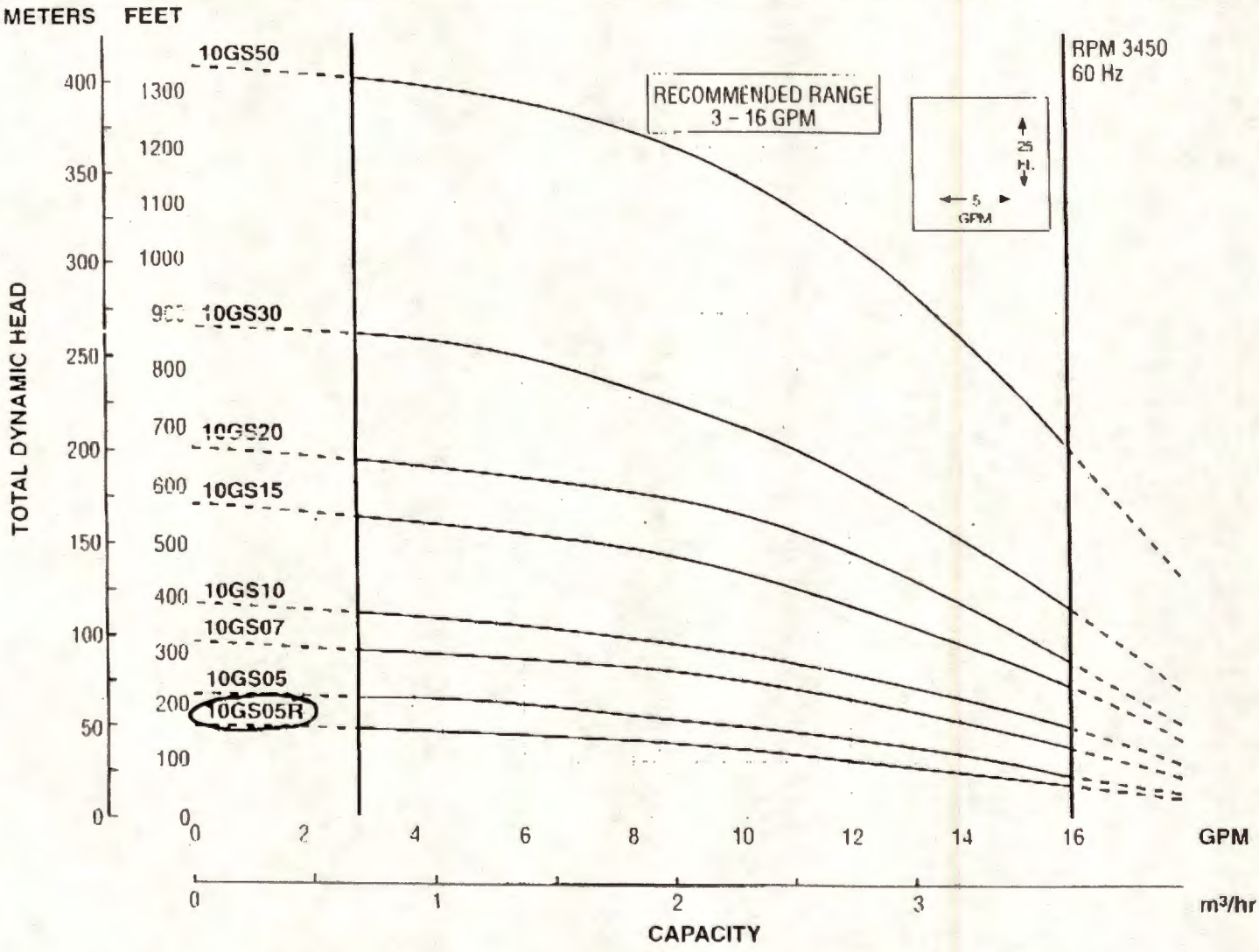
Goulds Pumps is ISO 9001 Registered.

Goulds Pumps

ITT Industries

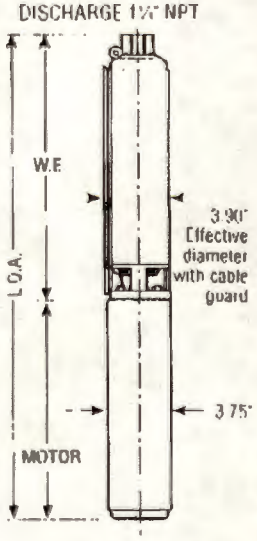
Model 10GS

GOULDS PUMPS



DIMENSIONS AND WEIGHTS

Model	HP	Phase	Stages	Length (inches)			Weight (lbs.)		
				W.E.②	Motor	L.O.A.③	W.E.	Motor	Total
10GS05412R,22,11,21①	½R①	1	5	9.6	9.5	19.1	6	18	24
10GS05412,22,11,21	½	1	7	11.0	9.5	20.5	7	18	25
10GS07412,22	¾	1	10	13.0	10.7	23.7	8	20	28
10GS10412,22	1	1	12	14.4	11.8	26.2	9	23	32
10GS15412	1½	1	17	17.9	13.6	31.5	11	28	39
10GS15422	1½	1	17	17.9	15.1	33.0	11	31	42
10GS15432	1½	3	17	17.9	11.8	29.7	11	23	34
10GS20412	2	1	20	20.0	15.1	35.1	12	30	42
10GS20432,34	2	3	20	20.0	13.6	33.6	12	28	40
10GS30412	3	1	27	26.0	23.5	49.5	15	52	67
10GS30432,34	3	3	27	26.0	20.6	46.5	15	43	58
10GS50142	5	1	42	36.3	29.5	65.8	20	69	89
10GS50432,34	5	3	42	36.3	23.6	59.9	20	53	73



① Reduced stage ½ HP pump/water end for low head applications. This model replaces the ½ HP water end
② W.E. = water end or pump without motor.
③ L.O.A. = length of assembly – complete pump – water end and motor.

Integrated System

Installation, Operation,
&
Maintenance Manual

JOB NUMBER

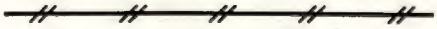
5888

North East Environmental Products, Inc.
7 Commerce Ave. West Lebanon New Hampshire 03784
Tel: 603 298-7061 Fax: 603 298-7063 Email: sales@neepsystems.com

900-900-02000 C

GENERAL INSTRUMENTATION	PRIMARY LOCATION NOT OPERATOR ACCESSIBLE	PRIMARY LOCATION OPERATOR ACCESSIBLE	FIELD MOUNTED	AUXILIARY LOCATION OPERATOR ACCESSIBLE
INSTRUMENT OR OPERATOR				
PROCESS CONTROLLER OR OPERATOR INTERFACE				
CONTROL LOGIC RELAY OR PLC				
INDICATOR				
INSTRUMENTS SHARING A COMMON HOUSING				

INSTRUMENTATION LINE SYMBOLS

	PROCESS WATER
	PROCESS AIR OR FUMES
	PNEUMATIC SIGNAL
	ELECTRIC, SIGNAL OR POWER
	FLEXIBLE PROCESS LINE, VIBRATION ISOLATOR, OR FLEXIBLE COUPLING

FUNCTIONS

	SQUARE ROOT OR SQUARE ROOT EXTRACTOR
	INTERLOCK - UNSPECIFIED
	INTERLOCK - ALTERNATING
	SCOPE OF WORK OR EQUIPMENT SUPPLIED BY NEEP # REFERENCES CONNECTION SCHEDULE


PROCESS CONTINUATION

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

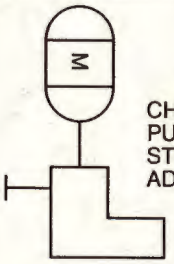
TITLE

PROCESS & INSTRUMENTATION DIAGRAM BASIC SYMBOLS

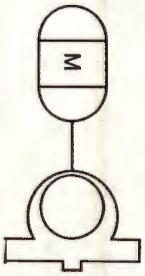
SIZE	DWG NO.	SHEET	REV
A	900-900-00195	1 OF 4	F

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	5/14/02

CENTRIFUGAL PUMP

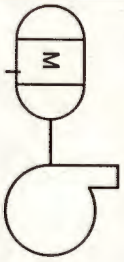


CHEMICAL FEED PUMP WITH MANUAL STROKE ADJUSTMENT



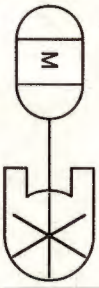
LIQUID RING PUMP

ROTARY LOBE BLOWER



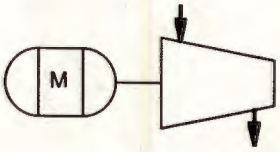
CENTRIFUGAL BLOWER

REGENERATIVE BLOWER

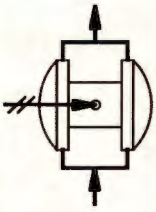


ROTARY VANE BLOWER

AXIAL FAN OR BLOWER



COMPRESSOR SCREW OR RECIPROCATING

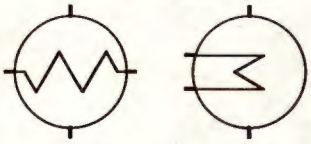


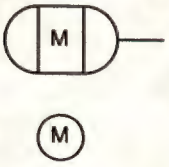
DOUBLE DIAPHRAGM PUMP PNEUMATIC ACTUATOR

PNEUMATIC SUBMERSIBLE PUMP

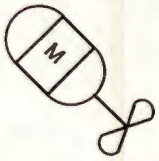
ELECTRIC SUBMERSIBLE PUMP

HEAT EXCHANGER



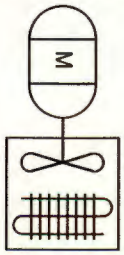


ELECTRIC MOTOR

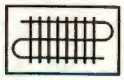


DYNAMIC MIXER

FORCED AIR ELECTRIC FINNED HEATER



ELECTRIC FINNED HEATER



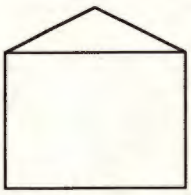
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

TITLE

PROCESS & INSTRUMENTATION DIAGRAM BASIC SYMBOLS

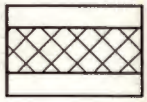
SIZE	DWG NO.	SHEET	REV
A	900-900-00195	3 OF 4	F

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	5/14/02

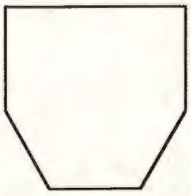


ATMOSPHERIC FLAT BOTTOM CLOSED TOP STORAGE TANK

CALIBRATION COLUMN

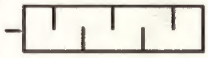


MIST ELIMINATOR OR COALESCING FILTER



ATMOSPHERIC CONE BOTTOM CLOSED TOP STORAGE TANK

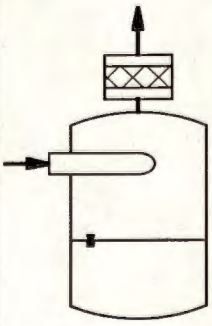
SPRAY NOZZLE ASSEMBLY



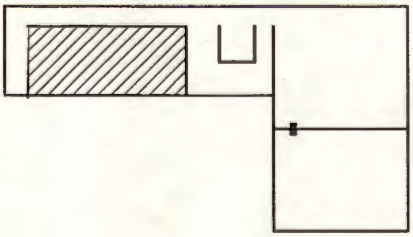
STATIC MIXER

VESSEL FOR USE IN PRESSURE OR VACUUM SYSTEM

SILENCER OR MUFFLER

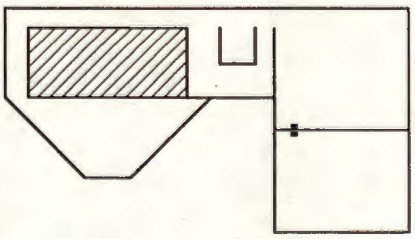


MOISTURE SEPARATOR WITH INTEGRAL MIST ELIMINATOR



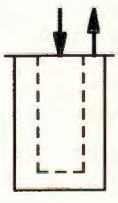
OIL WATER SEPARATOR GRAVITY TYPE WITH INTEGRAL SKIMMER, COALESCER, AND SUMP

LOW PROFILE, TRAY TYPE, AIR STRIPPER \WITH INTEGRAL MIST ELIMINATOR, SPRAY NOZZLE, AND SUMP TANK.

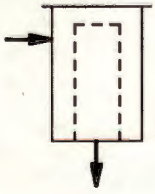


OIL WATER SEPARATOR GRAVITY TYPE WITH INTEGRAL SKIMMER, COALESCER, SLUDGE CHAMBER, AND SUMP

WATER FILTER



AIR FILTER FILTER/SILENCER



NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

TITLE

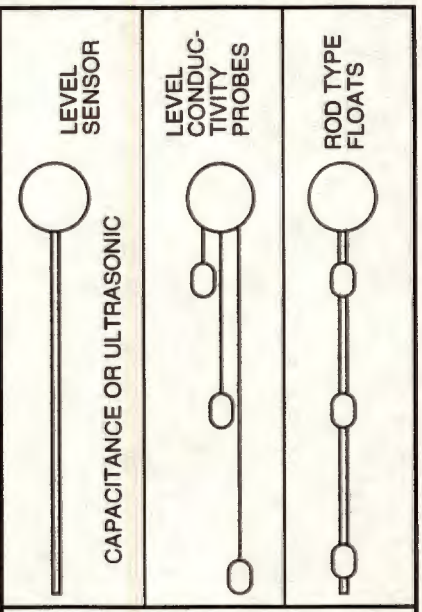
PROCESS & INSTRUMENTATION DIAGRAM BASIC SYMBOLS

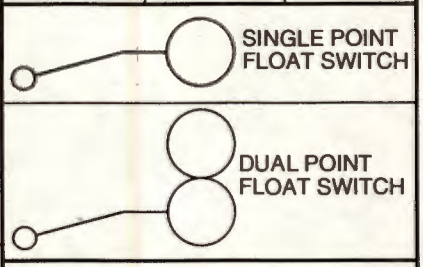
SIZE	DWG NO.	SHEET	REV
A	900-900-00195	2 OF 4	F

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	5/14/02

- DIAPHRAGM SEAL
- PULSATION DAMPENER
- REDUCER
- FLANGE
- UNION
- QUICK CONNECT
- Y-STRAINER
- VACUUM BREAKER OR VACUUM RELIEF VALVE
- PRESSURE RELIEF VALVE
- GATE VALVE
- BALL VALVE
- GLOBE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- MANUAL ACTUATOR
- S — ELECTRIC SOLENOID ACTUATOR
- M O/C — ELECTRIC MOTOR ACTUATED (OPEN/CLOSE)
- M MOD — ELECTRIC MOTOR ACTUATED (MODULATING)
- PNEUMATIC ACTUATOR
- REGULATOR

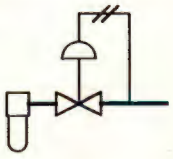
- TURBINE FLOW ELEMENT
- SINGLE POINT PITOT TUBE
- AVERAGING PITOT TUBE
- SIGHT TUBE OR SITE GLASS
- PADDLEWHEEL FLOW ELEMENT
- NUTATING DISK FLOW ELEMENT
- VENTURY FLOW ELEMENT
- FLOAT&ROD FLOW ELEMENT
- ORIFICE FLOW ELEMENT
- M — MAGNETIC FLOW ELEMENT
- VENTURI JET OR EDUCTOR
- 3 WAY VALVE





SAMPLE PORT

DRAIN PORT



FILTER REGULATOR

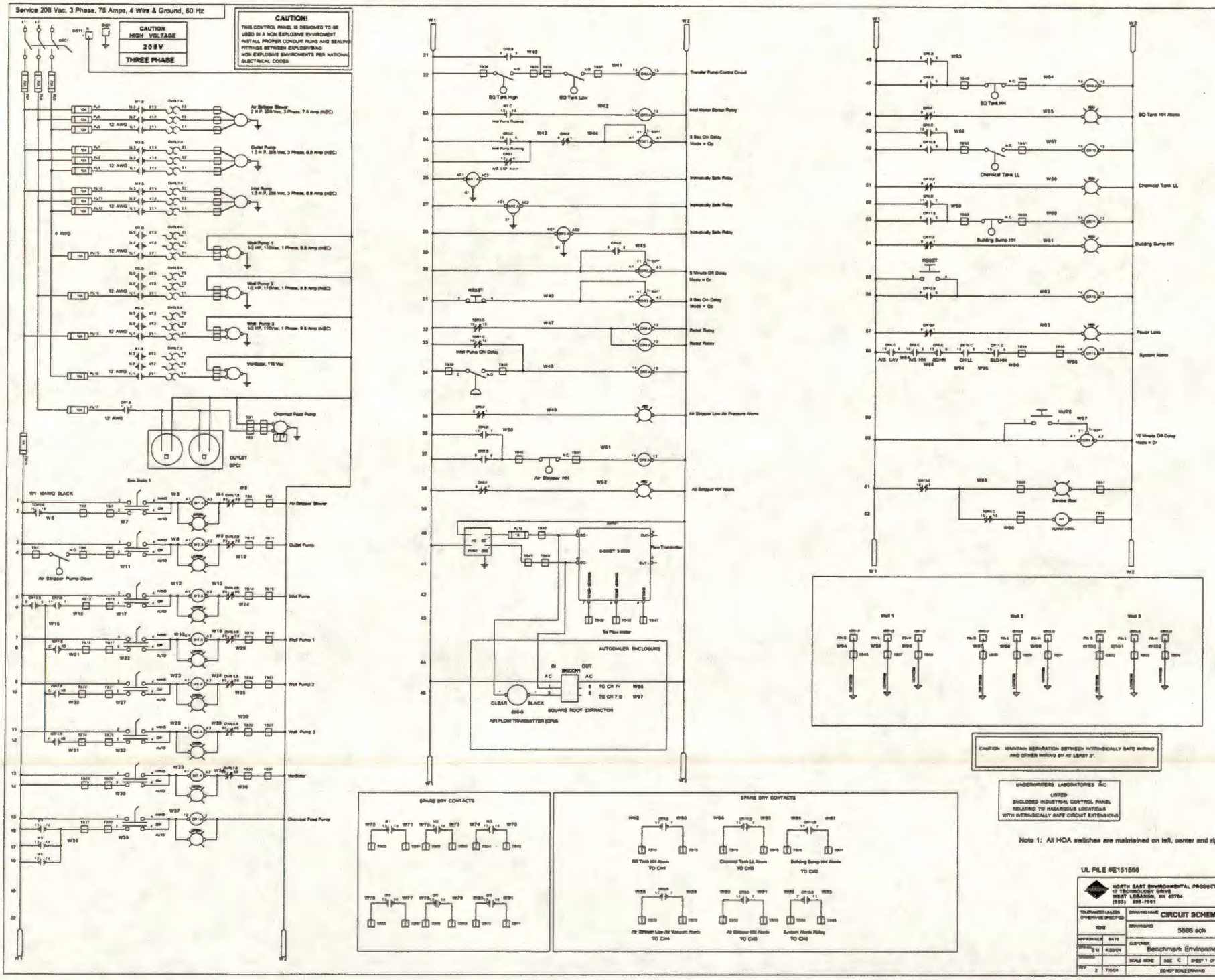
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

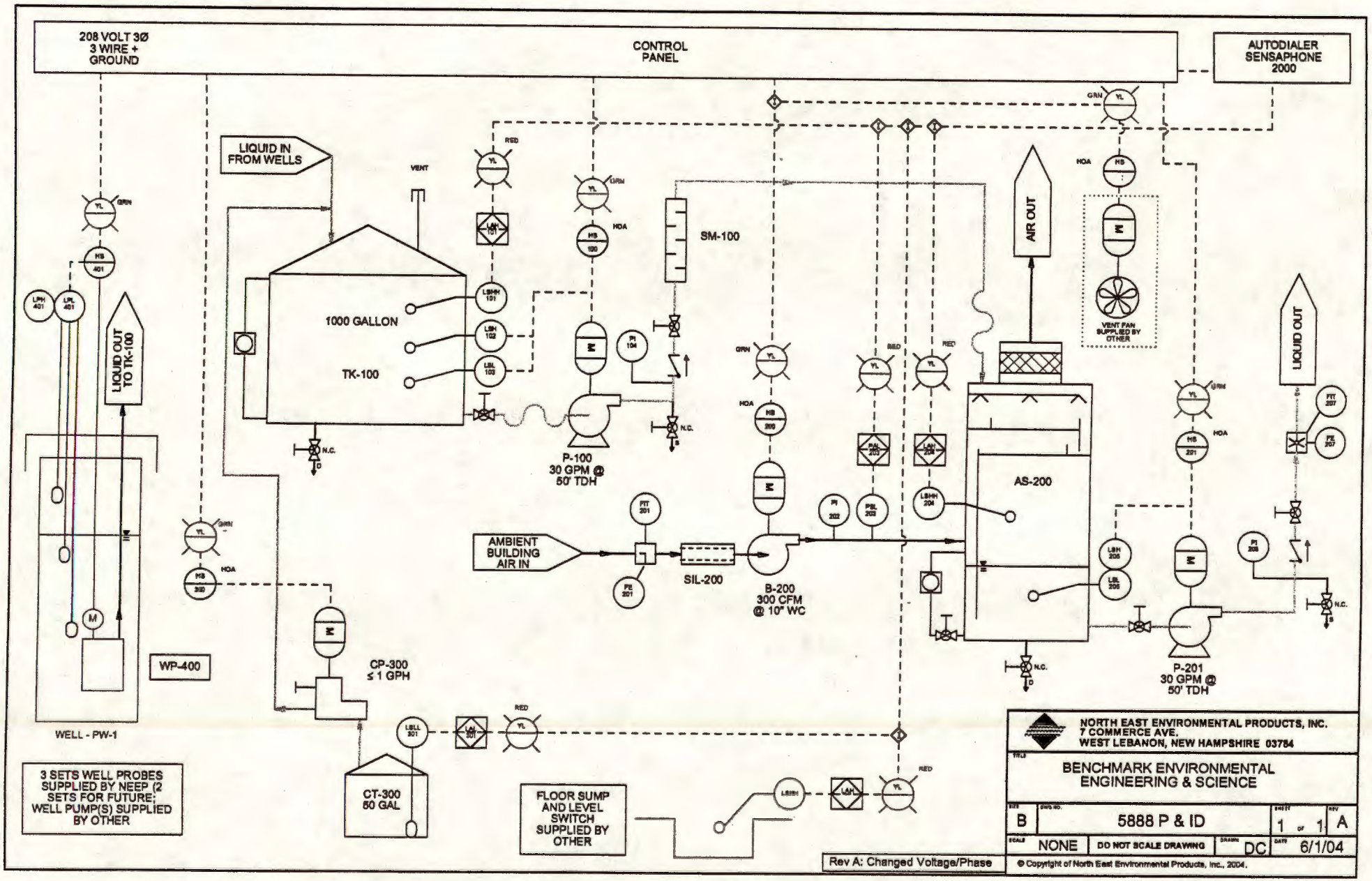
TITLE

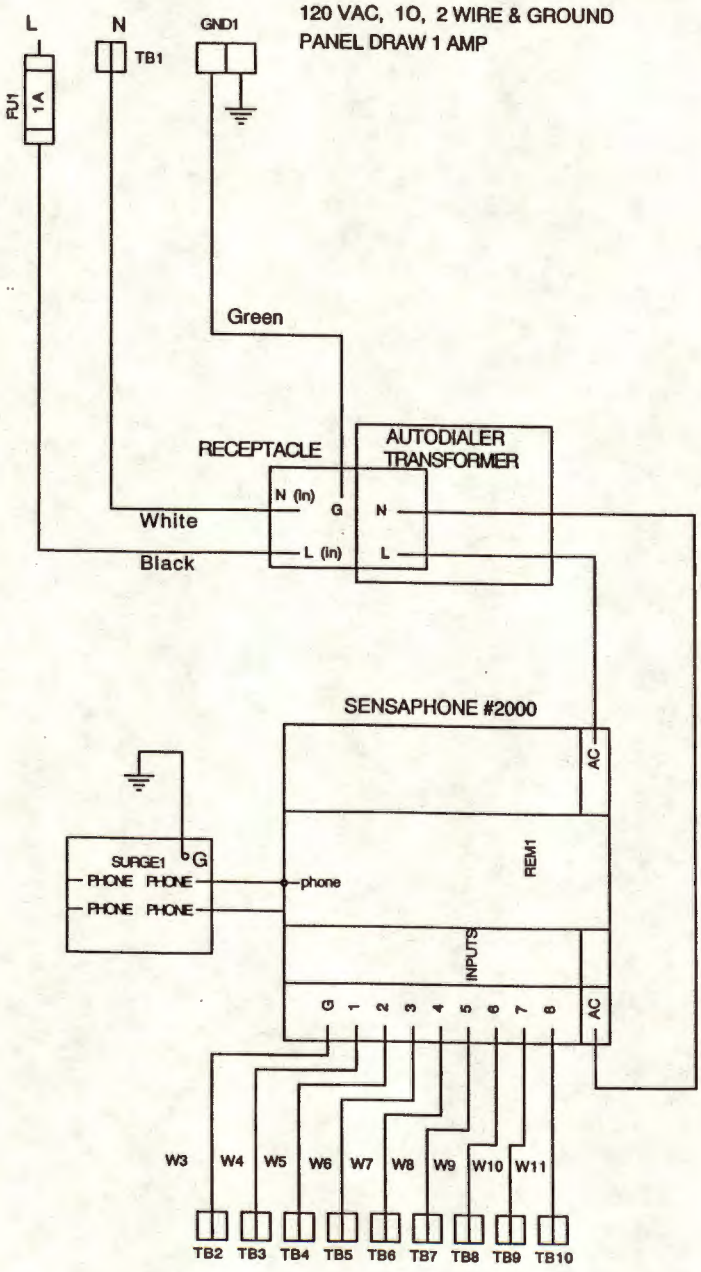
PROCESS & INSTRUMENTATION DIAGRAM BASIC SYMBOLS

SIZE	DWG NO.	SHEET	REV
A	900-900-00195	4 OF 4	F

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	5/14/02


Service 208 Vac, 3 Phase, 75 Amps, 4 Wire & Ground, 60 Hz
CAUTION
HIGH VOLTAGE
208V
THREE PHASE
CAUTION!
THIS CONTROL PANEL IS DESIGNED TO BE USED IN A NON EXPLOSIVE ENVIRONMENT. INSTALL PROPER CONDUIT RUNS AND SEALING FITTINGS BETWEEN EXPLOSIVE AND NON EXPLOSIVE ENVIRONMENTS PER NATIONAL ELECTRICAL CODES
Air Stripper Blower
Outlet Pump
Inlet Pump
Well Pump 1
Well Pump 2
Well Pump 3
Ventilator, 115 Vac
Chemical Feed Pump
OUTLET
SPCI
Air Stripper Pump-Down
Transfer Pump Control Circuit
Inlet Water Status Relay
Intrinsically Safe Relay
Relief Relay
Air Stripper Low Air Pressure Alarm
Air Stripper HH Alarm
Flow Transmitter
AUTODIALER ENCLOSURE
SQUARE ROOT EXTRACTOR
AIR FLOW TRANSMITTER (CPM)
SPARE DRY CONTACTS
SPARE DRY CONTACTS
SD Tank HH Alarm
Chemical Tank LL Alarm
Building Sump HH Alarm
Air Stripper Low Air Vacuum Alarm
Air Stripper HH Alarm
System Alarm Relay
TO CH1
TO CH5
TO CH3
TO CH4
TO CH6
SD Tank High
SD Tank Low
SD Tank HH
Chemical Tank LL
Building Sump HH
Strobe Red
Power Loss
System Alarm
Well 1
Well 2
Well 3
CAUTION: MAINTAIN SEPARATION BETWEEN INTRINSICALLY SAFE WIRING AND OTHER WIRING BY AT LEAST 3".
UNDERWRITERS LABORATORIES INC.
LISTED
ENCLOSED INDUSTRIAL CONTROL PANEL
RELATING TO HAZARDOUS LOCATIONS
WITH INTRINSICALLY SAFE CIRCUIT EXTENSIONS
Note 1: All HOA switches are maintained on left, center and right
UL FILE #E151586
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061
CIRCUIT SCHEMATIC
5886 sch
Benchmark Environmental
SCALE: NONE
SIZE: C
SHEET 1 OF 1
DO NOT SCALE DRAWING
REV 2 7/5/04


208 VOLT 3Ø
3 WIRE +
GROUND
CONTROL
PANEL
AUTODIALER
SENSAPHONE
2000
LIQUID IN
FROM WELLS
VENT
1000 GALLON
TK-100
SM-100
P-100
30 GPM @
50' TDH
AIR OUT
VENT FAN
SUPPLIED BY
OTHER
LIQUID OUT
TO TK-100
LIQUID OUT
AS-200
AMBIENT
BUILDING
AIR IN
SIL-200
B-200
300 CFM
@ 10" WC
P-201
30 GPM @
50' TDH
WP-400
CP-300
≤ 1 GPH
WELL - PW-1
CT-300
50 GAL
FLOOR SUMP
AND LEVEL
SWITCH
SUPPLIED BY
OTHER
3 SETS WELL PROBES
SUPPLIED BY NEEP (2
SETS FOR FUTURE;
WELL PUMP(S) SUPPLIED
BY OTHER
Rev A: Changed Voltage/Phase
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
7 COMMERCE AVE.
WEST LEBANON, NEW HAMPSHIRE 03784
BENCHMARK ENVIRONMENTAL
ENGINEERING & SCIENCE
B
5888 P & ID
1 OF 1
A
NONE
DO NOT SCALE DRAWING
DC
6/1/04
© Copyright of North East Environmental Products, Inc., 2004.



CIRCUIT SCHEMATIC

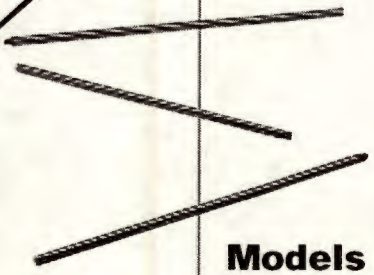
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED: NONE		DRAWING NAME: Sensaphone 2000	
		DRAWING NO.: 200-120-00305	
APPROVALS	DATE	CUSTOMER:	
DRAWN: SM	4/20/01		
CHECKED:		SCALE: NONE	SIZE: A / SHEET 1 OF 1
REV:		DO NOT SCALE DRAWING	

PROBES

SERIES 3R/3T General Purpose Probes

For general purpose use, Series 3R probes are metallic rods with threaded ends that screw into a fitting that extends vertically down into the liquid. Available in a variety of materials for different applications. 3T tapered rods are also available.



Ordering Information Series 3R & 3T

ORDER BY COMPONENT NUMBER 3R & 3T XXX

3RD PLACE SYMBOL	Length (Feet)
1	One
2	Two
3	Three
4	Four
5	Five
6	Six
7	Seven
8	Eight
9	Nine
10	Ten

4TH PLACE SYMBOL	Probe Material
A	Brass
C	**316 SS**
D	Carp. 20
E	Hast. B
F	Hast. C
G	Monel
H	Titanium

5TH PLACE SYMBOL	Sheathing Heat Shrink
0	**None**
4	PVC
5	Teflon

Standard part numbers in bold.

Specifications Series 3R, 3T & Series 3W

Series	Style	Material	Sheathing
3R 3T	1/4" (.64cm) rod (threaded) 1/4" (.64cm) rod (tapered)	Brass 316 SS Carp. 20 Hast. B Hast. C Monel Titanium	PVC Heat Shrink (200° F) Teflon Heat Shrink (350° F)
3W	Wire suspended	Brass 316 SS	Polyethylene shield PVC-coated wire (150° F)

LPL, LPH-400

LPL, LPH-401

LPL, LPH-402

SERIES 3W Wire Suspended Probes

Series 3W probes, consisting of metallic bars within a protective plastic shield, are designed to be suspended above liquid with PVC-insulated wires. 7/8" (2.22cm) diameter x 3 3/4" (9.52) length. 3Z1A wire and 3Z1B adaptor kit required for use with 3E, 3F and 3N fittings.

Ordering Information Series 3W

ORDER BY COMPONENT NUMBER 3WX

3RD PLACE SYMBOL	Probe Material:
1	**Brass**
2	**316 SS**

Standard part numbers in bold.

Models

- ~~Series 3R~~
- ~~Series 3T~~
- Series 3W

Applications

- ~~General Purpose Immersion (3R)~~
- Deep Applications (3W)

Features

- ~~Metallic Rods (3R & 3T)~~
- Metallic Bars (3W)
- Available in Many Materials for Various Requirements
- Adaptable for Various Fittings

Well Probes

Qty. [3] 200-120-00312

A 3 500-120-10119 Probe,Conductivity,Sensor

1-WELL [60] Probe Length

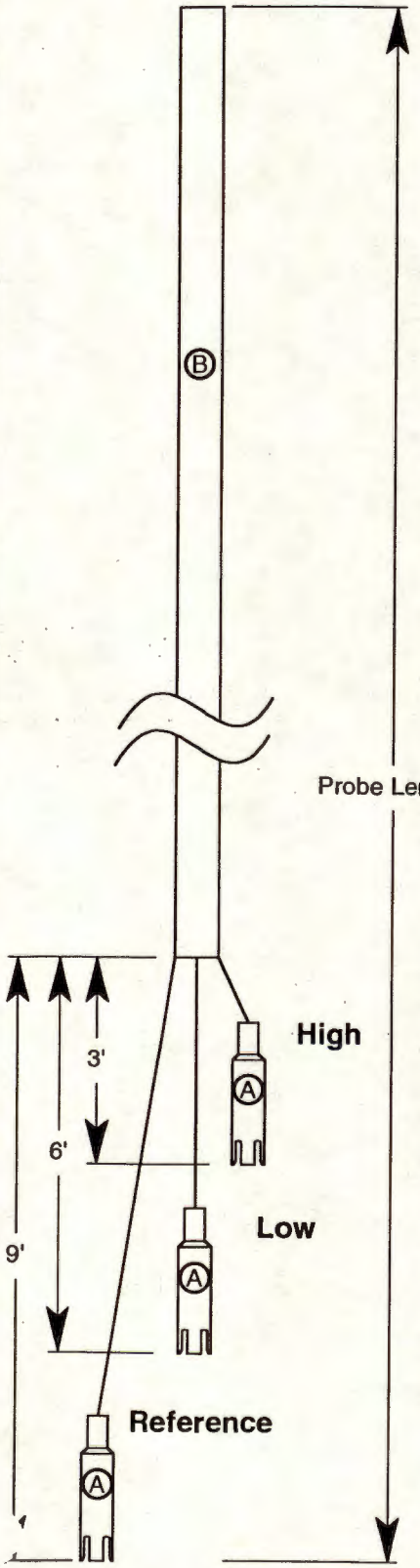
x

[3] Qty.

=

[180] 500-120-05480 Total Wire Length

B 500-120-05480 Wire,Sensor,Teflon Jacket



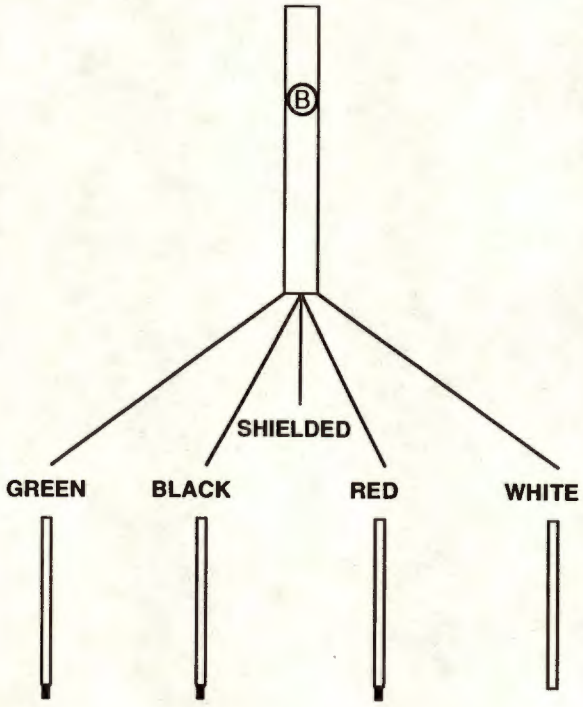
Note: See Well Probe Assembly Drawing.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

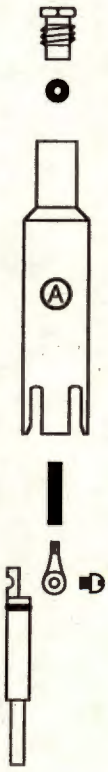
TITLE: WELL PROBES

SIZE	DWG NO.	SHEET	REV
A	900-120-00100	1 OF 2	C

SCALE		DRAWN	DATE
	DO NOT SCALE DRAWING	GC	8/07/01



GREEN = REFERENCE
BLACK = LOW
RED = HIGH
WHITE =DO NOT USE
SHIELDED



A	3	500-120-10119	Probe,Conductivity,Sensor
B	180	500-120-05480	Wire,Sensor,Teflon Jacket

Cable tie probes for 3' separation between H,L,Ref.

Maximum distance between High and Reference is 6 ft.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

TITLE

WELL PROBES ASSEMBLY DRAWING

SIZE	DWG NO.	SHEET	REV
A	900-120-00100	2 OF 2	C

SCALE		DRAWN	DATE
	DO NOT SCALE DRAWING	GC	8/07/01

ENGINEERING SPECIFICATIONS
SENSAPHONE 2000

I. General

The Automatic dialer shall be a self-contained microprocessor controlled system capable of monitoring 8 input channels. The system shall be integrated in construction and shall be installed and configured for operation by the user via Microsoft Windows™ software provided at no charge. Voice message recording shall be accomplished via local or remote touch-tone phone. Input channels shall be capable of monitoring analog or digital signals utilizing 10-bit resolution.

Upon detection of any alarm or status change, the system shall commence dialing telephone numbers from a list associated with the particular alarm condition(s) or combination thereof, and deliver the alarm message via a custom voice message, Fax, E-mail, modem, numeric pager or alphanumeric pager. The voice alarm message shall be delivered in digitized human voice using messages recorded by the user. The system will continue to call telephone numbers in succession until a positive acknowledgment of the alarm message is received. Acknowledgment can be accomplished from a voice phone call, a modem phone call, or by a callback from either a telephone or a computer with modem. Upon answering, the system shall attempt a data connection. If a connection is made the system shall allow remote access to programming and operation. If a data connection is not made, the system shall recite a voice status report and allow access to remote voice message programming.

The system shall be FCC registered for direct connection to the telephone network. The system shall have a one year warranty from the manufacturer. The system shall be a Sensaphone 2000 by Phonetics, Inc.

II. I/O Channel Attributes and Features

A. Inputs

The system shall come standard with 8 universal input channels. The input resolution shall be 10-bit with scalable lookup tables. All analog input values shall read to one decimal place. All input channels shall be user-configurable as:

1. NO or NC digital dry contact, using 0.5mA loop current
2. 4-20mA analog, using custom look up table
3. 0-5V analog, using custom look up table
4. Temperature from thermistor, using 2.8K or 10K devices
5. Run time accumulator
6. Pulse count

The system shall have the following built-in monitoring features:

1. AC power failure detection
2. Low battery detection

All monitored channels, including built-in monitoring features, shall allow local and remote data programming of pertinent operational data including, but not limited to:

1. Input type (NO/NC, 4-20mA and 0-5V analog, thermistor, run time, pulse count)
2. Units of measure (degrees F, degrees C, inches, feet, psi, volts, amps, pounds, gallons)
3. High and Low limits (-99,999.9 to +99,999.9)
4. Input recognition time (0 seconds to 270 minutes)
5. Alarm reset time (0 seconds to 270 minutes)
6. Alarm call list for each channel
7. Enable/Disable for each channel to dialout for alarm

III. Communications Features

A. Communication Methods

The system shall be able to communicate alarms and other status information using the following methods.

1. Programmable voice
2. Fax
3. Modem
4. Numeric pager
5. Alphanumeric pager
6. Internet E-mail

B. Telephone Specifications

The system shall connect to a standard 2-wire telephone line using pulse or tone dialing methods, with loop start only. The system shall recognize ringer frequencies from 16 to 60 Hz. No leased or dedicated lines shall be required. The system shall also be capable of being used on the same telephone line as other answering devices. Call progress detection shall ensure that the alarm dialout is not hindered by no-answers or busy signals.

C. Communications Interface

The system shall have a built-in 14,400 bps modem to allow remote data communication and programming via computer. The system shall have a built-in RS232 serial port for the purpose of local communication and programming via computer. Both communication interfaces shall accept standard Modbus protocol.

D. Destinations (Telephone Numbers and Email Addresses)

The system shall be capable of contacting up to 32 destinations (36 digit telephone numbers /64 character E-mail addresses). There shall be a capability to group the destinations into multiple lists to create calling schedules based on weekdays, weeknights and weekends. In addition, individual input alarms may be programmed to contact specific destinations.

E. Voice Messages

The System shall have the ability to record, store and reproduce voice messages and to use those messages to articulate the location and status of the monitored channels. In absence of user-recorded voice messages, the system shall articulate channel status using the internally resident vocabulary. All digitized speech message data shall be stored in nonvolatile memory. Such nonvolatile memory shall be capable of protecting speech memory for at least 10 years of complete power outage.

There shall be one recorded identification message for the system, and one recorded alarm message for each input channel. Message length shall be 4 seconds per input and 6 seconds for system identification.

IV. Programming

A. Local Programming

The System shall have a built-in RS232 port for the purpose of locally programming all system data using an IBM PC or compatible with Windows 3.1 or greater, and Sensaphone 2000 programming software (included). All operational data, system setup and configuration data, and all information regarding the status of monitored input channels shall be accessible. In addition, voice messages may be recorded and reviewed using a standard touch-tone telephone.

B. Remote Programming

The system shall have a built-in 14,400 bps modem for the purpose of remotely programming and communicating all system, configuration, and input data using an IBM PC or compatible with modem, Windows 3.1 or greater, and Sensaphone 2000 programming software (included). A user-programmable security password shall protect the system from unauthorized tampering. Voice messages may be recorded or reviewed via a phone call using a standard touch-tone telephone.

V. System Features

A. Power

The system shall be provided with a UL/CSA listed 8VAC 1.25A power transformer that the user may plug into a 115V AC outlet, ±10%, 60Hz. Typical power consumption shall be 10 Watts.

B. Battery Backup

The system shall have a battery compartment (batteries not included) to hold 6 "C-cell" Ni-Cad rechargeable batteries (2.2AH recommended). The batteries shall support approximately 10 hours of continued system operation in the absence of AC power. (Actual battery backup performance is dependent upon the Amp-Hour rating, age of the batteries, ambient temperature, and the charge condition.) The unit shall include an integrated battery charging circuit. The battery charging shall be intelligent with microprocessor guided precision voltage control, which will activate only when batteries are installed.

C. Local Visual Indication

Each input shall have a corresponding LED that will indicate the alarm and acknowledgment status of each input. The system shall also have LED's to indicate System On, Battery Condition and Phone Line status.

D. Data Log

The system shall be capable of logging the values of all input channels, the battery voltage and the AC power status. Items to be stored shall be selectable to maximize memory usage. Up to 32,000 total samples can be stored in the unit's nonvolatile memory. The time between logs shall be user-programmable. The system shall have the capability to send the datalog information via fax or E-mail on a time-programmable basis. Datalog information may also be retrieved via computer and modem, by using the polling option of the Sensaphone 2000 Windows™ software.

E. Security

The system shall allow the user to program a data password to prevent unauthorized local or remote access to programming.

VI. Remote Operation Features

A. Status Report

The system shall allow the user to call into the unit at any time using any standard telephone to obtain a full status report of all monitored channels. The status report shall be articulated using the resident voice-synthesized English vocabulary, in combination with digitized user-recorded voice messages.

B. Data Status Report

The system shall allow the user to call into the unit with a computer, modem and the Sensaphone 2000 software package. The system shall allow interrogation and programming access to system parameters and status. The real time input status can also be displayed graphically. Real time status snap shots can also be automatically transmitted to E-mail or Fax destinations on a time schedule.

C. Voice Acknowledgment

An alarm on any monitored channel may be acknowledged remotely by pressing tones on a touch-tone telephone keypad or by calling the system back within a specified time period.

D. Data Acknowledgment

An alarm on any monitored channel may be acknowledged remotely by the user via a computer, modem and the Sensaphone 2000 software. Alarms may be acknowledged manually by calling into the unit or they may be acknowledged automatically using the alarm-answer mode of the Sensaphone 2000 software package.

VII. Enclosure and Environmental

A. Enclosure

The system shall be housed in a durable aluminum enclosure with integral mounting brackets for wall or panel mounting. The dimensions shall be 12.1"W x 7.2"H x 1.6"D. The weight shall be 3 lbs.

B. Electrical Protection

Power and telephone connections shall have internal spike and surge protection using metal oxide varistors. All input channels shall have fault protected input circuits.

C. Additional Electrical Surge Protection

Additional Power and Telephone line surge protection shall be available from the manufacturer. When so installed, the system shall be fully warranted against any damage caused by transient surges entering the system through Power or Telephone lines.

D. Environmental

The system shall function over an operating temperature range of 32°F - 122°F at up to 0 - 90% RH, non-condensing. The system may be stored within the temperature range of 0° - 130°F.

E. Maintenance

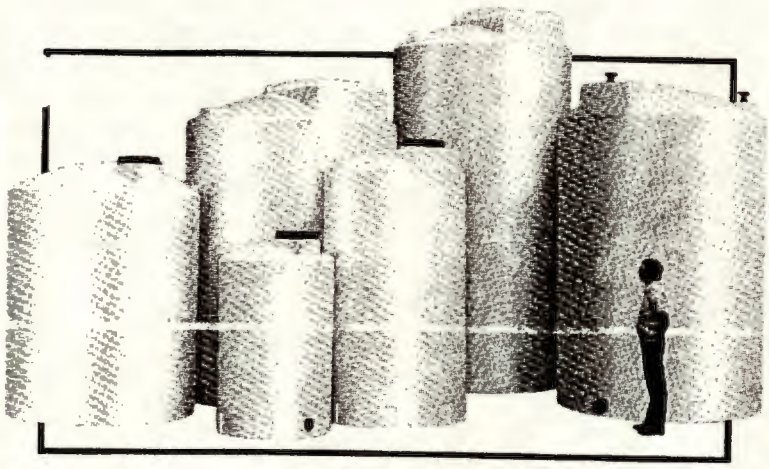
The system manufacturer shall have in-house service facilities and technical assistance available during normal business hours, Monday - Friday 8AM - 5PM(EST).

Specifications subject to change without notice.

Phonetics, Inc.
901 Tryens Road
Aston, PA 19014
Phone: (610)558-2700
FAX: (610)558-0222

2000 engin specs.pm6
1.15.97

CLOSED-TOP CYLINDRICAL TANKS

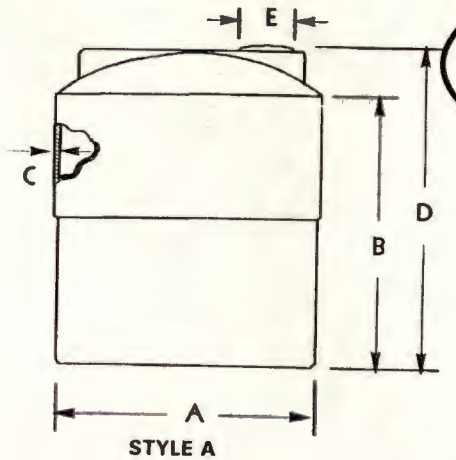


Terracon has you covered on all vertical bulk storage applications. A tank range of 57 capacities in a variety of configurations, incorporates all the features needed for tough, safe and economical indoor or outdoor storage of corrosive chemicals.

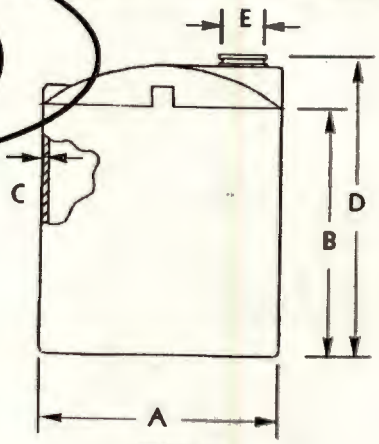
- One-piece molded seamless construction
- Translucent walls with molded calibration scales. Other colors available
- U.V. stabilized for sunlight protection
- Many tanks are provided with side wall and dome flats for mounting fittings and instrumentation
- XLPE available for larger tank rigidity concerns
- Most tanks available with wall thicknesses suitable for 1.5 and 1.9 specific gravity liquid storage

			1.5 S.G.		1.9 S.G.						
CXF 0050	50	185	–	–	18	.1875	23	30	30	8	A
CXF 0060	60	225	–	–	22	.1875	23	39	41	6	A
CXF 0075	75	280	–	–	27	.1875	23	44	48	8	A
CXF 0110	110	415	–	–	40	.1875	31	36	41	8	A.
CXF 0165	165	620	–	–	60	.1875	31	57	59	8	A
CXF 0220	220	830	–	–	70	.1875	43	39	42	8	A
CXF 0240	240	905	–	–	80	.250	48	34	44	6	C
CXF 0300	300	1135	–	–	90	.250	43	56	59	8	A
CXF 0301	300	1135	–	–	100	.225	35	73	80	16	C
CXF 0360	360	1360	–	–	110	.250	57	34	45	6	C
CXF 0375	375	1415	–	–	90	.250	45	56	62	18	A
CXF 0500	500	1890	–	–	140	.250	54	54	62	8	A
CXF 0501	500	1890	110	.210	120	.250	46	72	76	16	D
CXF 0525	525	1985	85	.210	–	–	56	49	53	16	D
CXF 0550	550	2080	120	.210	140	.250	48	72	82	16	D
CXF 0551	550	2080	110	.210	135	.250	69	30	40	16	D
CXF 0600	600	2270	–	–	150	.250	64	41	52	6	C
CXF 0700	700	2645	115	.220	140	.250	69	34	50	16	D
CXF 0750	750	2835	165	.250	180	.3125	46	112	119	16	D
CXF 0850	850	3215	190	.250	225	.3125	48	109	120	21	C
CXF 0851	850	3215	140	.250			56	76	80	16	D
CXF 1000	1000	3785	205	.3125	240	.375	64	73	84	16	B
CXF 1100	1100	4160	225	.280	210	.3125	64	79	88	18	B
CXF 1101	1100	4160	175	.250	190	.3125	86	40	55	16	D
CXF 1200	1200	4540	–	–	360	.4375	73	84	99	16	C
CXF 1201	1200	4540	190	.250	–	–	77	58	62	16	D
CXF 1500	1500	5675	300	.333	415	.406	64	108	121	16	B

TK-100



STYLE A



STYLE B

1008654

SUPER SINGLE® pump switch

Mercury-activated, wide-angle switch designed to control pumps up to 1 HP at 120 VAC and 2 HP at 230 VAC.

This mercury-activated, wide-angle pump switch provides automatic control of pumps in non-potable water and sewage applications.

This switch is not sensitive to rotation or turbulence. For certain pump applications, one Super Single® may be wired in place of two control switches to operate a relay control panel.

The Super Single® pump switch is suitable for use with intrinsically safe circuits.

LSHH-101	LSH-205	LSL-205

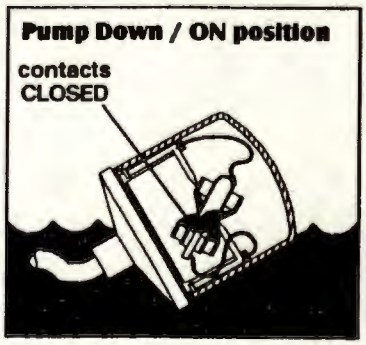
U.S. Patent No. 4,302,641

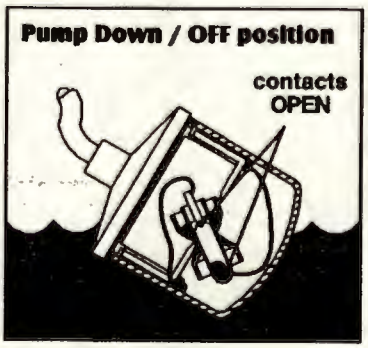
FEATURES

- Patented tumbler assembly gives positive pump on or pump off.
- Controls pumps up to 1 HP at 120 VAC and 2 HP at 230 VAC.
- Adjustable pumping range of 6.5 to 13.5 inches (17 to 34 cm).
- Includes standard mounting clamp and boxed packaging.
- UL Listed for use in non-potable water and sewage.
- CSA Certified.
- Three-year limited warranty.

LR64344 LISTED 83N2

Hydraulic





OPTIONS

This switch is available:

- for pump down or pump up applications.
- with a 120 VAC or 230 VAC piggy-back plug.
- without a plug for direct wiring in 120 VAC or 230 VAC applications.
- in standard cable lengths of 10, 15, 20, or 30 feet and 3, 5, 6, or 10 meters (longer lengths available).

CABLE: flexible 14 gauge 2 conductor (UL, CSA) SJOW, water-resistant (CPE)

FLOAT: 3.38 inch diameter x 4.25 inch long (8.58 x 10.80 cm) high impact, corrosion resistant, PVC housing for use in sewage and non-potable water up to 140°F (60°C)

MERCURY SWITCH: mercury-to-mercury contacts, hermetically sealed in a steel capsule

ELECTRICAL:

120 VAC 50/60Hz Single Phase:
Maximum Pump Running Current:
15 amps
Maximum Pump Starting Current:
55 amps
Recommended Pump HP:
1 HP or less

230 VAC 50/60Hz Single Phase:
Maximum Pump Running Current:
15 amps
Maximum Pump Starting Current:
35 amps
Recommended Pump HP:
2 HP or less

Note: This switch must be used with pumps that provide integral thermal overload protection.

SJE Rhombus
SJ Electro Systems, Inc.
PO Box 1709, Detroit Lakes, MN 56502
1-800-DIAL-SJE • 1-218-847-1317
1-218-847-4617 Fax
email: sje@sjerhombus.com
www.sjerhombus.com

Super Single® pump switch installation instructions

⚠WARNING [illegible] Disconnect power [illegible] product. A qualified [illegible] service this product [illegible] and plumbing codes. [illegible]

⚠WARNING [illegible] Do not use this product with flammable liquids. [illegible] defined by National Electrical Code ANSI/NFPA 70. [illegible]

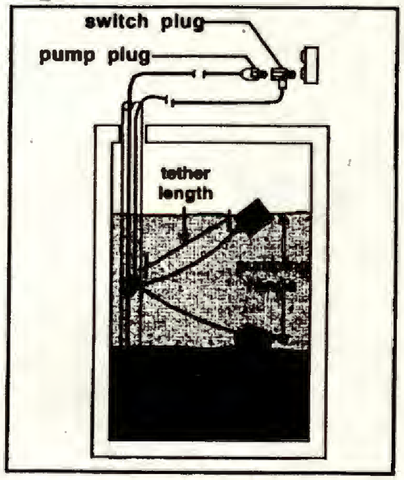
[illegible]

MOUNTING THE SWITCH

1. Determine the required cord tether length as shown in Figures A and B.
2. Place the cord into the clamp as shown in Figure C.
3. Secure the clamp to the discharge pipe as shown in Figure C. **Note:** Do not install cord under hose clamp.
4. Tighten the hose clamp using screwdriver. Over tightening may result in damage to the plastic clamp. Make sure the float cable is not allowed to touch the excess hose clamp band during operation.
5. Check installation. Allow system to cycle to insure proper operation.

Note: All hose clamp components are made of 18-8 stainless steel material. See your SJE-Rhombus supplier for replacements.

Figure A



PIGGY-BACK PLUG INSTALL

- Electrical outlet must not be located in pump chamber.
- Electrical outlet voltage, piggy-back plug voltage, and pump voltage must match.

1. Follow steps 1 through 4 of "Mounting The Switch."
2. Insert switch's piggy-back plug into outlet.
3. Plug pump into piggy-back plug as shown in Figure A.
4. Check installation. Allow system to cycle to insure proper operation.

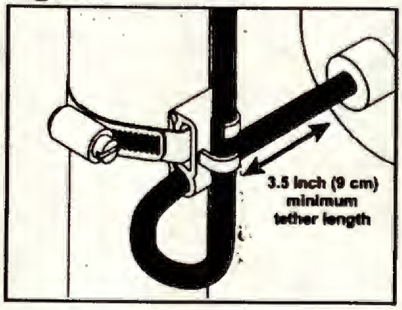
Figure B

Determining Pumping Range
In Inches (1 inch = 2.5 cm)

tether length	3.5	5	7	9	11	13	15
pumping range	6.5	7.5	8.5	10	11	12.5	13.5

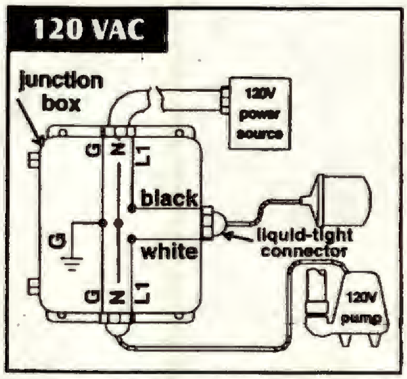
Use only as a guide. Pumping ranges are based on testing in non-turbulent conditions. Range may vary due to water temperature and cord shape. **Note:** As the tether length increases, so does the variance of the pumping range.

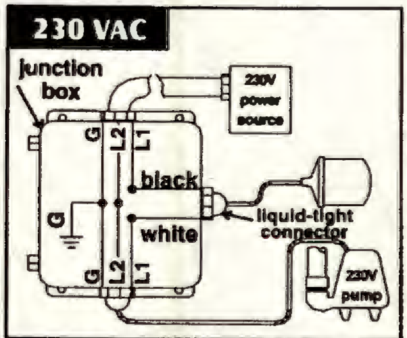
Figure C



DIRECT WIRE INSTALL

1. Follow steps 1 through 4 of "Mounting The Switch."
2. Wire switch as shown below.
3. Check installation. Allow system to cycle to insure proper operation.





⚠WARNING In 230 VAC pump installations, one side of the line going to the pump is always HOT. This condition exists if the switch is on or off. Install double pole disconnect on all 230 VAC pump circuits.

SJE Rhombus CONTROLS
SJ Electro Systems, Inc.
22650 County Highway 6 ■ P.O. Box 1708 ■ Detroit Lakes, Minnesota 56502 USA
1-888-DIAL-SJE (1-888-342-5753) ■ Phone: 218-847-1317 ■ Fax: 218-847-4617
E-mail: sje@sjerhombus.com

Instl. Instr. PN 1009475A
Cat. Page PN 1009505A

Installation Operation & Maintenance Instructions

Model SSP & SSPC

Description and Specifications: The Model **SSP** is a close coupled, end suction, single stage, open-impeller, back-pullout centrifugal pump. The model **SSPC** is the enclosed impeller version of the same pump. Connections are NPT threaded. All wetted metal pump parts are 18-8, 304SS, or better. Most parts are formed from stainless steel sheet. O-rings and elastomeric seal parts are Buna (Viton, EPR are optional). Motors are NEMA 56J frame, with a C-Face mounting flange and a threaded shaft. All pumps use a mechanical seal to prevent leakage around the motor shaft.

Operating limits: The models **SSP & SSPC** are designed for 75-PSIG operating pressure at 212 deg. F., with the standard Type-6, carbon vs. ceramic with buna-n elastomers mechanical seal, and a maximum temperature limit of 250 deg. F., with a Type-21 mechanical seal with viton elastomers. The motor is limited to 20 starts per hour, evenly distributed.

Notice: Upon receipt of this equipment, inspect the carton and the equipment for any damages that might have occurred during shipment and notify the carrier immediately. Damage that occurs during shipment is not the responsibility of American Stainless Pumps. Failure to notify the carrier will place responsibility on the purchaser for any repairs or damages occurring during shipment.

Safety Instructions: To avoid serious or fatal injury and/or property damage, read and follow all instructions in this manual. Review all instructions and warnings included in this manual before attempting any work on this pump or pump/motor assembly. Do not remove or alter any decals.

The motor used to drive this pump is an electrical device connected to a potentially lethal voltage power source. Take all precautions required when working with or on the motor and its power source, including but not limited to:

1. Always disconnect and lockout the electrical power source before attempting any connection, maintenance or repairs. Failure to do so can cause electrical shocks, burns and death.
2. Install, ground and wire motors in accordance with all local and national electrical codes.
3. Install an all leg disconnect switch near the motor for quick access.
4. The electrical supply must match the motor nameplate specifications and the motor must be wired per the wiring diagram on the motor to match the selected voltage. **Incorrect wiring can cause fire and motor damage and will void the warranty.**
5. Most single-phase motors and some three phase motors will have automatic thermal protection switches wired in the motor. These switches will open and stop the motor if the motor overheats. As the motor cools, these switches will close and start the motor automatically and unexpectedly.
6. Motors which do not have thermal overloads must have a properly sized contractor or magnetic starters and overload switches (or fuses) in the starter panel. Three phase motors require all leg protection.
7. Use only stranded copper wire to motor and ground. Wire size must limit the maximum voltage drop to 10% of the motor nameplate voltage at the motor terminals.
8. Three phase motors can rotate in either direction. The pump will operate properly only in one direction (clockwise when looking from the motor end, counterclockwise when viewed from the pump end). **Operating the pump in the reverse rotation may damage or destroy the pump and motor and voids the warranty.**

Installation:

Units may be installed horizontally, at an angle or vertically with the motor on top. **Do not mount the motor below the pump as leakage from the pump will damage the motor and can cause a shock, burns or death.**

- ☑ Locate the pump as near to the liquid source as possible. The pump must be primed with little or no air in the case to begin operation. The pump must be located below the liquid level when starting. This pump is not self-priming.
- ☑ Protect the pump and motor from freezing. Although the pump may survive a freeze up, the mechanical seal and O-Rings may not.
- ☑ Allow adequate space around the unit for service and ventilation.
- ☑ Units mounted horizontally should be located on a flat, rigid surface. Unit may be free standing, but some vibrations may occur. If attached to a foundation, tighten hold down bolts before connecting the piping.

Piping:

- ☑ All piping must be independently supported. No piping loads may be carried by the pump.
- ☑ Piping should be the same size or larger than the pump connections.
- ☑ Proper Piping to the suction is critical for proper pump operation. Suction pipe should be short and direct, with a minimum of fittings and turns.
- ☑ Suction pipe must continuously rise to the pump to avoid air pockets. All pipe connections must be airtight.
- ☑ If suction pipe is larger than the pump, an eccentric reducer must be used with the straight side on top to avoid an air pocket.
- ☑ If suction of pump is above the liquid source level, a foot valve or other isolation valve will be needed to prime the pump. A continuous stream of liquid must be made available for the pump suction to hold its prime.
- ☑ Do not use any suction valve for throttling the pump. This will cause loss of prime and damage to the pump that is not covered by warranty.
- ☑ Be sure that the source liquid level is sufficient to prevent vortices from drawing air into the pump.
- ☑ Install a valve on the discharge line for use in regulating the pump flow and for isolating the pump during maintenance and inspection.

Rotation:

The models SSP & SSPC will operate properly only in one direction (clockwise when looking from the motor end, counterclockwise when viewed from the pump end). **Operating the pump in the reverse rotation may cause the impeller to unscrew, breaking the shaft, damaging the pump and/or the motor, and voids the warranty.** Three phase motors can rotate in either direction. Single phase motors normally only rotate in the proper direction.

To check rotation, you must observe the motor shaft from the back of the motor.

1. Remove the end cover from the center of the back of the motor by prying off the cap. You do not need to remove any screws on most motors.
2. Quickly switch on and off the motor and watch the shaft rotation as it slows down. Motor shaft should be turning in the clockwise direction when viewed from the back of the motor.
3. If your three-phase motor is turning in the wrong direction, **have a qualified electrician interchange two of the three motor power wires**. This should reverse the rotation. If a single-phase motor is turning in the wrong direction, it has been wired wrong internally. Consult the motor manufacturer or American Stainless Pumps for instructions.
4. Check the rotation again, if it is correct, replace the end cover cap.

Operation:

- ☑ Pump must be completely primed before starting. Air in the suction lines or case must be vented.
- ☑ **Model SSPC Only:** If the pump case is rotated so that the discharge nozzle is not vertical, an air pocket may form in the case that will prevent the pump from operating properly. Loosen the case bolts until this air is removed for proper operation. Be sure to retighten the bolts before operating the pump.
- ☑ **Do not operate the pump at or near zero flow.** At zero flow, heat will build up in the pump and can cause extreme damage to the pump, property damage and/or possible injury to operating personal. Minimum flows of 10% of the pumps best efficiency point are recommended unless otherwise authorized by ASP.
- ☑ Do not operate the pump beyond the flow rates shown on published curves. Noisy pumps or the sounds of "pumping rocks" may be signs of cavitation or operation beyond the pumps capacity.

Operation Continued:

- ☑ Check pump and motor for vibration. Vibration may be a sign of pipe strain, insufficient mounting or operation beyond the pumps capacity.
- ☑ The pump models SSP & SSPC are not designed for handling large amounts of solids. For the model SSP, Spherical solids size should not exceed the vane height of the impeller, less 0.060". For the model SSPC, solid sizes must be smaller than the impeller vane family expressed in thousandths of an inch, less 0.140".

Maintenance:

There is no scheduled maintenance required. Close-coupled pumps have no bearings. Bearings in the motors are permanently grease lubricated and cannot be re-greased. Mechanical seals will need to be replaced when leaking. O-Rings may harden with age and may need to be replaced when they leak.

Motor Bearings and Pump Thrust: Model SSP Only

Open impellers generate significantly more thrust than do enclosed impellers. The Model SSP with a 4.38" diameter impeller operating at 20 psig generates about 150 pounds of thrust. This thrust load is carried by the motor bearing. The standard jet pump motor and the standard SSP motor uses as a front and rear bearing a size 203 grease lubricated bearing. This bearing has a B10 rated life of approximately 6,000 hours when operated with a thrust load of 150 pounds at 3500 RPM. This rating means that 10% of all bearings operated in this condition will fail within 6,000 hours of operation. The average bearing life will be 3 to 4 times this 6,000 hours.

Pumps and motors which operate intermittently, or only operate 40 hours per week, will usually have acceptable bearing lives with the standard jet pump motor bearing. Pumps that operate continuously, 24 hours per day, will have about 10% of their thrust bearings fail in the first year of operation.

For service applications that are critical, for installations that are difficult to access, or for pumps operating at differential pressures above 25 psig, American Stainless Pumps recommends that motors with a larger thrust bearings and higher load ratings be used. Consult factory for pricing and details.

Disassembly:

Disconnect and lockout the electrical power before attempting any disassembly. Casing may contain hazardous fluids. Drain and flush and take necessary precautions.

It is not necessary to remove piping from the case to disassemble. Pump is a back pullout design and unless casing needs to be repaired or replaced, it can stay in place during servicing.

- ☑ See page 7 for model SSP, and page 8 for model SSPC cross sectional drawings.

1. Close all valves and drain pump and pipes and flush if necessary.
2. Remove any motor hold down bolts.
3. Remove the eight (8) case bolts (Item 7CS) with a 3/16" allen wrench.
4. Pull the motor and pump internals back out of the case. The baseplate (Item 800) will slip off when the bottom two case bolts are removed and can be left with the pump case. Remove the case o-ring (item 500) and inspect for damage or hardness.
5. If the motor is a three phase motor, a locking mechanism (item 7SC) is used to prevent the impeller (item 200) from unthreading if started in the wrong direction. If motor horsepower is less than 1 HP, the starting torque is relatively weak. ASP uses a locking compound to prevent the impeller from unthreading at start-up. If the motor horsepower is equal to or greater than 1.0 HP, ASP will provide a left hand threaded, button head locking screw with an impeller washer to prevent unthreading. The locking screw (item 7SC) is installed with removable Loctite to prevent it from coming out when operating in the correct rotation. Remove this locking screw by turning it **clockwise** while holding the impeller against rotation.
6. Remove the impeller (item 200) by turning the impeller counterclockwise (when looking at the impeller from the pump end) while holding the motor shaft. It will be necessary to remove the motor shaft cover plate in the center of the rear of the motor to get access to the shaft. Using a screwdriver, wrench or vise grips as needed, hold the shaft tightly against rotation while turning the impeller. **Do apply any heat to the components.** If you are unable to hold the shaft in this manner, remove the rear motor housing and grip the motor shaft with vise grips or other similar device (do not hold shaft where bearings will mount).
7. **Model SSP Only:** There should be several spacing washers behind the impeller. These spacers locate the open impeller vanes close to the case for efficient operation. Measure the thickness of this stack of spacers for future reference. Remove them from the shaft but do not lose these washers. You will need them for reassembly.

Disassembly continued...

8. Remove the rotating element of the mechanical shaft seal (item 300). This element is held in place by the impeller only. If the rotating element does not come off easily, it is stuck to the shaft. Pry up the seal plate (Item 400) with screwdrivers or pry bars. The seal plate should compress the seal spring and force the seal off the shaft. If seal is stuck, and you must pry with force, do not pry towards your face or body. The seal and seal plate can come free unexpectedly and injure you.
9. If the seal plate (item 400) did not come off with the seal, remove it now. If you plan to replace the stationary seat, you will need to press it out from the back. Do not push with your finger, as you will probably cut it on the edges of the seal plate when the seal pushes out.
10. If you plan to replace the motor, remove the four motor adapter bolts (Item 7MB) with a 7/32" allen wrench and remove the motor adapter plate (Item 600). If you are not replacing the motor, leave the adapter plate in place.
11. If the motor comes with a deflector, the deflector should go outside of the motor adapter plate and must be removed if the adapter plate is to be removed.
12. Check the suction o-ring (item 510) in the case suction nozzle. It may be difficult to remove. Use a sharp pointed awl or similar device to pry the o-ring from the groove. Replace if damaged, swollen, fretted, or just worn out.

Assembly or Reassembly: SSP & SSPC

- ☑ See page xxx for model SSP, and page xxx for model SSPC cross sectional drawings.
- ☑ Assembly of the pump and motor is easier when the motor is standing face up so that parts do not fall off, although access to the motor shaft at the rear of the motor will require a horizontal position.
- ☑ It is considered good practice to replace the mechanical seal whenever you have to disassemble the pump.

1. If replacing the motor, remove the deflector from the motor shaft. There may not be enough room behind the motor adapter plate for the deflector to spin freely.
2. Install the motor adapter plate (Item 600) with the four motor bolts (Item 7MB) using a 7/32" allen wrench. You must use the low profile button head socket screws that came with the pump or other low profile head bolts. There is not enough room for a standard cap head screw/bolt. Tighten the bolts. Install the deflector now.
3. Install the mechanical seal stationary seat into the Seal Plate (Item 400) by putting a suitable lubricant on the cup seat and gently pressing into the seal plate bore. **Do not get any lubricant on the seal faces**. Use the foam sheet from the seal box to protect the seal face from dirt and scratches while pressing into the seal plate. Place the seal plate onto the motor adapter plate.
4. Lubricate the sealing elastomers on the rotating assembly of the mechanical seal and press gently onto the shaft. You may have to hold the seal in place until the impeller is installed.
5. **Model SSP Only:** Place the necessary number and thickness of impeller spacer/washers onto the threaded portion of the shaft. If you are not changing the impeller or the motor, use the same batch of spacer/ washers you removed. See the section on ***Setting Impeller Clearance*** for procedures if you have changed the impeller to case setting.
6. (If motor is three-phase, read section 7 below for Loctite instructions, then continue reading here) Thread the impeller onto the pump shaft. Be sure the impeller hub is tight against the spacer/washers that are tight against the shoulder of the motor shaft. If you leave the impeller loose, when the motor starts up, the impeller will tighten up on the shaft so tightly that you may not be able to remove it later. You will need to hold the motor shaft from the rear of the motor with a large screwdriver, wrench or vise grips while tightening the impeller.
7. If motor is three-phase, and wiring has been reconnected, rotation may have changed. To protect against rotation in the wrong direction at start up, reinstall the left hand threaded impeller locking screw and washer (item 7SC), or for motor horsepowers less than 1 HP, install the impeller with a locking compound such as Loctite.
8. Install the case o-ring (item 500). Replace if brittle, damaged or misshapen.
9. **Model SSPC Only:** Install the suction o-ring (item 510). Replace if brittle, damaged or misshapen.
10. **Model SSPC Only:** Join up the back pull out assembly with the case. Do not force the pump into the case. The suction O-ring (item 510) can be pinched when installing. You may have to back out the pump from the case, center up the O-ring with your finger and slip in the pump assembly again. Before installing the case bolts, check to be sure the impeller is spinning freely.
11. **Model SSP Only:** Join up the back pull out assembly with the case. Install the (8) case bolts (item 7CS), leaving the bottom two bolts loose for attaching the base (not necessary with footed motors). Slip the baseplate under the bottom two bolts. Tighten the case bolts while holding the baseplate in place.
12. **Model SSP Only:** Check the impeller to case clearance per the following instructions and adjust as needed.
13. Install and tighten the motor base hold down bolts.

Setting Impeller Clearance: Model SSP Only

- ☑ **See *SSP Performance Notes* for impeller shimming discussion.**
- ☑ **Properly setting the impeller to case clearance is the most critical factor in determining the SSP's performance.** You will get maximum performance and efficiency (and maximum amp draw) with near to zero clearance. Factory standard clearance is 8 to 12 mil. Spacer/Washers to adjust clearances are available in 10 mil and 15-mil thickness.
- ☑ You can have more or less than normal flow and head by changing the clearance. To increase clearance, remove impeller spacer/washers. To decrease clearance, add impeller spacer/washers. **Be aware that if you set the impeller at near to zero clearance, and operate near maximum flow rates, you may overload the standard motor. Also be aware that impeller clearances near zero greatly increase the risk of the impeller grinding against the casing.**
- ☑ Standard factory settings for spacers are 30 to 90 mils of spacer/washers to obtain 10-mil clearance. Since the tolerances of the motor shaft and pump parts can stack up, some pumps may need more or less than this standard. Some special OEM assemblies will not have any spacers when the customer elects to accept reduced performance in return for ease of assembly.
- ☑ American Stainless Pumps provides special feeler gauges for impeller shimming. Call and order our feeler gauge set, part number K200. Our standard shim pack set is also available. It contains ten each of the 0.010" and 0.015" shims.

Use the following impeller shimming method when building a new pump:

- ☑ American Stainless Pumps provides special feeler gauges for impeller shimming. Call and order our feeler gauge set, part number K200. Our standard shim pack set is also available. It contains ten each of the 0.010" and 0.015" shims. Use part number 200115.

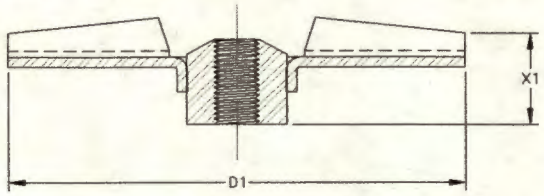
1. Place the pump (as assembled through step 4 on page 47) on the workbench, positioned vertically.
2. Place 0.050" shims onto the motor shaft (two 0.015" shims and two 0.010" shims).
3. Thread the impeller onto the shaft, compressing the seal and shims. You will need to hold the motor shaft from the rear of the motor with a large screwdriver, wrench or vise grips while tightening the impeller.
4. Place case o-ring (item 500) onto seal plate. Make sure o-ring is laying flat against the seal plate flange.
5. Place case onto pump assembly, and install case screws (item 7CS). Tighten case screws in a cross-bolting fashion.
6. Rotate the impeller from the back of the motor, or with your finger through the suction or discharge nozzles. Listen and feel for any scraping noises from the impeller hitting the casing. If a scraping noise is heard, remove the case and impeller, and then remove either one 10 or one 15 mil shim. Repeat step 5 & 6. If no noise is heard, proceed to step 7.
7. Use the pink feeler gauge (0.015"), and slide it in between the impeller and the casing through the discharge nozzle. If the pink feeler gauge does not fit, go back to step 6 and remove shims as necessary to make pink gauge slide in between impeller and casing. When done correctly, the feeler gauge will become visible through the suction nozzle. Continue pushing the feeler gauge into the casing until it is all the way in, and centered across the face of the impeller. Rotate the feeler gauge using a pair of needle nose pliers, and feel for tight spots. If gauge encounters only a slight pinching resistance, you probably have a good impeller clearance. Remove the pink feeler gauge, and check to see that the brown feeler gauge (0.010") does not bind when used in the same way. If it does not, go to step 9. If it does, remove 0.010 mils of shims from behind impeller and repeat step 7. If the pink feeler gauge is free to rotate 360 degrees across the face of the impeller without binding or resistance, go to step 8.
8. If the pink gauge is capable of rotating 360 degrees without binding, then there is a greater impeller/casing clearance than 0.015". Determine this clearance by repeating step 7 with the thicker gauges. Yellow=0.020", White=0.025", Orange=0.030". If clearance is larger than 0.030", stack the various gauge thickness and repeat procedure until clearance is known. When clearance is determined, add shims behind the impeller to close clearance as desired. Repeat step 7.
9. Proper clearance has been established. Return to step 5 on the previous page.

Model SSP Impeller Shimming Method for Replacement Impellers

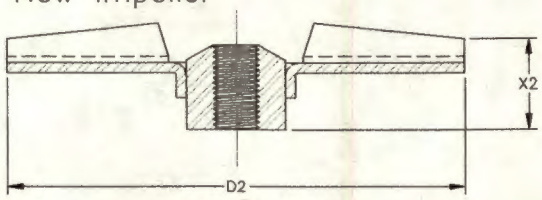
When replacing impellers in a model SSP open impeller pump, the following worksheet will provide a relatively quick method for maintaining the proper impeller/casing clearance. You may also want to read the previous page for an overview of the impeller shimming procedure.

REPLACEMENT IMPELLER SHIMMING PROCEDURE

Old Impeller



New Impeller



1. Measure D1, X1, D2, & X2. (Measure X1 & X2 as accurately as possible)

   D1=_____ X1=_____ D2=_____ X2=_____

2. Determin K1 & K2.

Impeller Diamerer D	K
3-3/4	-0.033
4-3/8	0.0
5-1/4	0.046

   K1=_____ K2=_____

3. Calculate H1 & H2
   H1=X1+(K1) H2=X2+(K2)

   H1=_____ H2=_____

4. Calculate S.
   S=H1-H2

   Round S to the nearest 0.005 increment.

   If S>0, then add shims equal to S.
   If S<0, subtract shims equal to S.

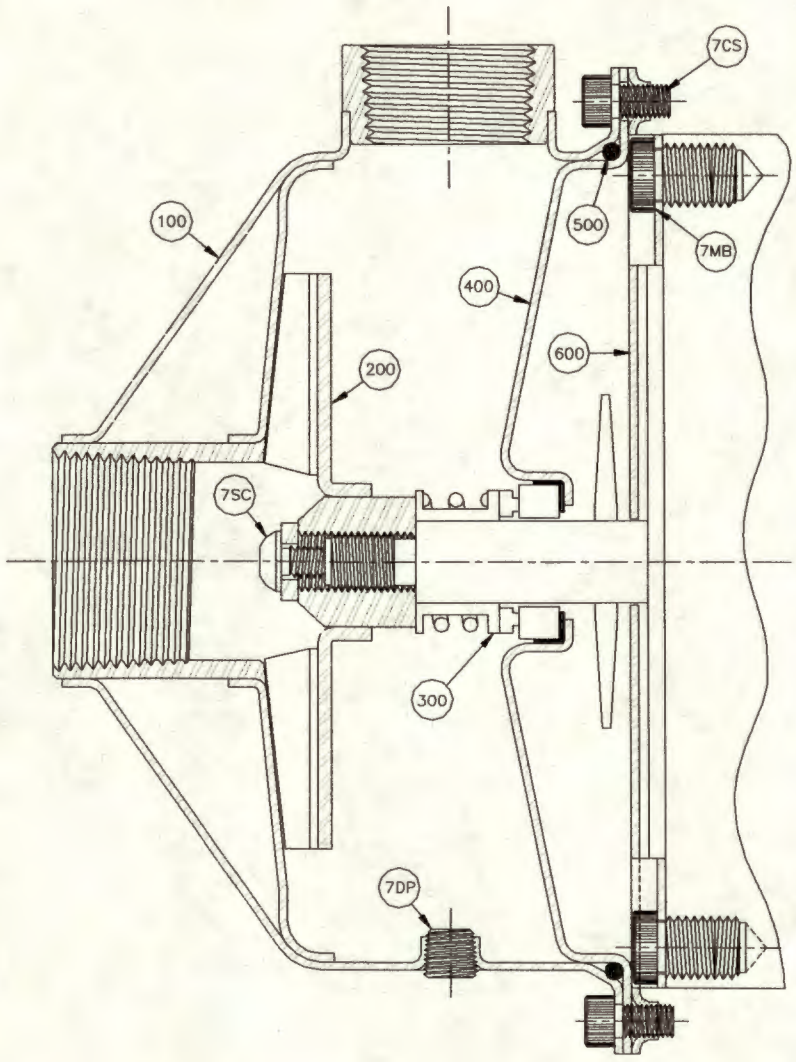
NO.	REVISION DESCRIPTION	DATE
0	ORIGINAL DRAWING	XX/XX/XX

NOTES: & WHEN NOT NOTED OTHERWISE:
NO SHARP EDGES
FILLET ALL CORNERS TO 0.01
RADIAL & DIAMETRICAL DIMENSIONS ARE TO BE HELD TO A ±0.002 SYMMETRICAL TOLERANCE, AND ARE CONCENTRIC WITH PART CENTERLINES.
ALL DIMENSIONS ARE IN INCHES
PLEASE CALL (310) 630-8089 IF THERE ARE ANY QUESTIONS OR COMMENTS RELATED TO THIS DRAWING

STANDARD TOLERANCES	
0.X	±0.01
0.XX	±0.005
0.XXX	±0.002
0.XXXX	±0.0005

AMERICAN STAINLESS PUMPS
SSP IMPELLER SHIM GUIDE 12/13/00
IMWC
...\ASP\SSP\XXXXXXXX.DWG 0

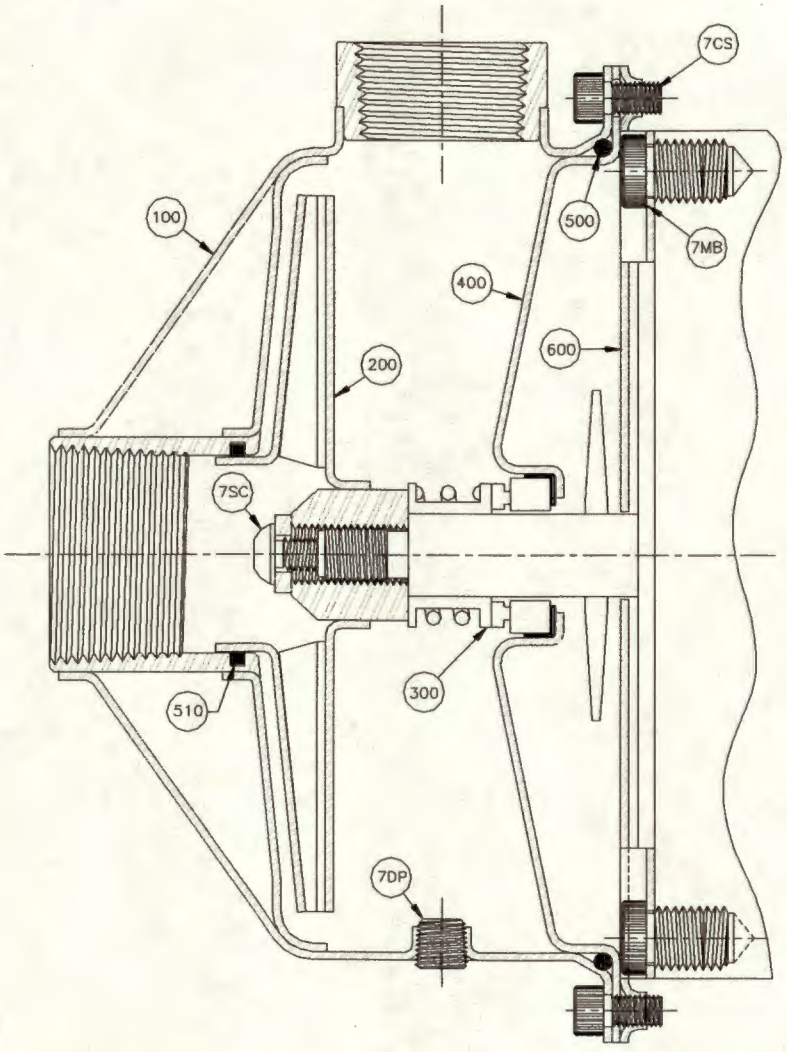
SSP (Open Impeller) Cross Sectional Drawing



Item No.	Part Description	Standard Materials
100	Casing	304 SS
200	Impeller (Open)	304 SS
300	Mechanical Seal - Type 6 (std.) (Other seal types available)	Car/Cer/Buna N/316 SS (Other materials available)
400	Seal Plate	304 SS
500	Casing O-Ring	Buna N (Other materials available)
600	Motor Adapter Plate	304 SS
7CS	Casing Screw - 1/4-20 (3/16 Allen)	Nickle Plated Steel
7DP	Drain Plug - 1/8" NPT	304 SS
7MB	Motor Bolt - 3/8-16 (7/32 Allen)	304 SS
7SC	Impeller Screw - 10-32LH (1/8 Allen) (Standard on 3-Ph motors 1-hp or larger)	304 SS
800 (not shown)	Pump Base (not supplied with footed motors)	304 SS

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

SSPC (Enclosed Impeller) Cross Sectional Drawing



Item No.	Part Description	Standard Materials
100	Casing	304 SS
200	Impeller (Enclosed)	304 SS
300	Mechanical Seal - Type 6 (std.) (Other seal types available)	Car/Cer/Buna N/316 SS (Other materials available)
400	Seal Plate	304 SS
500	Casing O-Ring	Buna N (Other materials available)
510	Impeller O-Ring	Buna N (Other materials available)
600	Motor Adapter Plate	304 SS
7CS	Casing Screw - 1/4-20 (3/16 Allen)	Nickle Plated Steel
7DP	Drain Plug - 1/8" NPT	304 SS
7MB	Motor Bolt - 3/8-16 (7/32 Allen)	304 SS
7SC	Impeller Screw - 10-32LH (1/8 Allen) (Standard on 3-Ph motors 1-hp or larger)	304 SS
800 (not shown)	Pump Base (not supplied with footed motors)	304 SS

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

SSP & SSPC Product Description

The models SSP and SSPC are similar pumps. The model SSP is the open-impeller version, and the model SSPC is the enclosed-impeller version of the same pump. The dimensions of both pumps are identical. The SSP(C) is a single-stage, close-coupled, back-pullout centrifugal pump, fabricated of 304 stainless steel.

The SSP(C) was designed primarily for the commercial OEM marketplace. Our goal was to provide a new pumping alternative that met the following conditions:

Lower Cost

The model SSP(C) is priced lower than any other comparable stainless steel pump on the market. In fact, in most cases the SSP(C) is less expensive than similar cast iron or plastic pumps.

Durability

The SSP(C) was designed to provide long lasting service. The stainless steel materials of construction, heavy-duty nozzles and impellers, rigid case design, and large mechanical seal selection assure a long pump life.

Versatility

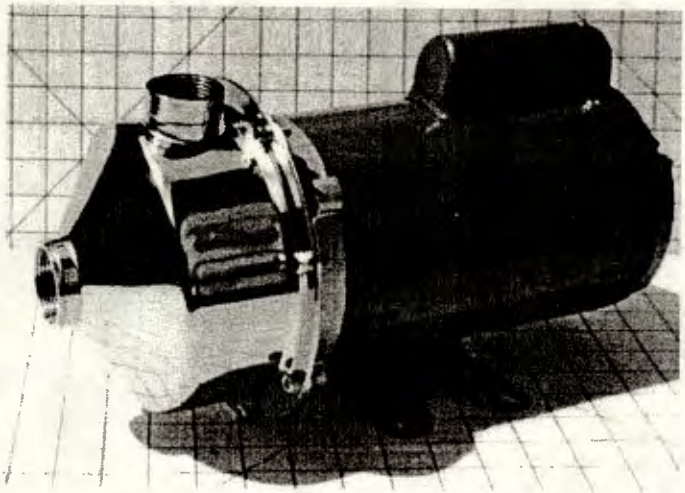
We wanted the SSP(C) to be able to perform well in a variety of applications; and we knew that our customers all had different requirements. That's why we designed our pump to be easily modified or customized, to fit each application's essentials. We have over 50 different impeller designs, and can mount our pump in almost any configuration.

High Efficiency

The SSP(C) is often times, more efficient than the competition's pumps. This is attributable to the smooth surface finishes provided by stainless steel sheet, and our computer aided impeller and casing designs. In many cases, an SSP can be installed with a lower horsepower motor than your previous pump.

Better Looking

Judge for yourself. We think the SSP is the best looking pump on the market. If you're using someone else's rusty cast iron pump, or one of our competitor's bulky stainless pumps, the SSP(C) will definitely be an upgrade.



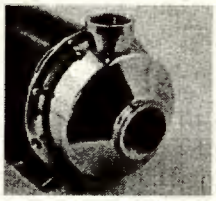
14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS

Stainless Steel Pumps for the Commercial Marketplace

The models SSP & SSPC offer the following features and benefits when compared with other similarly formed stainless steel centrifugal pumps.

The SSP outer case is a one-piece shell, capable for supporting the pump and motor weight in a vertically mounted position. Many of our competitors formed cases cannot be mounted on the suction nozzle and must use the motor as a support, or have a special mounting base. Our internal design also prevents any air from being trapped in the pump case when mounted vertically, something our competitors cannot say.



The suction and discharge nozzles on the SSP & SSPC are machined from stainless pipe, and have an extra heavy wall thickness. These nozzles cannot be easily damaged in shipment or during installation, as can the nozzles of our competitors' pumps.

Impellers on pumps supplied with 3-phase motors of 1.5-hp or larger, come as standard with a left-hand thread locking screw. This screw prevents the impeller from backing off the motor shaft at start up, if the motor is started in reverse rotation. Our competitors do not have a positive locking mechanism on their equivalent pump, and damaged impellers, cases and motors are often the victims of a reverse rotation start.

The SSP & SSPC do not have a volute design casing, which can put a radial load on the motor bearing; and no diffuser to plug up, wear out, or replace. The unique case/impeller design acts as a vaneless diffuser, to convert velocity to pressure. This results in higher efficiencies, lower horsepower, and increased reliability.

The case bolts on the SSP & SSPC are American National, not metric screws like so many of our competitors use in their pumps.

The SSP & SSPC come as standard with an inexpensive Type 6, carbon v. ceramic, with Buna N elastomers, mechanical seal. This seal is easy to install and replace, can be purchased at any seal supply store, and is relatively inexpensive. We also offer upgraded type 21 seals, with viton or EPR elastomers, and silicon carbide faces as options. Our competitors use a very expensive, non-standard seal as their standard seal, and charge to change to a less expensive seal.

The SSP & SSPC are priced to beat the competition, without the onerous stocking and purchasing conditions set by our competitors. For volume users, the models SSP & SSPC can be customized in many ways, to better fit our customer's requirements. We offer two day shipments on standard product orders, and just in time deliveries for our blanket order customers.

www.aspumps.com

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS

Stainless Steel Pumps for the Commercial Marketplace

SSP & SSPC Product Code

C 1 56 25 B 1 T 1 X Sample code for a model SSPC, size 1x1.25 with a 5.75" diameter impeller, 0.250 Vane height (at 4.38" diameter), Carbon/Ceramic/Buna Type 6 mechanical seal, with a 1 HP, TEFC, 1/60/115-230V motor, and with a special construction code letter.

1/9/2001

1st Symbol	Pump Model	S = SSP: Open Impeller, 304SS Pump, 6 inch case, threaded connections C = SSPC: Closed Impeller, 304SS Pump, 6 inch case, threaded connections
2nd Symbol	Size Code Discharge x Suction	1 = 1.0" x 1.25" NPT 2 = 1.5" x 2.0" NPT
3rd & 4th Symbol	Impeller Diameter	Digits indicate impeller diameter in inches, and eighths of an inch. Examples: 43 = 4.38", 56 = 5.75"
5th & 6th Symbol	Impeller Vane Height (at a reference diameter of 4.38")	Two digits indicate vane height at 4.38" diameter, as indicated on performance curve. Example: 25 indicates an average vane height of approximately 0.250 inch at 4.38". (Note: if the impeller diameter is larger than 4.38", the vane height at the outside diameter will be smaller than the size code.)

7th Symbol — Mechanical Seal Type & Materials

Type 6

B = Car/Cer/Buna	Stock	(Std.)
E = Car/Cer/EPR	Stock	

X = Special

Type 21

4 = Car/SiC/Viton	Stock
5 = Car/Cer/Viton	Stock
7 = SiC/SiC/EPR	
8 = SiC/SiC/Viton	Stock

9 = Car/TC/Buna

X = Special

Material Index

Material Format:
Rotating Face/Stationary Face/Elastomer
Car = Carbon
Cer = Ceramic
SiC = Silicon Carbide
TC = Tungsten Carbide

Note:
Standard case and impeller o-ring material will match seal elastomer as selected above.

8th Symbol	Motor HP	A = 1/3 HP	1 = 1 HP	3 = 3 HP
		B = 1/2 HP	E = 1.5 HP	5 = 5 HP
		C = 3/4 HP	2 = 2 HP	
9th Symbol	Motor Enclosure	D = Dripproof	X = Explosion Proof	
		T = TEFC	W = Washdown Duty	

10th Symbol — Motor Power Details

Power Rating	3500 RPM	1750 RPM	2900 RPM
1/60/115-230V	1	A	
1/60/230V	2	B	
3/60/230-460V	3	C	
3/60/460V	4	D	
3/60/575V	5	E	
1/50 or 1/60 (dual)	V	G	V
3/50 or 3/60 (dual)	S	U	S
Special	X	X	X
1/50/110-220V			W
1/50/220V			Y
3/50/380V			Z

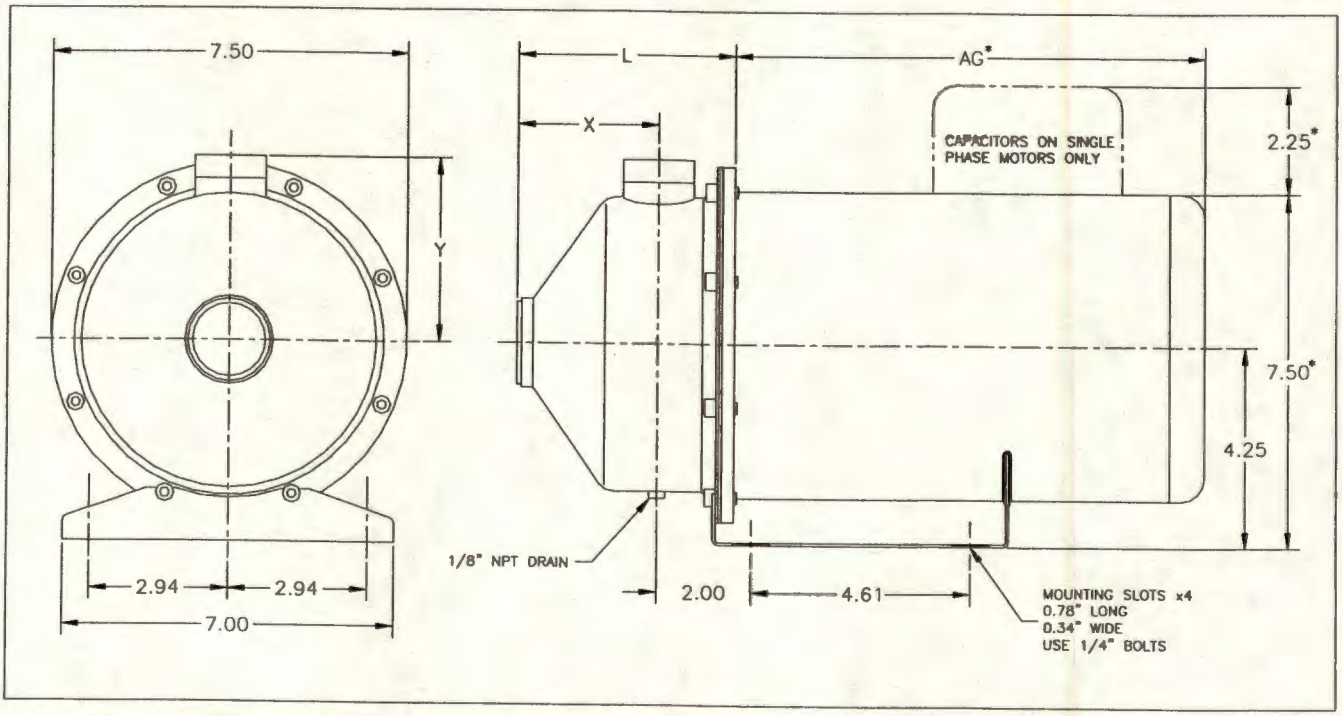
11th Symbol Up	Special Construction Code. Consult factory for pricing and details. May Indicate special OEM configuration.	F = Footed Motor T = Thermal Overload Protection (3 phase motors only) L = Pump less base.

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS
Stainless Steel Pumps for the Commercial Marketplace

SSP & SSPC Dimensions

With Standard Pump Base



* Dimensions may vary by motor manufacturer and motor enclosure. Weights and dimensions listed are the largest for each motor horsepower size likely to be encountered. "Certified for Construction" drawings are available upon request.

Size	Suction	Discharge	L	X	Y	Motor HP	AG	Ship Wgt.
1SSP/C	1.25 NPT	1.0 NPT	4.7	3.1	3.9	1/2	10.0	29
						3/4	10.3	31
						1.0	11.3	33
						1.5	11.5	37
						2.0	12.1	42
						3.0	12.5	51
2SSP/C	2.0 NPT	1.5 NPT	4.3	2.7	4.5	1.0	11.3	33
						1.5	11.5	37
						2.0	12.1	42
						3.0	12.5	51
						5.0	13.5	55

All dimensions in inches. Shipment weight includes packaging.

3/1/2001

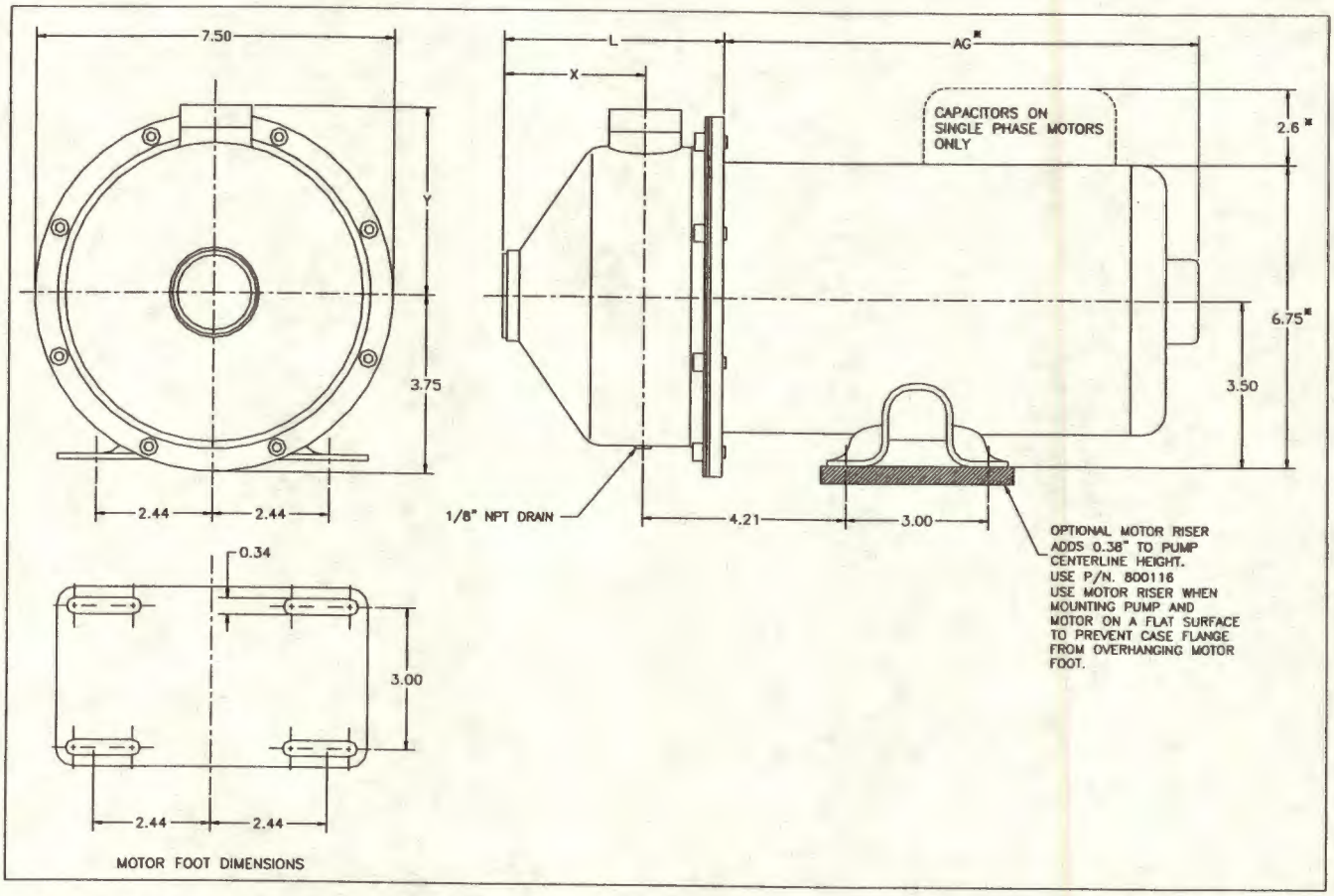
www.aspumps.com
14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS

Stainless Steel Pumps for the Commercial Marketplace

SSP & SSPC Dimensions

With Standard Footed Motor



* Dimensions may vary by motor manufacturer and motor enclosure. Weights and dimensions listed are the largest for each motor horsepower size likely to be encountered. "Certified for Construction" drawings are available upon request.

Size	Suction	Discharge	L	X	Y	Motor HP	AG	Ship Wgt.
1SSP/C	1.25 NPT	1.0 NPT	4.7	3.1	3.9	1/2	10.0	29
						3/4	10.3	31
						1.0	11.3	33
						1.5	11.5	37
						2.0	12.1	42
						3.0	12.5	51
2SSP/C	2.0 NPT	1.5 NPT	4.3	2.7	4.5	1.0	11.3	33
						1.5	11.5	37
						2.0	12.1	42
						3.0	12.5	51
						5.0	13.5	55

All dimensions in inches. Shipment weight includes packaging.

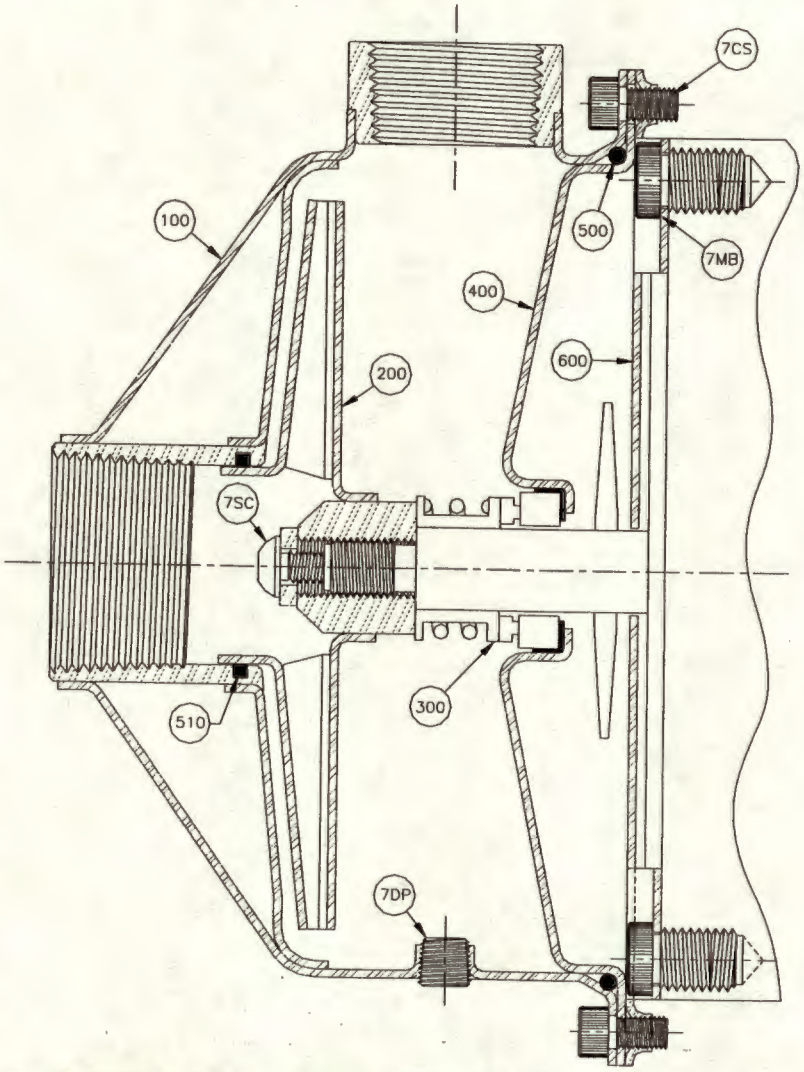
www.aspumps.com

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS

Stainless Steel Pumps for the Commercial Marketplace

SSPC (Enclosed Impeller) Cross Sectional Drawing



Item No.	Part Description	Standard Materials
100	Casing	304 SS
200	Impeller (Enclosed)	304 SS
300	Mechanical Seal - Type 6 (std.) (Other seal types available)	Car/Cer/Buna N/316 SS (Other materials available)
400	Seal Plate	304 SS
500	Casing O-Ring	Buna N (Other materials available)
510	Impeller O-Ring	Buna N (Other materials available)
600	Motor Adapter Plate	304 SS
7CS	Casing Screw - 1/4-20 (3/16 Allen)	Nickle Plated Steel
7DP	Drain Plug - 1/8" NPT	304 SS
7MB	Motor Bolt - 3/8-16 (7/32 Allen)	304 SS
7SC	Impeller Screw - 10-32LH (1/8 Allen) (Standard on 3-Ph motors 1-hp or larger)	304 SS
800 (not shown)	Pump Base (not supplied with footed motors)	304 SS

www.aspumps.com

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

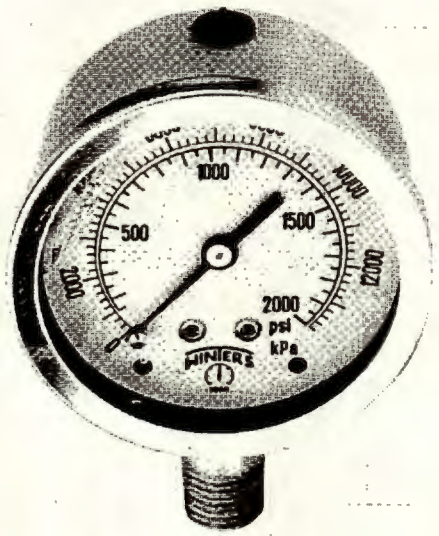
3/1/01

WINTERS 1953

PI-104

LF SERIES QUALITY

Quality Gauge



Features:

- 1 1/2" (40mm), 2 1/2" (63mm), and 4" (100mm) dials with black and red markings
- 304 stainless steel case
- Brass internals or stainless steel internals
- Liquid filled or dry
- 1 1/2" (40mm) - 2.5% accuracy filled, ANSI/ASME Grade B
- 2 1/2" (63mm) - 1.6% accuracy filled, ANSI/ASME GRADE A. 1% dry, ANSI/ASME Grade 1A.
- 4" (100mm) - 1.6% accuracy filled, ANSI/ASME GRADE B. 1% dry, ANSI/ASME Grade 1A.
- 1/8", 1/4", 1/2" npt bottom or back connection
- Restrictor screw standard

Applications:

- Pumps, compressors, hydraulic presses & machinery, motors, winches etc. Whenever a quality liquid filled gauge is required.

How to order: Specify product code

PRODUCT CODES

Dial Size	1 1/2" (40mm)		2 1/2" (63mm)		4" (100mm)				4" (100mm)			
Connection	Bottom	Back	Bottom	Back	Bottom	Bottom	Back	Back	Bottom	Bottom	Back	Back
Tube, Socket & Movement	Brass	Brass	Brass	Brass	Brass	Brass	Brass	Brass	Stainless	Stainless	Stainless	Stainless
NPT Connection	1/8"	1/8"	1/4"	1/4"	1/4"	1/2"	1/4"	1/2"	1/4"	1/2"	1/4"	1/2"
30" Hg Vacuum/kPa	*	*	Q801	Q900	Q700	*	Q730	*	Q760	*	Q1260	*
30"-0-15 psi/kPa	*	*	Q790	Q890	Q701	*	Q731	*	Q761	*	Q1261	*
30"-0-30 psi/kPa	*	*	Q798	Q898	Q702	*	Q732	*	Q762	*	Q1262	*
30"-0-60 psi/kPa	*	*	Q799	Q899	Q703	*	Q733	*	Q763	*	Q1263	*
30"-0-100 psi/kPa	*	*	Q791	Q891	Q704	*	Q734	*	Q764	*	Q1264	*
30"-0-150 psi/kPa	*	*	Q792	Q892	Q705	*	Q735	*	Q765	*	Q1265	*
30"-0-200 psi/kPa	*	*	Q794	Q894	Q706	*	Q736	*	Q766	*	Q1266	*
30"-0-300 psi/kPa	*	*	Q795	Q895	Q707	*	Q737	*	Q767	*	Q1267	*
0-15 psi/kPa	*	*	Q800	Q901	Q708	*	Q738	*	Q768	*	Q1268	*
0-30 psi/kPa	Q1102	Q1122	Q802	Q902	Q709	*	Q739	*	Q769	*	Q1269	*
0-60 psi/kPa	Q1103	Q1123	Q803	Q903	Q710	*	Q740	*	Q770	*	Q1270	*
0-100 psi/kPa	Q1104	Q1124	Q804	Q904	Q711	*	Q741	*	Q771	*	Q1271	*
0-160 psi/kPa	Q1105	Q1125	Q805	Q905	Q712	*	Q742	*	Q772	*	Q1272	*
0-200 psi/kPa	Q1106	Q1126	Q806	Q906	Q713	*	Q743	*	Q773	*	Q1273	*
0-300 psi/kPa	Q1107	Q1127	Q807	Q907	Q714	*	Q744	*	Q774	*	Q1274	*
0-400 psi/kPa	*	*	Q817	Q917	Q715	*	Q745	*	Q775	*	Q1275	*
0-600 psi/kPa	Q1108	Q1128	Q808	Q908	Q716	*	Q746	*	Q776	*	Q1276	*
0-1000 psi/kPa	Q1109	Q1129	Q809	Q909	*	Q717	*	Q747	*	Q777	*	Q1277
0-1500 psi/kPa	Q1110	Q1130	Q816	Q914	*	Q718	*	Q748	*	Q778	*	Q1278
0-2000 psi/kPa	Q1111	Q1131	Q810	Q910	*	Q719	*	Q749	*	Q779	*	Q1279
0-3000 psi/kPa	Q1112	Q1132	Q811	Q911	*	Q720	*	Q750	*	Q780	*	Q1280
0-5000 psi/kPa	Q1113	Q1133	Q812	Q912	*	Q721	*	Q751	*	Q781	*	Q1281
0-10000 psi/kPa	*	*	Q813	Q913	*	Q722	*	Q752	*	Q782	*	Q1282
0-15000 psi/kPa	*	*	*	*	*	Q723	*	Q753	*	Q783	*	Q1283
0-20000 psi/kPa	*	*	*	*	*	*	*	*	*	*	*	*

Options:

Dry = supply above gauge less liquid fill
25UC = 2.5" (63mm) U-Clamp
25BF = 2.5" (63mm) Back Flange
25FF = 2.5" (63mm) Front Flange
4UC = 4" (100mm) U-Clamp
4BF = 4" (100mm) Back Flange
4FF = 4" (100mm) Front Flange

Other ranges available upon request.

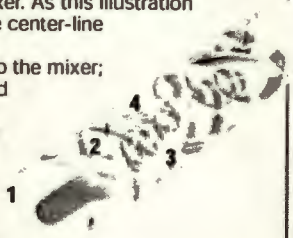
* Available upon request.

In-Line Static Mixers

These economical, long-lasting, in-line mixers are more convenient than most motorized mixers. Instead of mixing fluids with a motorized mixer before pumping them through a pipe line, you can mix fluids as you pump them through a pipe line. In-line mixers prevent overmixing and undermixing, and resist fouling in your pipes or tubes. They are virtually maintenance free and need no spare parts.

In-line mixers provide efficient mixing and can withstand large pressure changes—up to 1500 psi with smallest sizes. Mixing elements in pipe and tube mixers are securely attached to the mixer walls, so internal pressure changes cannot collapse elements and stop flow.

With in-line static mixers, the mixer does not move through the fluid—the fluid moves through the mixer. As this illustration shows, mixing takes place around the center-line and in the direction of flow.
1) Pump pushes a stream of liquid into the mixer;
2) The stream of liquid is then split and forced to the opposite outside walls;
3) A vortex is created along the pipe's centerline axis; 4) The vortex is sheared and the process recurs with the opposite rotation. This clockwise/counterclockwise motion mixes the liquid to ensure a homogeneous end product.



Use the Reynolds equation and the table below to determine the minimum number of elements you need for efficient mixing.

Reynolds equation: $Re = \frac{3157QS}{\mu D}$

Re = Reynolds number
Q = Flow rate (gallons per minute)
S = Specific gravity
μ = Viscosity (centipoise)
D = Inside pipe diameter (inches)

Reynolds number	Elements required
>1000	6
500 to 1000	12
10 to 500	18
<10	24

Disposable In-Line Mixers

Ideal for your one-time mixing applications, these disposable polyacetal mixers are available unmounted or mounted in polypropylene tubing. Adjust unmounted mixer length to get optimal mixing action—shorten by cutting or extend by using more than one mixer.

Unmounted Mixers can be used with any standard tubing having the same tubing ID as the element OD given in the table. They work well with flexible tubing.

Catalog number	Element OD (tubing ID)	Number of elements	Mixer length	Price/ pk of 10
P-04667-02	3/16"	12	2⅜"	
P-04667-12		24	4⅝"	
P-04667-04	¼"	12	3"	
P-04667-14		24	6"	
P-04667-06	⅜"	12	4⅝"	
P-04667-16		24	9⅜"	
P-04667-08	½"	12	6¼"	
P-04667-18		24	12⅜"	

Mounted Mixers can be used with any compression fitting with the same tubing OD (see pages 278-286).

Catalog number	Tubing OD	Number of elements	Mixer length	Price/ pk of 10
P-04668-02	5/16"	12	3½"	
P-04668-12		24	5¾"	
P-04668-04	⅜"	12	4¼"	
P-04668-14		24	7¼"	
P-04668-06	½"	12	6½"	
P-04668-16		24	11¼"	
P-04668-08	⅝"	12	8½"	
P-04668-18		24	14½"	

SM-100

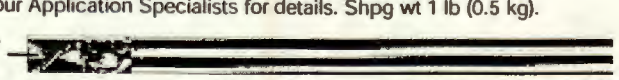
Pipe Mixers

Install these mixers directly into your process line to achieve a 100% mixed output—mixing elements are welded inside the pipe. All mixers have threaded ends. Choose PVC, 316 stainless steel, or KYNAR® construction material. The clear PVC mixers are ideal for a visual check of your mixing processes. Models with removable elements, or with elements made of TEFLON® PFA resin are available on request—call our Application Specialists for details.

Catalog number	NPT(M)	No. of elements	Pipe ID	Mixer length	Shpg wt lb (kg)	Price
Clear PVC schedule 40 pipe mixers						
P-04669-85	⅛"	6	0.473"	6½"	1 (0.5)	
P-04669-87		12		11"	1 (0.5)	
P-04669-89	¼"	6	0.602"	7"	1 (0.5)	
P-04669-91		12		12"	1 (0.5)	
P-04669-92	¾"	6	0.804"	9"	1 (0.5)	
P-04669-93		12		15"	1 (0.5)	
P-04669-94	1"	6	1.029"	11"	1 (0.5)	
P-04669-95		12		18"	1 (0.5)	
P-04669-96	1½"	6	1.590"	15"	1 (0.5)	
P-04669-97		12		28"	2 (1.0)	
P-04669-98	2"	6	2.047"	19"	2 (1.0)	
P-04669-99		12		35"	3 (1.4)	
Standard PVC schedule 80 pipe mixers						
P-04669-00	¼"	6	0.62"	5"	1 (0.5)	
P-04669-06		12		10"	1 (0.5)	
P-04669-02	¾"	6	0.82"	7"	1 (0.5)	
P-04669-08		12		14"	1 (0.5)	
P-04669-04	1"	6	1.05"	10"	1 (0.5)	
P-04669-10		12		19"	1 (0.5)	
316 stainless steel pipe mixers						
P-04669-12	¼"	6	0.62"	5"	1 (0.5)	
P-04669-18		12		10"	1 (0.5)	
P-04669-14	¾"	6	0.82"	7"	1 (0.5)	
P-04669-20		12		13"	2 (1.0)	
P-04669-16	1"	6	1.05"	9"	2 (1.0)	
P-04669-22		12		17"	3 (1.4)	
KYNAR schedule 80 pipe mixers						
P-04669-30	¾"	6	0.82"	6"	1 (0.5)	
P-04669-34		12		12"	1 (0.5)	
P-04669-32	1"	6	1.05"	8"	1 (0.5)	
P-04669-36		12		16"	1 (0.5)	

Tube Mixers

These mixers consist of a series of fixed right- and left-hand elements. Tube and mixing elements are made of 316 stainless steel—ideal for mixing high-viscosity fluids such as epoxies. Mixers have plain ends and accept standard tube fittings (see pages 278-286 for compression fittings). Food grade tube mixers with TRI-CLAMP® flanges are available—call our Application Specialists for details. Shpg wt 1 lb (0.5 kg).



Catalog number	Tube OD	No. of elements	Tube ID	Mixer length	Viscosity (cp)	Price
P-04669-50	3/16"	17	0.13"	4⅞"	0 to 200	
P-04669-52		21		6"	0 to 200	
P-04669-54		27		7½"	200 to 750	
P-04669-56	¼"	21	0.19"	7"	0 to 200	
P-04669-58		27		9¼"	200 to 750	
P-04669-60		34		11½"	750 and up	
P-04669-62	⅜"	21	0.32"	11"	0 to 200	
P-04669-64		27		14"	200 to 750	
P-04669-66		32		17"	750 and up	
P-04669-68	½"	15	0.43"	11⅞"	0 to 200	
P-04669-70		21		16⅜"	0 to 200	
P-04669-72		32		24¾"	750 and up	

KYNAR—Reg TM Elf Atochem North America
TEFLON—Reg TM E. I. DuPont de Nemours & Co. TRI-CLAMP—Reg TM Tri-Clover, Inc.

ShallowTray® Low Profile Air Stripper Specification Sheet - Polyethylene Systems

ShallowTray Serial #: 2321-5888 **Customer:** BENCHMARK **Intended Ship Date:** _____

gineered By: Dave Cushman Order Date: _____ Submittal Approval Required: ✔ Yes No _____

Design Review: Engineering _____ Sales _____

Additional Treatment Equipment:

System Serial #: _____ **EconoPump Serial #:** _____

I. Special Components / Requirements / Information / Comments

II. Design Criteria

Design Water Flow Rate	30 gpm
Maximum Water Flow Rate	30 gpm, which is considered a ✔ Low Water Flow Design, or ___ a High Water Flow Design, and is based on the blower model selection.
Weir Height	2 " Inlet, 2 " Outlet
Equipment Power Requirements	1 Ø, 230 volts, 60 Hz

INSTALL ALL EQUIPMENT PER APPLICABLE NATIONAL AND LOCAL CODES.
CUSTOMER TO PROTECT EXPLOSION-PROOF MOTORS FROM RAIN.

III. Basic System Components

CAUTION: MAXIMUM PRESSURE OR VACUUM ACROSS PLASTIC SYSTEM = 22" WC

✔ Sump Tank, Cover, Rings	Linear low density polyethylene
2 Stripper Trays (quantity)	High density polyethylene
√ Latches	Zinc-plated steel
✔ Main Blower (with inlet screen and damper)	American Fan Model # AF-12-B12327-7
Minimum Required Blower Performance	300 cfm @ 10 " wc — Blower P/N 500-100-00094
	2 hp, 1 Ø, 230 volts, 3450 rpm — Coupling P/N _____
	60 Hz, ✔ TEFC or ___ EXP — Riser P/N _____
	7 "Blower Inlet Size, 6 "Blower Outlet Size
✔ Blower on Inlet (Pressure system)	Main Blower Sized For:
___ Blower on Outlet (Vacuum system)	10 "wc required for ShallowTray Air Stripper
___ Blowers on In & Out (Combo system)	0 "wc additional available for airstream equipment
✔ Mist Eliminator Pad	Koch style 4310, 4" thick, 304 ss
✔ Spray Nozzle	Hollow cone, 90° pattern, sized for 15 psi, brass
✔ Sight Tube	Brass fittings, Nalgene tubing
✔ Stripper Tray Gaskets	Medium density neoprene sponge rubber
✔ Inlet Piping Connection	Schedule 80 PVC, Brass
✔ Blower and Vent Line Connections	Flexible PVC couplings

IV. Optional Equipment

✔ Frame — Solid steel deck, angle runners, painted.

✔ Air Pressure Gauge (0 - 20 "wc) — Dwyer Magnehelic 2000 series

Gravity Discharge Riser — PVC 80 Piping, with vacuum relief valve

Additional Blower (with inlet screen and damper) — _____ Fan Model #_____

Required Performance — _____cfm @ _____" wc Blower P/N_____
_____hp, ____Ø, _____volts, _____rpm, Hz, ____TEFC or ____EXP
____"Blower Inlet Size, ____"Blower Outlet Size

✔ Feed Pump — American Stainless Pump Model # C143255ET1

Required Performance — 30 gpm @ 50 ' TDH Feed Pump P/N 500-110-05578
1.5 hp, 1 Ø, 230 volts, 3450 rpm, 60 Hz, ✔ TEFC or ____EXP
Port Sizes: 1.25 inch inlet, 1.00 inch outlet. Impeller Size 4.38 inches

✔ Discharge Pump — American Stainless Pump Model # C143255ET1

Required Performance — 30 gpm @ 50 ' TDH Discharge Pump P/N 500-110-05578
1.5 hp, 1 Ø, 230 volts, 3450 rpm, 60 Hz, ✔ TEFC or ____EXP
Port Sizes: 1.25 inch inlet, 1.00 inch outlet. Impeller Size 4.38 inches

✔ Main Disconnect Switch — Integral with electrical enclosure, rotary style, door/cabinet interlocked

Control Panel — Motor starters, system alarm interlock circuit, operator switches. alarm light.
NEMA _____ Enclosure, _____ Amps, _____Ø, _____Volts, _____Hz, _____ wire plus ground

✔ Control Panel w/ Pump Controls — Motor starters, system alarm interlock circuit, pump level control circuit, operator switches, alarm light,
NEMA 4 Enclosure, _____ Amps, 1 Ø, 230 Volts, 60 Hz, 3 wire plus ground

PurgePanel ™ — NEMA 7 Main Disconnect switch, NEMA 4 enclosure, air pressure gauge,
Low air pressure switch, Blower (100 cfm @ 2" w.c.)

✔ Autodialer — Manufacturer Sensaphone (2000)

✔ Control Circuit Transformer — 230 :120vac

Intrinsically-Safe Relay — _____ Pepperl+Fuchs, WE77/Ex2-UL repeater relay Dual Channel, SPDT relay output
_____Warrick 27A1E0 latching relay Single Channel, SPDT relay output

✔ Intermittent Operation — Blower time-delay circuit added to panel design. Blower shuts off 5 minutes after inlet water flow stops.

✔ Auto Operation — # of wells 3

✔ Well Probes — Warrick, series 3W, Cord Length= 60 FT

___Blower Start/Stop Switch — Local blower switch mounted near blower, NEMA _____

✔ Power Lapse Indicator — Black-out / Brown-out indicating light, switch, and circuit added to panel design

___Individual Alarm Light — Light and relay circuit added to panel design

✔ Strobe Alarm Light — ___Red, ___ Blue, Federal Signal, NEMA 4, UL listed

✔ Alarm Horn — Federal Signal

✔ Low Air ✔ Press. ___Vacuum Switch — Dwyer 1950-1, preset at 1.6" wc (range=0.3"wc to1.6" wc), Explosion-proof

___High Air ___Press. ___Vacuum Switch — Dwyer 1950, _____"wc to _____"wc, Explosion-proof

___Low Water Level Alarm Float Switch — Mechanical, SJ Electro, (qty) N.O., (qty)____N.C.

✔ High Water Level Alarm Float Switch — Mechanical, SJ Electro, (qty) N.O., (qty) 1 N.C.

✔ Discharge Pump Float Switch — Mechanical, SJ Electro, (qty) 1 N.O., (qty)____N.C.

✔ Water Flow Meter — Manufacturer Signet

✔ Air Flow Meter — Dwyer 2000-0 meter, single-point insertion pitot tube, mounting kit, & slide rule

✔ Water Press. Gauge, ✔ inlet, ✔ outlet — Dial gauge, liquid-filled

___Water Temp. Gauge, ___inlet, ___outlet — Dial gauge

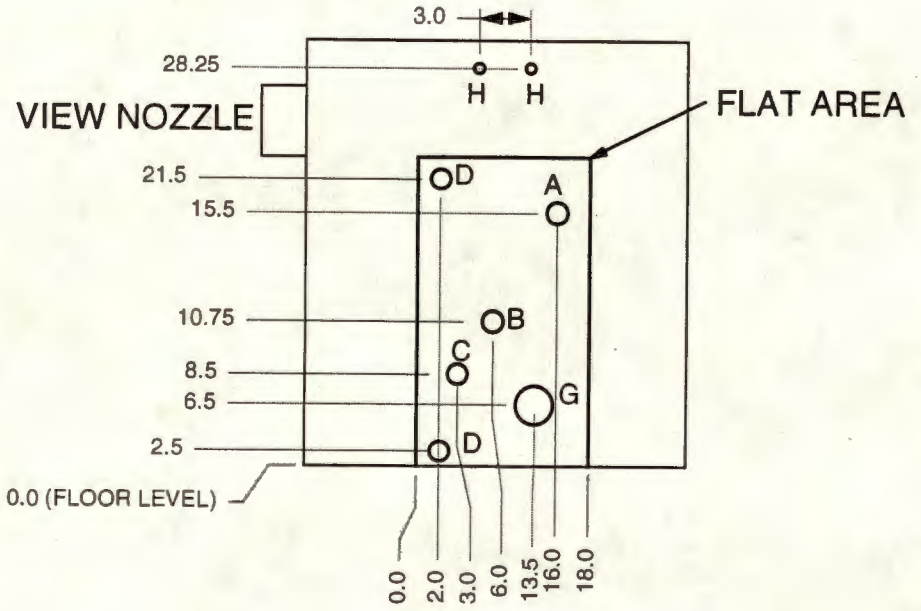
✔ Line Sampling Port, ✔ inlet, ✔ outlet — Schedule 80 PVC

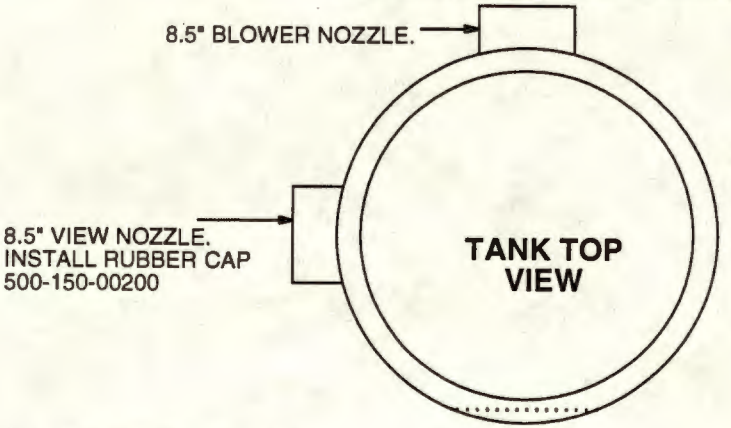
✔ Air Blower Silencer — Manufacturer Clevaflex

___Washer Wand — Nozzle, Elbow, 1/4" steel pipe

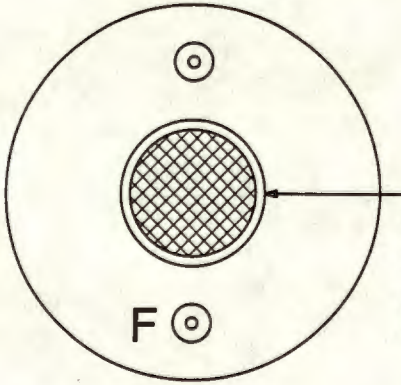
DATE	REV.	ENG.	DESCRIPTION
5-5-94	A	RC	NOTATION FOR OUTLET BULKHEAD SIZE
8-17-94	B	RC	ONLY 3" OUTLET BULKHEAD
6-28-96	C	KM	CHANGE COUPLING LAYOUT FOR NEW TANK
10-2-96	D	RC	FLAT AREA COUPLING LOCATION
10-20-96	E	SAC	Remove 1 1/2" bulkheads
2/4/99	F	RC	REMOVED ONE 1.25" COVER BULKHEAD

TANK SIDE VIEW





COVER TOP VIEW



14" ROUND DEMISTER
500-160-00035
8"X6" RUBBER COUPLING
500-150-00150

CONNECT TO MINIMUM 6"
DIAMETER VENT STACK

BULKHEAD SELECTION-FLOAT SWITCH LOCATION					
CHECK ALL THAT APPLY					
	A		B		C
✔	SWITCH N.C.		SWITCH N.C.		SWITCH N.C.
	SWITCH N.O.		SWITCH N.O.	✔	SWITCH N.O.
	1/2" PLUG	✔	1/2" PLUG		1/2" PLUG
	MOUNT CORD FITTINGS OUTSIDE				

COUPLING	FITTING	P/N	HOLE SIZE	USE
A	1/2"BLKHD	-01155	1-3/8" HOLESAW	FLOAT
B	1/2"BLKHD	-01155	1-3/8" HOLESAW	FLOAT
C	1/2"BLKHD	-01155	1-3/8" HOLESAW	FLOAT
D	1/2"BLKHD	-01150	1-3/8" HOLESAW	SIGHT TUBE
F	1-1/4"BLKHD	-01180	2-3/8" HOLESAW	INLET
G	3"BLKHD	-01191	4-1/2" HOLESAW	OUTLET
H	1/8" NPT	-02735/-02880	11/32" DRILL	AIR BARB

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603)-298-7061 FAX(603)-298-7063

TOLERANCES UNLESS OTHERWISE SPECIFIED : ± .030 in.

DRAWING NAME: 2300P COUPLING LAYOUT

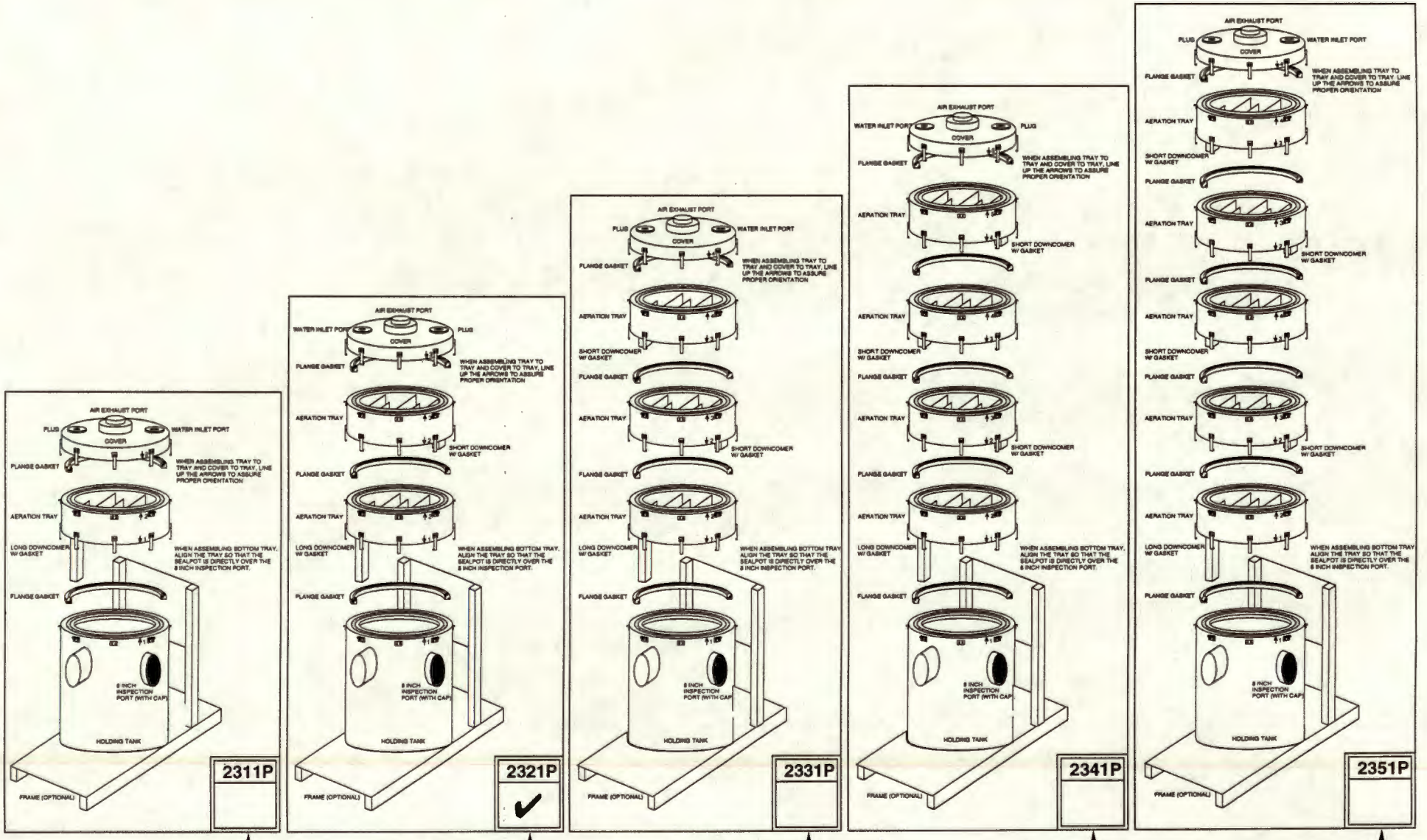
DRAWN: RC

DRAWING #: 900-190-00020

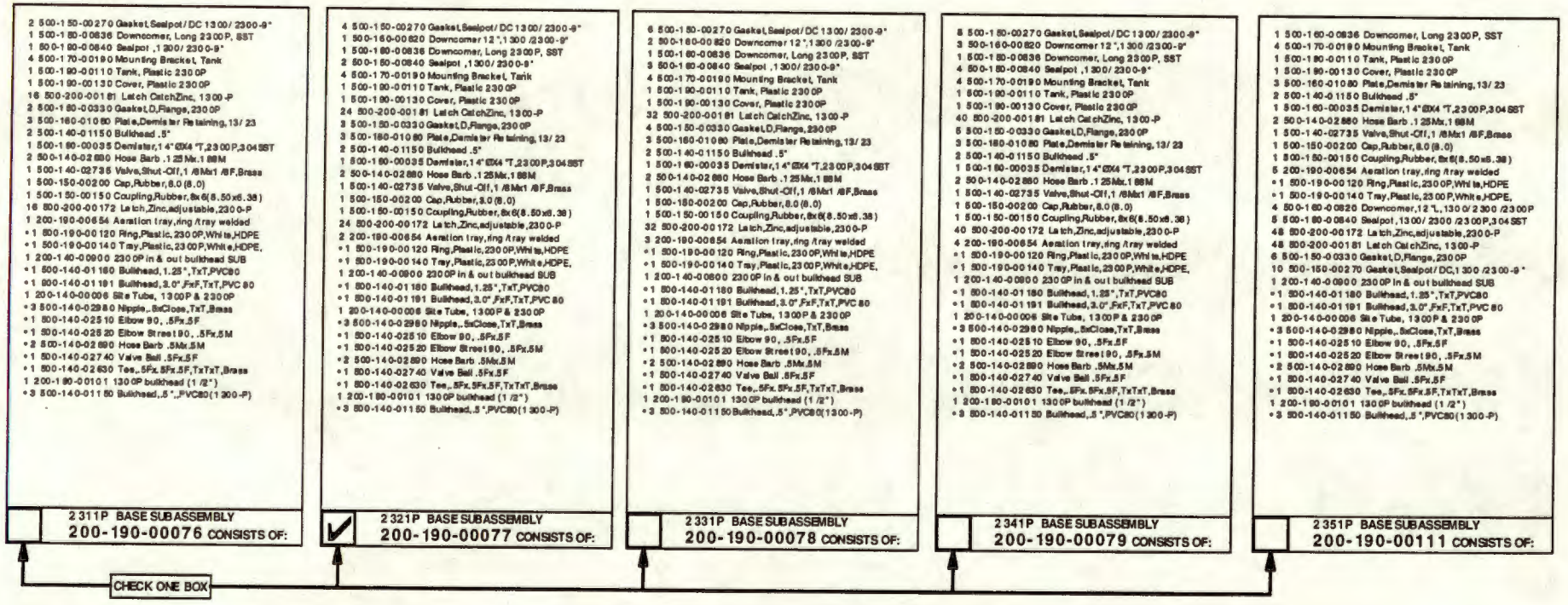
DATE: 3-23-94

SCALE: NONE | SIZE: A | SHEET 1 OF 1

DO NOT SCALE DRAWING



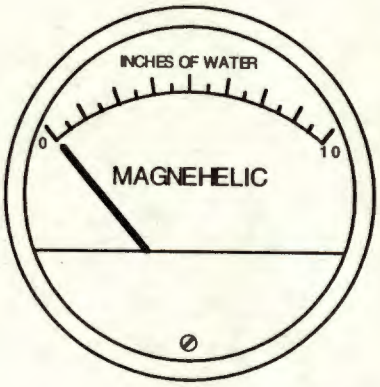
NORTH EAST ENVIRONMENTAL PRODUCTS, INC. 17 TECHNOLOGY DRIVE WEST LEBANON, NH 03784 (603) 298-7061	
TOLERANCES UNLESS OTHERWISE SPECIFIED N/A	DRAWING NAME: 2300P BASE SUBASSEMBLY
	DRAWING #: 900-190-00041-A
DRAWN: KM	CUSTOMER:
DATE: 1/30/96	SCALE:



NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603)-298-7061 FAX(603)-296-7063

TOLERANCES UNLESS OTHERWISE SPECIFIED : ± .005 in.	DRAWING NAME: 2300P SUBASSEMBLY PARTS LIST SHALLOWTRAY TANK LABEL
DRAWN: GC/PC	DRAWING #: 900-190-00036-F
DATE: 6/14/00	SCALE: NONE | SIZE: A | SHEET 1 OF 1
	DO NOT SCALE DRAWING

AIR PRESSURE GAGE

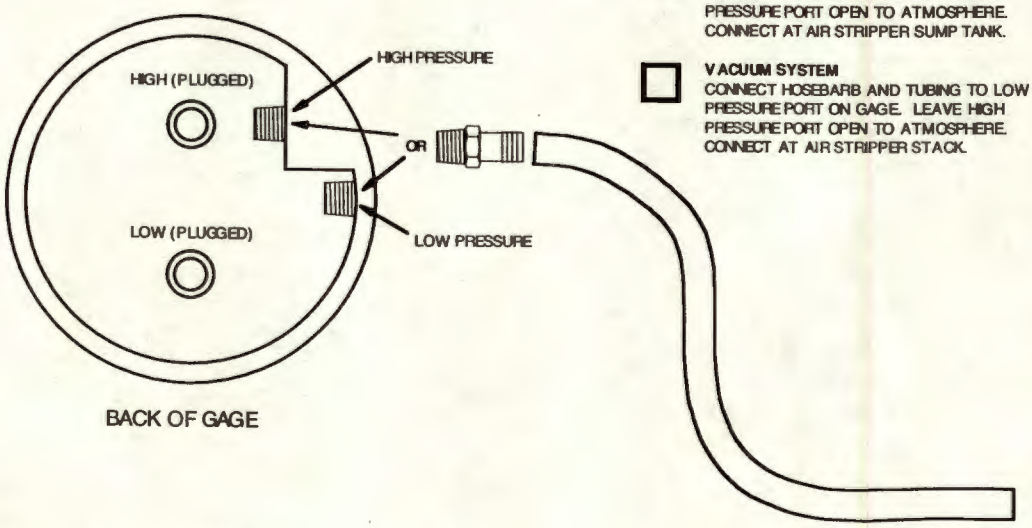


NOTES

1 PRESSURE LINE SHUT-OFF VALVE SHOULD BE CLOSED UNTIL A READING IS NEEDED. THIS WILL PREVENT CONDENSATION FROM BUILDING UP AND FLOODING THE GAGE.

☑ **PRESSURE SYSTEM**
CONNECT HOSEBARB AND TUBING TO HIGH PRESSURE PORT ON GAGE. LEAVE LOW PRESSURE PORT OPEN TO ATMOSPHERE. CONNECT AT AIR STRIPPER SUMP TANK.

☐ **VACUUM SYSTEM**
CONNECT HOSEBARB AND TUBING TO LOW PRESSURE PORT ON GAGE. LEAVE HIGH PRESSURE PORT OPEN TO ATMOSPHERE. CONNECT AT AIR STRIPPER STACK.



BACK OF GAGE

☐ **200-130-00209 Air pressure gauge SUB 0-5"wc**
• 1 500-130-00035 Gauge, Air Pressure, 0-5"WC
• 4' 500-200-00145 Tubing Air 3/16IDx5/16OD

☐ **200-130-00210 Air pressure gauge SUB 0-10"wc**
• 1 500-130-00040 Gauge Air Pressure, 0-10"WC
• 4' 500-200-00145 Tubing Air 3/16IDx5/16OD

☐ **200-130-00211 Air pressure gauge SUB 0-15"wc**
• 1 500-130-00050 Gauge Air Pressure0-15"WC
• 4' 500-200-00145 Tubing Air 3/16IDx5/16OD

☑ **200-130-00212 Air pressure gauge SUB 0-20"wc**
• 1 500-130-00060 Gauge Air Pressure0-20"WC
• 4' 500-200-00145 Tubing Air 3/16IDx5/16OD

☐ **200-130-00213 Air pressure gauge SUB 0-30"wc**
• 1 500-130-00065 Gauge Air Pressure o-30"
• 4' 500-200-00145 Tubing Air 3/16IDx5/16OD

☐ **200-130-00214 Air pressure gauge SUB 0-40"wc**
• 1 500-130-00066 Gauge, Air Pressure, 0-40"WC
• 4' 500-200-00145 Tubing Air 3/16IDx5/16OD

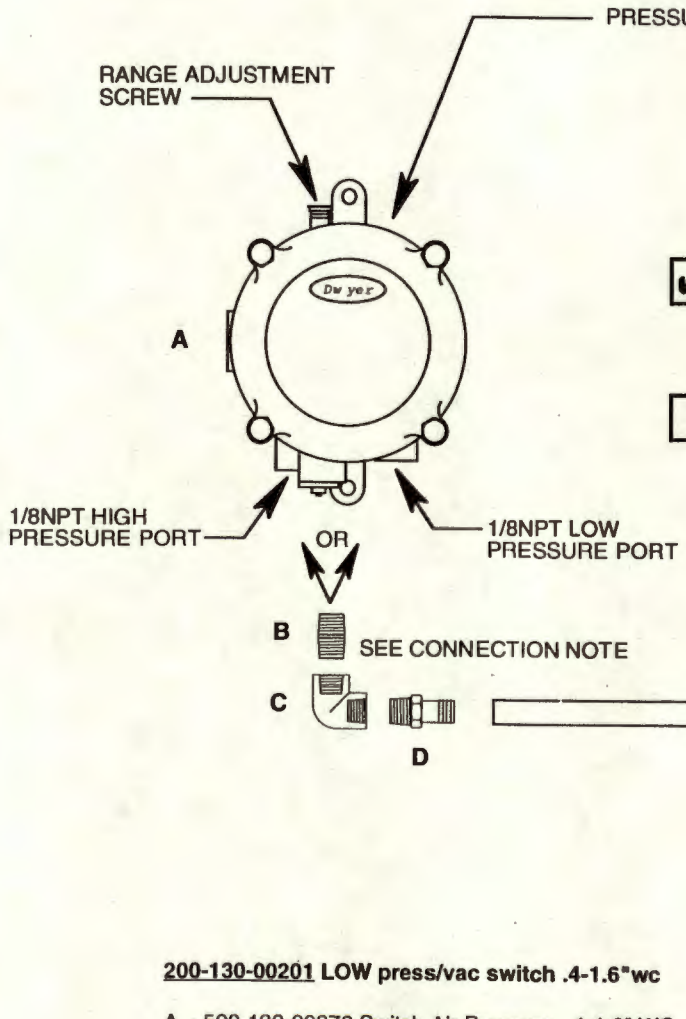
☐ **200-130-00215 Air pressure gauge SUB 0-60"wc**
• 1 500-130-00068 Gauge, Air Pressure, 0-60"wc
• 4' 500-200-00145 Hose, 3/16id x 5/16od, Tygon, cle

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

AIR PRESSURE GAGE

A	900-130-00012	1 of 1	Ø
NONE	DO NOT SCALE DRAWING	RC	10-31-94

LOW AIR PRESSURE/VACUUM SWITCH



CONNECTION NOTE

☑ **LOW AIR PRESSURE SYSTEM**
CONNECT FITTINGS TO HIGH PESSURE PORT OF PRESSURE DIFFERENTIAL SWITCH, LEAVE LOW PRESSURE PORT OPEN. STRIPPER CONNECTION ON SUMP TANK

☐ **LOW VACUUM SYSTEM**
CONNECT FITTINGS TO LOW PESSURE PORT OF PRESSURE DIFFERENTIAL SWITCH, LEAVE HIGH PRESSURE PORT OPEN. STRIPPER CONNECTION ON STACK

200-130-00201 LOW press/vac switch .4-1.6"wc

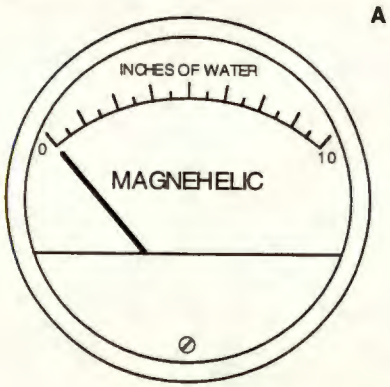
A 500-130-00070 Switch Air Pressure, .4-1.6" WC
B 500-140-02960 Nipple,.125xClose,TxT,Brass
C 500-140-02490 Elbow,90,.125Fx.125F,TxT,Brass
E 500-200-00145 Hose,3/16id x 5/16od,Tygon,cle

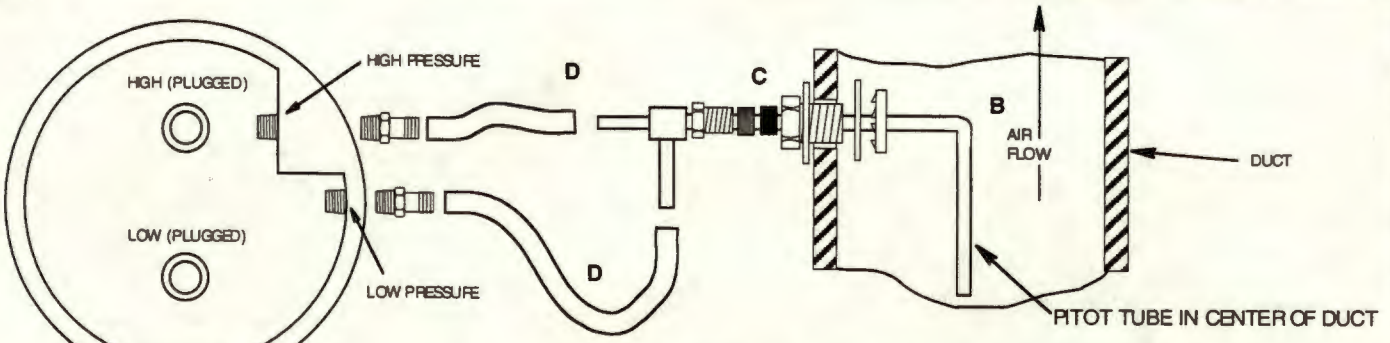
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

TITLE: LOW AIR PRESSURE/VACUUM SWITCH

SIZE	DWG NO.	SHEET	REV
A	900-130-00011	1 OF 1	Ø

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC/MS	9-22-94





BACK OF GAGE

	DUCT DIA	MAXIMUM SCFM FOR GAUGE			
		0 TO .5	0 TO 1	0 TO 2	0 TO 3
SCH 40 PVC	2	59	84	119	145
	3	131	185	262	320
	4	225	319	451	552
	6	511	723	1,023	1,252
	8	885	1,252	1,771	2,169
	10	1,396	1,974	2,791	3,418
	12	1,981	2,802	3,962	4,852
	14	2,394	3,386	4,788	5,864
	16	3,127	4,423	6,255	7,661
	18	3,959	5,598	7,917	9,697
SCH 80 PVC	2	52	74	105	128
	3	117	165	234	286
	4	203	288	407	498
	6	461	652	923	1,130
	8	808	1,143	1,616	1,980
	10	1,271	1,798	2,543	3,114
	12	1,799	2,544	3,598	4,406
	14	2,172	3,071	4,344	5,320
	16	2,848	4,028	5,696	6,976
	18	3,615	5,112	7,229	8,854
GALV DUCT	3	125	177	250	306
	4	222	315	445	545
	6	500	708	1,001	1,226
	8	890	1,258	1,779	2,179
	10	1,390	1,966	2,780	3,405
	12	2,002	2,831	4,003	4,903
	14	2,724	3,853	5,449	6,673
	16	3,558	5,032	7,117	8,716
	18	4,504	6,369	9,007	11,031
	20	5,560	7,863	11,120	13,619
	22	6,728	9,514	13,455	16,479
	24	8,006	11,323	16,013	19,612

(STANDARD) ☑

200-130-00010 Air Flow Meter 0-0.5
A 1 500-130-00010 Meter Air Flow, 0-.5"WC
B 1 500-130-00020 Sensor Air Flow
C 1 500-130-00030 Sensor Mtg. Kit
D 24' 500-200-00145 Tubing Air3/16IDx5/16OD

☐

200-130-00011 Air Flow Meter 0-1.0
A 1 500-130-00032 Gauge,Air Pressure,0-1"wc
B 1 500-130-00020 Sensor Air Flow
C 1 500-130-00030 Sensor Mtg. Kit
D 24' 500-200-00145 Tubing Air3/16IDx5/16OD

☐

200-130-00012 Air Flow Meter 0-2.0
A 1 500-130-00033 Gauge,Air Pressure,0-2"wc
B 1 500-130-00020 Sensor Air Flow
C 1 500-130-00030 Sensor Mtg. Kit
D 24' 500-200-00145 Tubing Air3/16IDx5/16OD

☐

200-130-00013 Air Flow Meter 0-3.0
A 1 500-130-00036 Gauge,Air Pressure,0-3"WC
B 1 500-130-00020 Sensor Air Flow
C 1 500-130-00030 Sensor Mtg. Kit
D 24' 500-200-00145 Tubing Air3/16IDx5/16OD

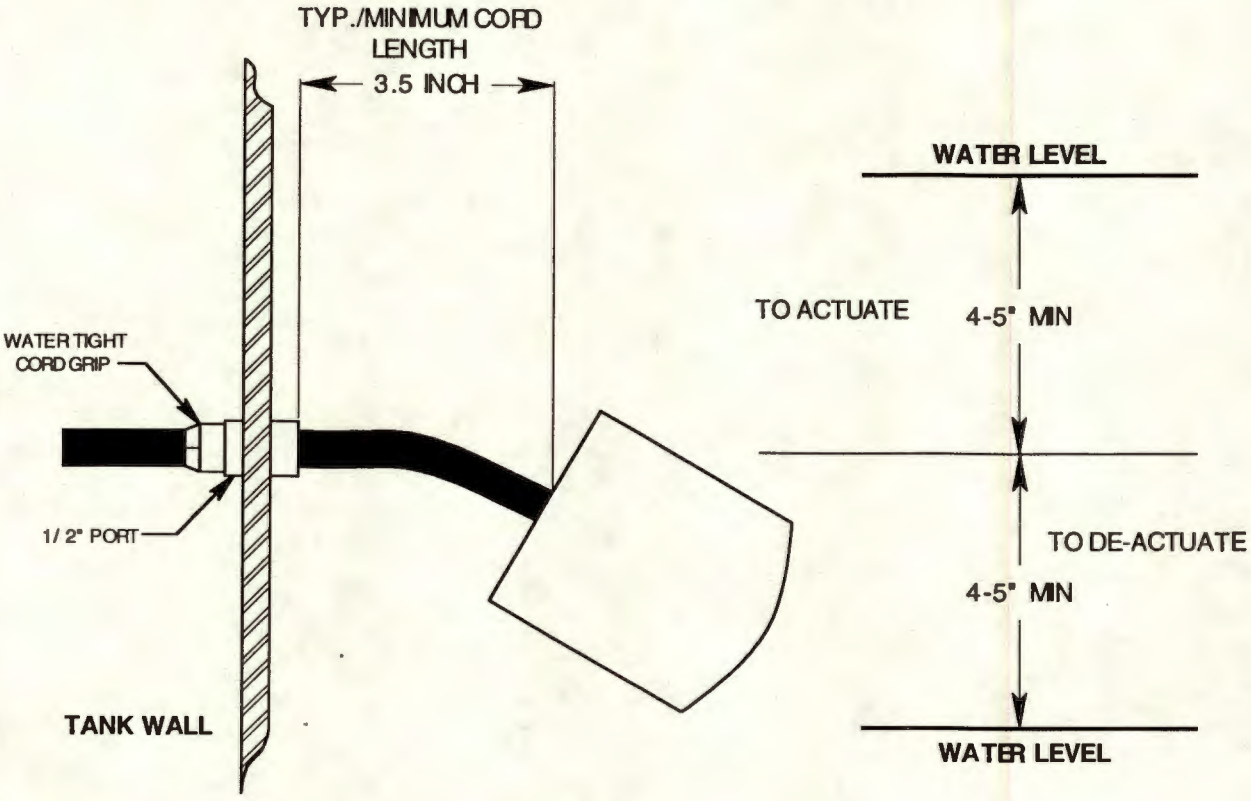
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

TITLE: **AIR FLOW METER ASSEMBLIES**

SIZE	DWG NO.	SHEET	REV
A	900-130-00013	1 OF 1	Ø

SCALE		DRAWN	DATE
None	DO NOT SCALE DRAWING	MD	5/9/97

FLOAT SWITCH



MECHANICAL FLOATS (FOR 120VAC ONLY)

QTY

☐ **200-120-00310 FLOAT SWITCH, N.O., 10' CORD, PVC**
1 500-120-02521 Switch,float,N.O.,mech,10ft cord
1 500-120-02490 Cord,Watertight,1/2",Bulkhead

☐ **200-120-00311 FLOAT SWITCH, N.C., 10' CORD, PVC**
1 500-120-02522 Switch,float,N.C.,mech,10ft cord
1 500-120-02490 Cord,Watertight,1/2",Bulkhead

☐ **200-130-00312 FLOAT SWITCH NO/NC, 10' CORD, POLYOPRO**
1 500-120-02497 Switch,Float,NO or NC,polypro
1 500-120-02490 Cord,Watertight,1/2",Bulkhead

MERCURY FLOATS (FOR ALL VOLTAGES INCLUDING I.S.)

QTY

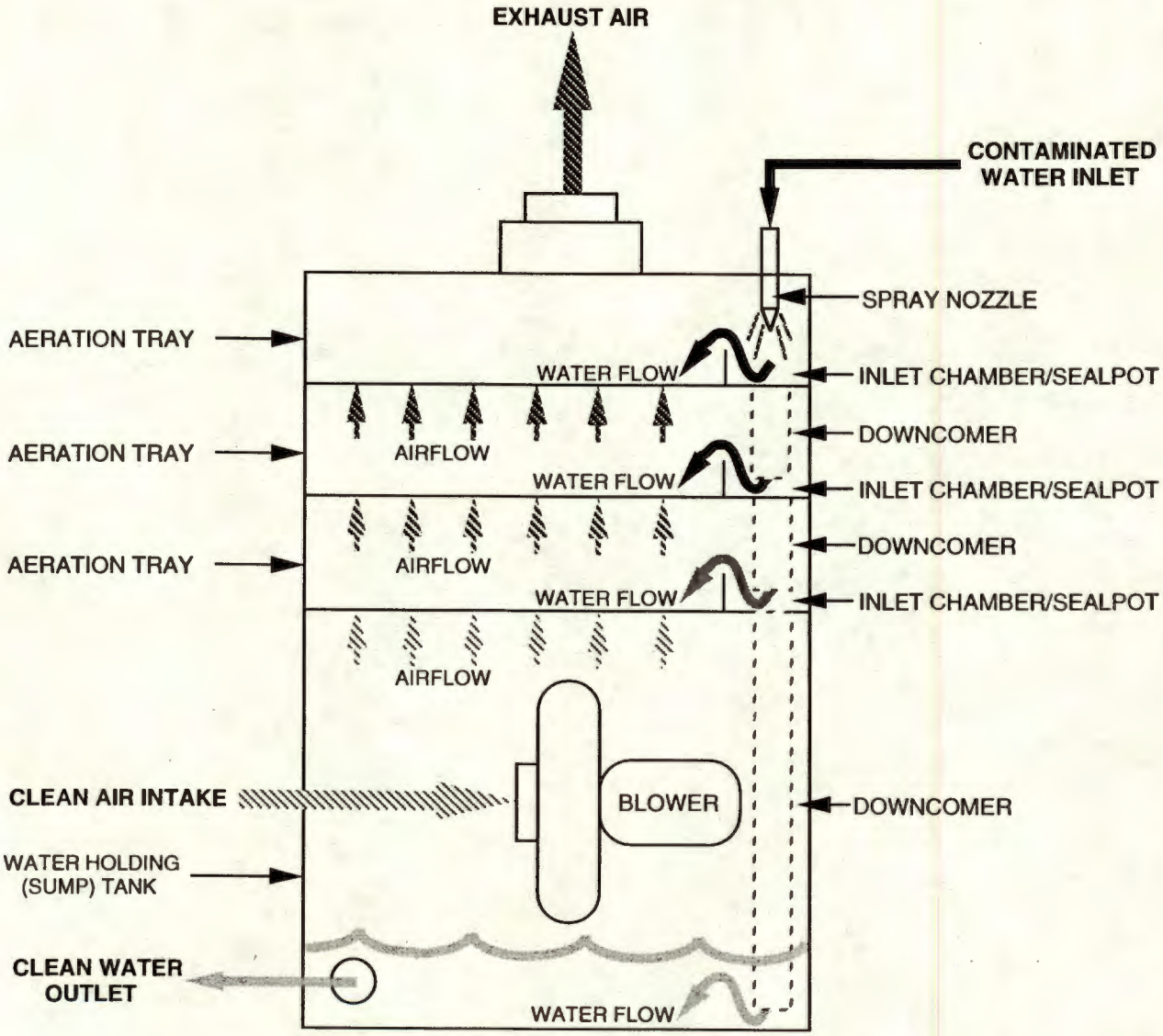
1 **200-120-00314 Float Switch, NO, 10',merc**
1 500-120-02490 Cord,Watertight,1/2",Bulkhead
1 500-120-02500 Switch,Float,merc ,N.O.,10ft cord

1 **200-120-00315 Float Switch, NC, 10',merc**
1 500-120-02490 Cord,Watertight,1/2",Bulkhead
1 500-120-02510 Switch,Float,merc ,N.C.,10ft cord

900-900-00321

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.	DOCUMENT 900-120-00029	PAGE 1 OF 1	REV B
TITLE FLOAT SWITCH		DATE 12/19/01	BY RC

AERATION PROCESS, COUNTER-CURRENT AIR AND WATER FLOW



FOR REFERENCE ONLY !

DO NOT ASSEMBLE PER THIS DRAWING. SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ±1 In.	DRAWING NAME: AERATION PROCESS		
	DRAWING #: 900-200-00003		
DRAWN: MS DATE: 1/11/93	CUSTOMER:		
REV: A 3/9/94	SCALE:	SIZE: A	SHEET : OF:

Troubleshooting Guide for Poor Removal

WATER ISSUES

1. What is the water flow rate through the stripper?

2. Is there foam in the air stripper caused by surfactants, greases, fats , etc.?

3. What else is in the water besides the contaminates in question?

4. Are there occasional slugs of free product that could contaminate the sump of the air stripper?

5. Does the sump tank have at least 4 inches of water at all times?

6. Are the seal pots on each tray full of water?

7. Are the samples being taken, stored, and tested per approved methods?

AIR ISSUES

1. What is the air flow rate through the stripper?
   - How is it measured?
   - How does it compare with the shop tests?

2. Is there water blowing out the exhaust stack?

3. Is there air blowing out the water discharge piping?

4. What is the design of the air intake and exhaust?
   - Is there any constriction of the flow of air?

14. is there any way contaminated air can get into the blower intake?

MECHANICAL AND OTHER ISSUES

1. Is the blower spinning in the correct direction? i.e.Top of blower wheel spinning towards blower outlet. (The blower will blow air even if running backwards.)

2. Is the system level?

3. When system shuts down, does blower continue to run for 5 minutes after influent water stops?

4. Have there been any power outages that would cause untreated water to fall into the sump?

5. Are trays properly stacked so that the downcomers are in seal pots?

FOULING ISSUES

1. Is there any scaling or fouling on the trays? The holes in the trays should be 3/16 of an inch in diameter.

2. What is the sump tank pressure reading? Has it changed over time?

TYPICAL VENT LINE INSTALLATION

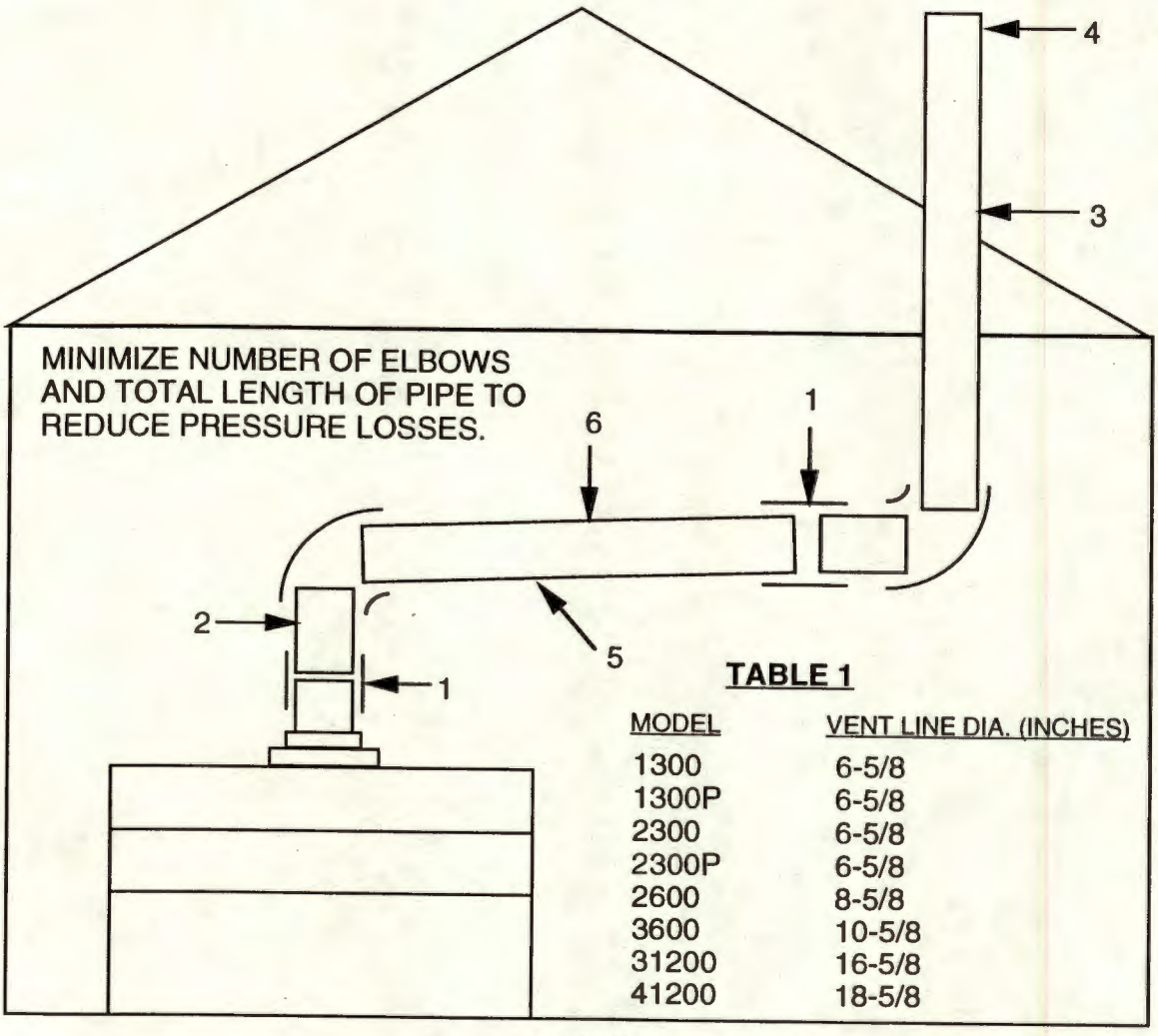
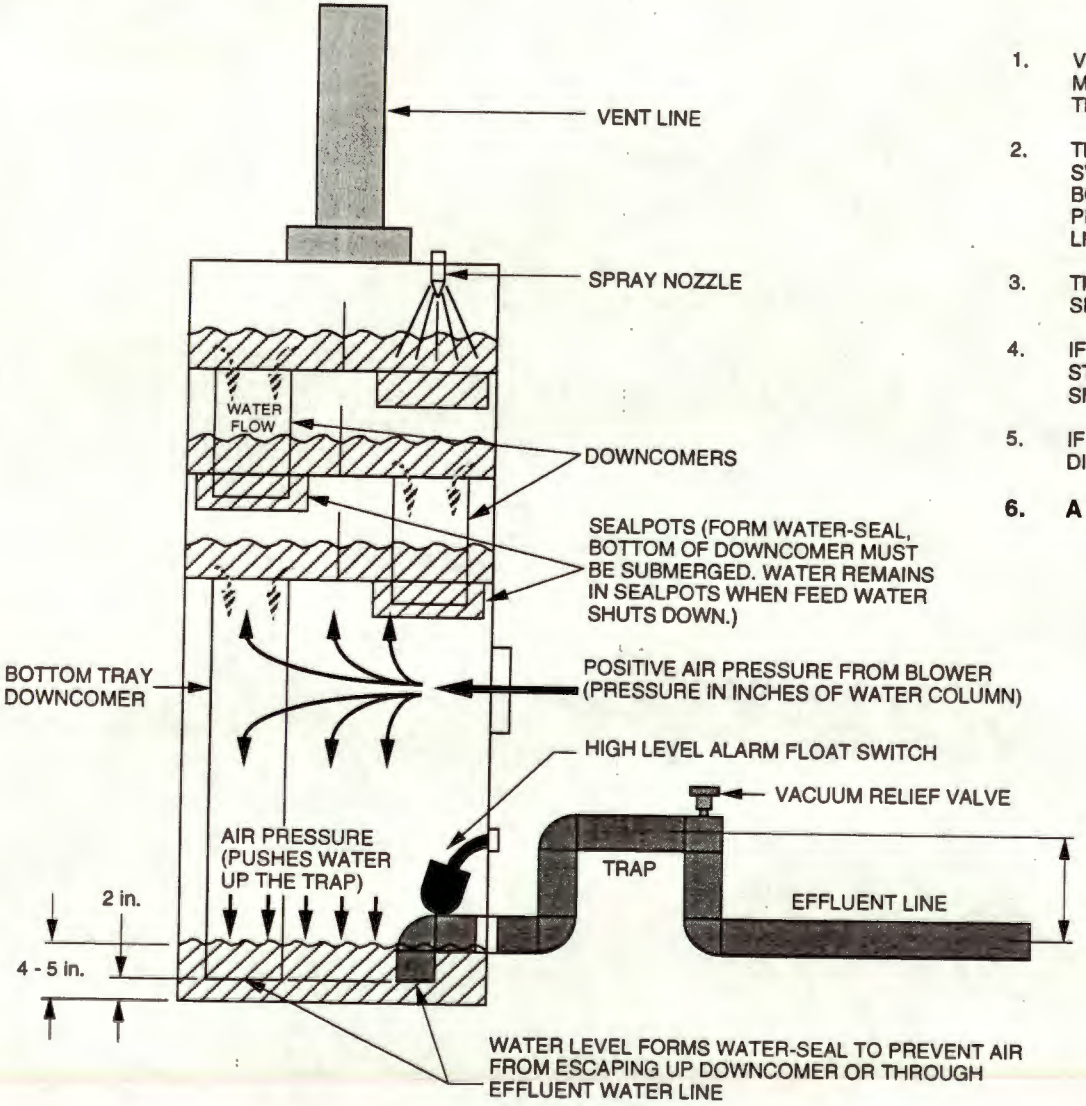


TABLE 1

MODEL	VENT LINE DIA. (INCHES)
1300	6-5/8
1300P	6-5/8
2300	6-5/8
2300P	6-5/8
2600	8-5/8
3600	10-5/8
31200	16-5/8
41200	18-5/8

NOTES:

1. RUBBER COUPLING WITH STAINLESS STEEL RING CLAMPS.
2. VENT LINE PIPE DIAMETER MUST BE EQUAL TO OR GREATER THAN THE AIR EXHAUST VENT DIAMETER ON THE AIR STRIPPER COVER.
3. FIRMLY SUPPORT PIPE AT ROOF PENETRATION.
4. FOR INTERMITTENT OPERATION, INSTALL WIRE MESH OF 1/4" (OR LARGER). FOR DRINKING WATER SUPPLY, INSTALL ELBOW WITH WIRE MESH.
5. ALLOW CLEARANCE FOR REMOVING SECTION OF VENT LINE FOR EASY ACCESS TO AERATION TRAYS.
6. PITCH VENT LINE TOWARD SHALLOW TRAY UNIT.
7. USE PIPING THAT HAS ADEQUATE STRENGTH (PRESSURE OR VACUUM) SPECIFICATIONS, AND THAT IS OF SUITABLE MATERIAL.



SIDE VIEW

DO NOT USE THIS TRAP WHEN PUMPING OUT OF ShallowTray OR WITH INDUCED DRAFT SYSTEMS

GRAVITY DISCHARGE TRAP SET-UP (SEE NOTE 6)

1. VERTICAL TRAP HEIGHT SHOULD BE SET SO THAT THE SYSTEM MAINTAINS A SUMP TANK WATER LEVEL OF 4-5 INCHES (FROM THE BOTTOM OF THE SUMP TANK) DURING NORMAL OPERATION.
2. THE 4-5 INCH WATER LEVEL ALLOWS THE HIGH LEVEL ALARM SWITCH TO RESET AND ALSO FORMS A WATER SEAL AROUND THE BOTTOM TRAY DOWNCOMER AND THE EFFLUENT WATER LINE. THIS PREVENTS AIR FROM ESCAPING THROUGH THE EFFLUENT WATER LINE AND BOTTOM TRAY DOWNCOMER.
3. THE VACUUM RELIEF VALVE PREVENTS THE WATER FROM SIPHONING OUT THE EFFLUENT WATER LINE.
4. IF THE SUMP TANK WATER IS DEEPER THAN 4-5 INCHES WHEN THE STRIPPER IS IN OPERATION, THEN EITHER THE LINE SIZE IS TOO SMALL OR THERE IS SOME TYPE OF RESTRICTION IN THE LINE.
5. IF THE EFFLUENT LINE BECOMES FOULED, IT WILL REDUCE THE DIAMETER OF THE LINE AND CAUSE THE WATER LEVEL TO RISE.
6. **A TRAP IS NOT NEEDED IF THERE IS A DISCHARGE PUMP.**

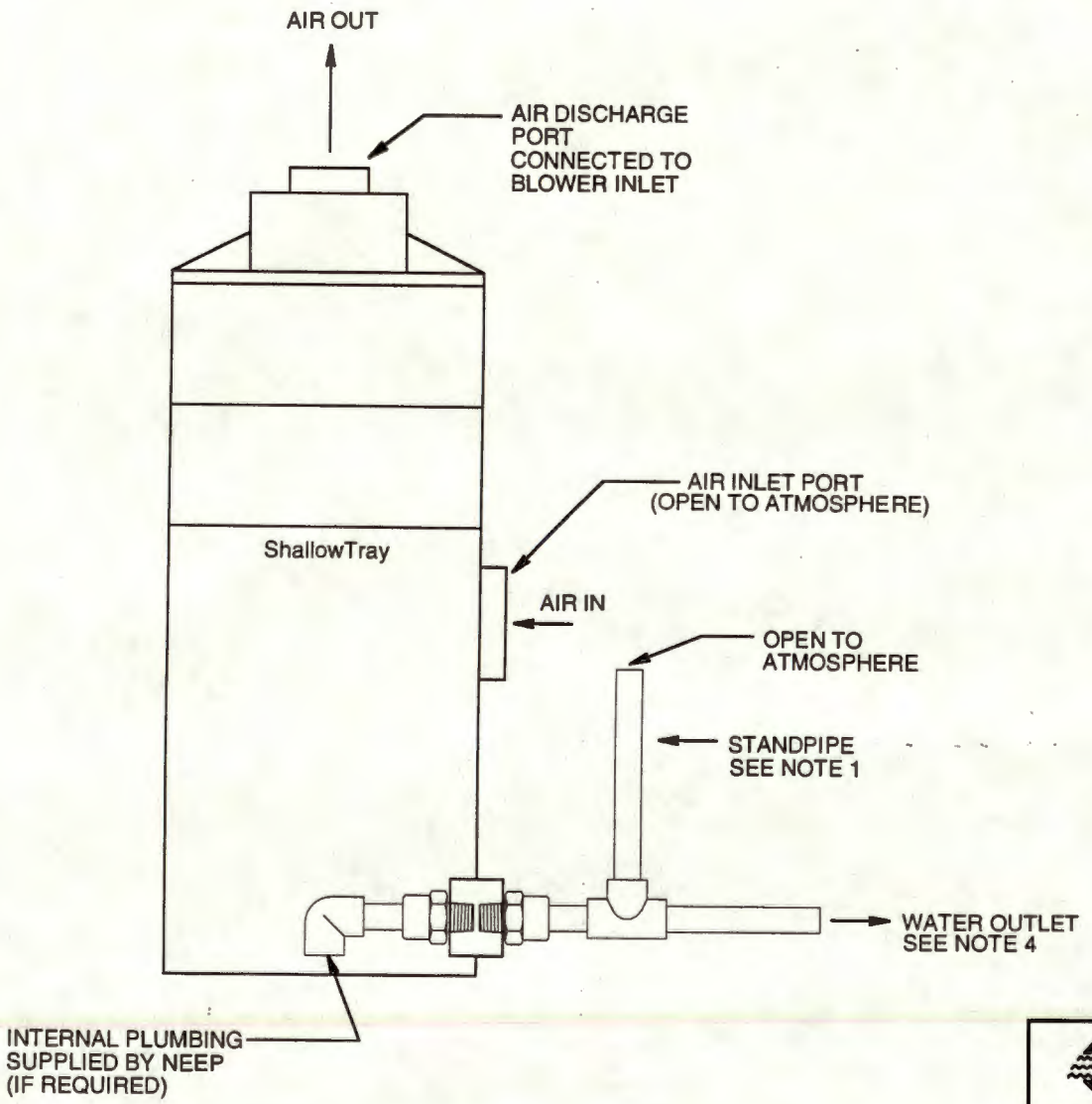
FOR REFERENCE ONLY !

DO NOT ASSEMBLE PER THIS DRAWING. SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

SET HEIGHT OF INVERTED U-TRAP TO MAINTAIN 4-5 in. WATER LEVEL IN SUMP TANK DURING STRIPPER OPERATION

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 in.	DRAWING NAME: GRAVITY DISCHARGE TRAP HEIGHT		
	DRAWING #: 900-140-00001		
DRAWN: MS	CUSTOMER:		
DATE: 11/8/93	SCALE:	SIZE: A	SHEET : OF :



NOTES

1. HEIGHT TO TOP OF STANDPIPE SHOULD BE 1" HIGHER THAN LOWEST POINT ON AIR INLET PORT.
2. DO NOT USE THIS SETUP IF PUMPING OUT OF ShallowTray.
3. DISHARGE PIPING SHALL BE GREATER THAN OR SAME SIZE AS WATER DISCHARGE PORT.
4. PIPING RUN MUST PITCH AWAY FROM STRIPPER.

DRAWING FOR REFERENCE ONLY
DO NOT ASSEMBLY PER THIS DRAWING.
SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

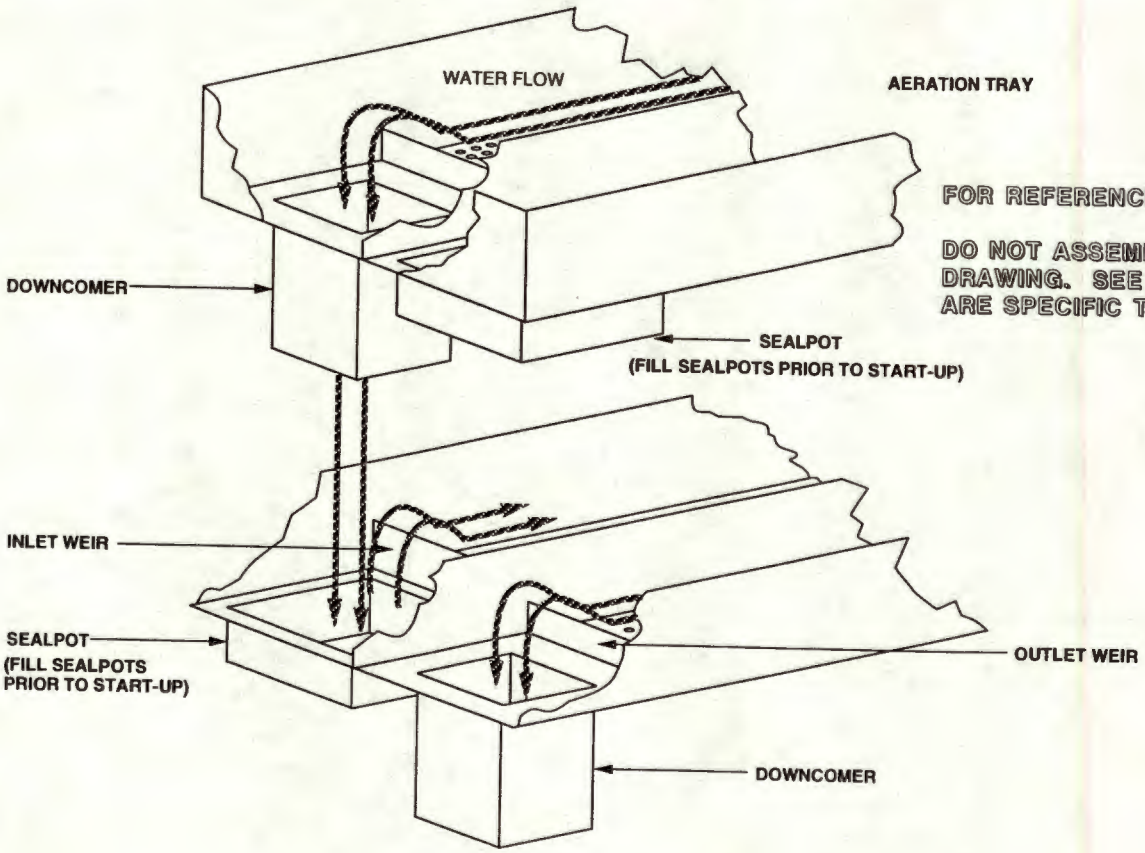
TITLE

RECOMMENDED GRAVITY DISCHARGE SETUP FOR INDUCED DRAFT SYSTEMS

SIZE	DWG NO.	SHEET	REV
A	900-140-00003	1 OF 1	Ø

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	7-7-95

SEALPOT FUNCTION - WATER SEAL

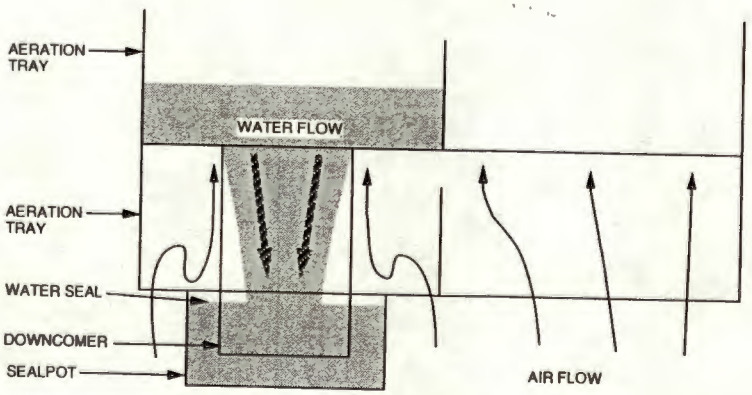


FOR REFERENCE ONLY !

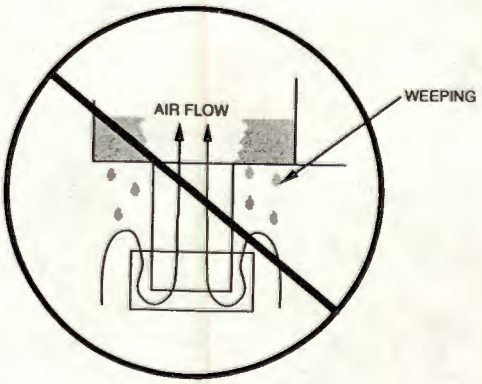
DO NOT ASSEMBLE PER THIS DRAWING. SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

CAUTION!

SEALPOT MUST BE FILLED WITH WATER TO CREATE WATER SEAL.



FILLED SEALPOT



UNFILLED SEALPOT

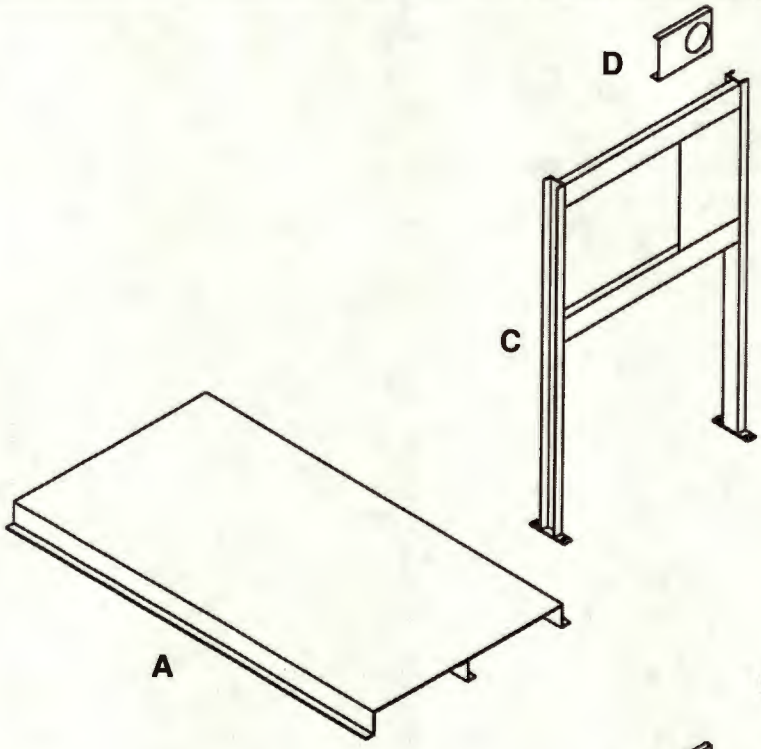
1. EACH AERATION TRAY CONTAINS A SEALPOT. ALL SEALPOTS MUST BE FILLED WITH WATER TO FORM A WATER SEAL AROUND THE DOWNCOMERS.
2. IF SEALPOTS ARE NOT FILLED, AIR WILL TRAVEL UP THE DOWNCOMER AND PREVENT WATER FROM FLOWING DOWN THEM. THIS WILL CAUSE THE WATER TO WEEP THROUGH THE 3/16" AERATION HOLES ON THE BOTTOM OF EACH TRAY, RESULTING IN POOR REMOVAL EFFICIENCY.
3. THE SUMP TANK WATER LEVEL ACTS AS A WATER SEAL FOR THE BOTTOM TRAY DOWNCOMER. MAINTAIN AT LEAST 3" OF WATER IN THE SUMP TANK AT ALL TIMES.
4. SEALPOTS CAN BE FILLED MANUALLY, OR BY FOLLOWING THE PROCEDURES LISTED IN THE OPERATION AND MAINTENANCE MANUAL.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 in.	DRAWING NAME: SEALPOTS		
	DRAWING #: 900-160-00061		
DRAWN: MS DATE: 11/19/92	CUSTOMER:		
REV: A 3/9/94	SCALE:	SIZE: A	SHEET: OF:

TO PREVENT PLASTIC DAMAGE

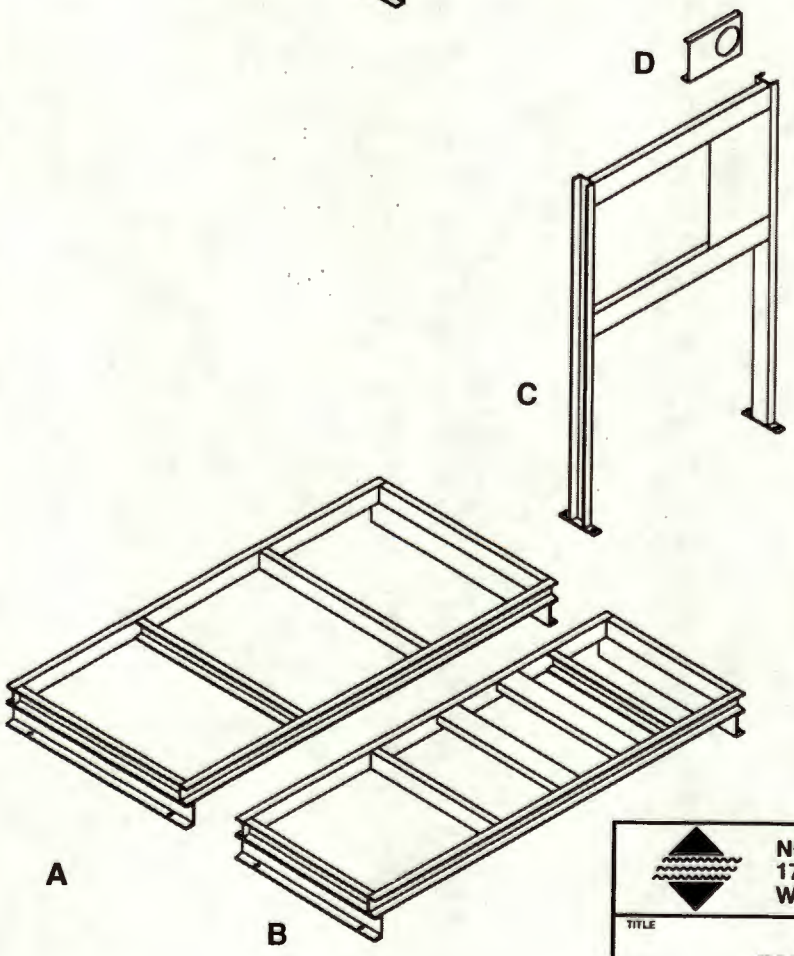
- Keep water temperature inside the system less than 95°F (35°C).
- Keep air temperature around the system less than 95°F (35°C).
- Keep ShallowTray system out of direct sun.
- Make sure all piping to the tank/cover mates up properly, without stress.
- Make sure all piping is supported independent of the tank/cover.



FRAMES FOR PLASTIC SYSTEMS

200-170-00041 Frame Assembly, 1300P Steel
A 1 500-170-00332 Frame,Steel,1300P
C 1 500-170-00045 Frame, control panel
D 1 500-170-00047 Instrument bracket

200-170-00042 Frame assembly, 2300P steel
A 1 500-170-00330 Frame,Steel,2300P
C 1 500-170-00045 Frame, control panel
D 1 500-170-00047 Instrument bracket



FRAMES FOR STAINLESS SYSTEMS

200-170-00030 Frame assembly, 1300
A 1 500-170-00021 Frame Tank, Steel, 1300
B 1 500-170-00031 Frame, Blower, Steel, 1300/2300
C 1 500-170-00045 Frame, control panel
D 1 500-170-00047 Instrument bracket

200-170-00031 Frame assembly, 2300
A 1 500-170-00041 Frame, Holding Tank, Steel, 2300
B 1 500-170-00031 Frame, Blower, Steel, 1300/2300
C 1 500-170-00045 Frame, control panel
D 1 500-170-00047 Instrument bracket

200-170-00032 Frame assembly, 2600
A 1 500-170-00051 Frame, Holding Tank,Steel 2600
B 1 500-170-00061 Frame, Blower, Steel 2600/3600
C 1 500-170-00045 Frame, control panel
D 1 500-170-00047 Instrument bracket

200-170-00033 Frame assembly, 3600
A 1 500-170-00071 Frame, Tank, Steel, 3600
B 1 500-170-00061 Frame, Blower, Steel 2600/3600
C 1 500-170-00045 Frame, control panel
D 1 500-170-00047 Instrument bracket

200-170-00034 Frame assembly 31200
A 1 500-170-00080 Frame, Tank, Steel, 31200
B 1 500-170-00091 Frame, Blower, Steel, 31200
C 1 500-170-00045 Frame, control panel
D 1 500-170-00047 Instrument bracket

200-170-00035 Frame assembly, 41200
A 1 500-170-00100 Frame,Tank,Steel 41200
B 1 500-170-00096 Frame, Blower, Steel, 41200
C 1 500-170-00045 Frame, control panel
D 1 500-170-00047 Instrument bracket

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

TITLE: SHALLOW TRAY FRAME OPTION

SIZE	DWG NO.	SHEET	REV
A	900-170-00020	1 OF 1	Ø

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	11/4/96

AMERICAN FAN COMPANY® & WOODS U.S.A. DIVISION

DESIGNERS AND MANUFACTURERS OF HIGH EFFICIENCY FANS AND BLOWERS

SPECIFICATIONS FOR MODEL "AF" CAST ALUMINUM PRESSURE BLOWER

1. Furnish an American Fan Company cast aluminum blower: Model "AF". The fan ratings shall be based on tests conducted in accordance with AMCA 210-85, figure 7 for air performance, and AMCA 300-85 installation B for sound performance.

2. The blower shall be produced by a manufacturer who is ISO 9001 certified and has manufactured pressure blowers for a minimum of (10) years.

3. The fan housing shall be constructed of non-sparking, rust-proof cast aluminum. The housing shall be split for ease of maintenance. The intake and discharge shall be round.

4. The wheel shall be centrifugal type with one of the following wheels: cast aluminum radial blade, cast aluminum backward curved blade, or fabricated aluminum forward curve blade. The wheel is to be secured to the shaft by means of a keyway and setscrew. The wheel shall be statically and dynamically balanced.

5. The assembled fan/motor unit(s) shall be given a short factory mechanical run test to verify balance and vibration. Data shall be documented and kept on file for a minimum of seven years.

6. The fan shall be AMCA Type "B" spark resistant construction.

7. Inlet and outlet flanges, when required, shall be cast aluminum construction with ANSI 125 # flange drilling.

8. Accessories are as scheduled.

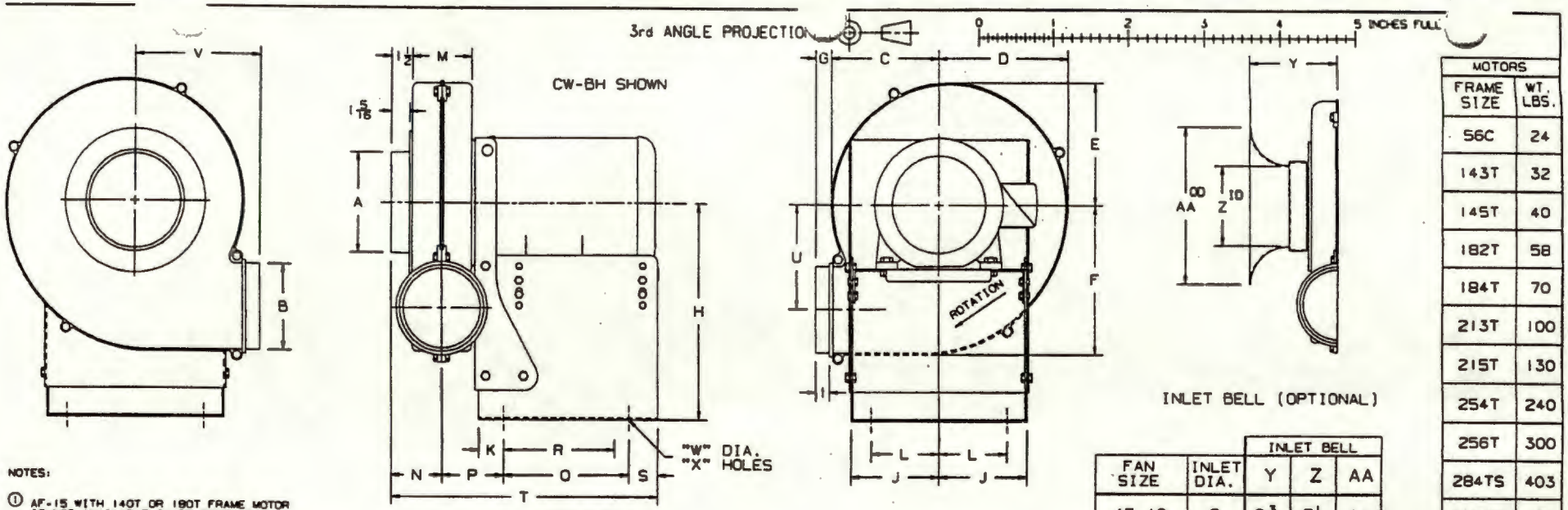
amca MEMBER

2933 Symmes Road
Fairfield, Ohio 45014-2035
Tel: (513) 874-2400

Administration / Accounting / Purchasing FAX: (513) 870-5577
Axial Plant FAX: (513) 870-6250
Parts and Service Department FAX: (513) 874-3932
Sales / Engineering FAX: (513) 870-6249

REG. NO. AQC 19201 ISO 9001 AMERICAN FAN CO.

3rd ANGLE PROJECTION



INLET BELL (OPTIONAL)

MOTORS	
FRAME SIZE	WT. LBS.
56C	24
143T	32
145T	40
182T	58
184T	70
213T	100
215T	130
254T	240
256T	300
284TS	403
286TS	420

FAN SIZE	INLET DIA.	INLET BELL Y	INLET BELL Z	INLET BELL AA
AF-10	6	6 3/16	5 1/2	11
AF-12	7	6 13/16	6 1/2	13
AF-15	7	7 3/4		
AF-15	8	8 1/4	7 1/2	15
AF-15	10	9 1/4	9 1/2	19

NOTES:

① AF-15 WITH 140T OR 180T FRAME MOTOR IS NOT AVAILABLE IN DB DISCHARGE.

② AF-15, ADD 1/8" TO DIMENSIONS "P" & "T" FOR DB DISCHARGE (213T,215T,254T,284TS,286TS ONLY).

③ AF-15, NOT AVAILABLE WITH 56 OR 56C FRAME MOTORS.

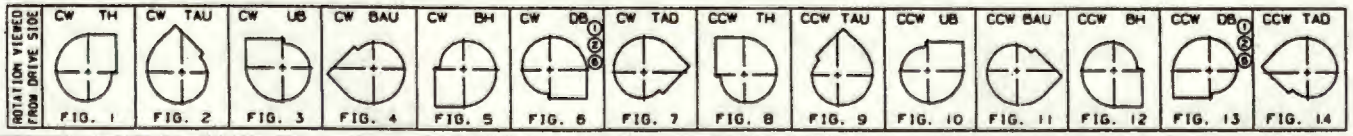
④ FOR FLANGE DETAILS, SEE DRAWING AFA11421F

⑤ MOTOR BASE IS FIELD ADJUSTABLE TO ACCEPT MOTOR FRAMES AS SHOWN

⑥ ALL SIZES "DB" DISCHARGE ONLY AVAILABLE LESS OUTLET FLANGE

FAN SIZE	MOTOR FRAME SIZE	INLET DIA. A	OUTLET DIA. B	C	D	E	F	G	H	J	K	L	M	N	P	O	R	S	T	U	V	W	X	NET WTS. LESS MOTOR LBS.
AF-10	56, 143T, 145T, 56C, 143TC, 145TC, 182T, 184T	6	5	6 1/16	8 5/16	7 15/32	9	1 1/8	11 1/2	5	1 1/16	4	3 3/4	3 3/8	3 1/8	8	7	1 3/16	15 5/16	6 3/8	7 13/16	1/2	6	39
AF-12	56, 143T, 145T, 56C, 143TC, 145TC, 182T, 184T	7	6	7 3/4	9 1/4	8 1/2	10 7/16	1 1/8	11 1/2	5	1 1/16	4	4 1/4	3 5/8	3 3/8	8	7	1 3/16	15 13/16	7 5/16	8 7/8	1/2	6	46
AF-12	213T, 215T	7	6	7 3/4	9 1/4	8 1/2	10 7/16	1 1/8	11 1/2	6 5/16	1 3/4	4 7/8	4 1/4	3 5/8	4 1/16	8 7/8	-	2 1/16	18 5/8	7 5/16	8 7/8	9/16	4	46
AF-15	143T, 145T 182T, 184T, 213T, 215T	7	8	9 3/8	11	10	12	1 5/8	15	6 5/16	1 3/4	4 7/8	5 7/8	4 7/16	② 5 1/8	8 7/8	-	2 1/16	② 20 1/2	7 7/8	10 15/16	9/16	4	79
		8																						
		10																						
AF-15	254T, 256T, 284TS, 286TS	7	8	9 3/8	11	10	12	1 5/8	15	7	1 3/4	4 7/8	5 7/8	4 7/16	② 5 1/8	16 1/4	-	2	② 27 13/16	7 7/8	10 15/16	11/16	4	121
		8																						
		10																						

ROTATION VIEWED FROM DRIVE SIDE



9-AUG-00	REV. NOTE #1 TO INCLUDE "140T"	JAH	
30-AUG-96	REV. "K,P,T"(AF-12), "D & S"(AF-12 & 15)	JAH	MAS
26-MAR-96	REV. ADDED INLET BELL, INLET SCREEN, REDRAWN	REE	MAS
15-FEB-95	REDRAWN	JPD	MAS
20-FEB-92	REV. DIM. "A" SIZES 15-7,8-10	PES	MAS
4-DEC 91	REV. "P"(AF-12), "N & W"(ALL SIZES)	PES	MAS

DATE: 22-JUL-90	SCALE: NONE	DRAWING NO. AFC1946F	REVISION NO. 6
DRAWN BY: TK	APPROVED BY: MAS		

AMERICAN FAN COMPANY
2933 SYMMES ROAD
FAIRFIELD, OHIO 45014
PHONE: (513) 874-2400
FAX: (513) 870-2577

WOODS USA DIVISION

TITLE:

AF-10 THRU 15 PRESSURE BLOWERS
ARR'T 4 WITH STEEL BASE

American Fan Company

A Flakt Woods Company

Control #
ENG016-0902

2933 Symmes Road, Fairfield, Ohio 45014-2035
Phone: (513) 874-2400 Fax: (513) 870-6249
Service and Parts Phone: (513) 874-2400, Extension 3011
Service and Parts Fax: (513) 874-3932
Service and Parts e-mail: af-serv@amfan-woods.com

AMERICAN FAN CO. INSTALLATION, OPERATION, AND MAINTENANCE MANUAL 0902

This general manual has been prepared to assist you in installing and maintaining your American Fan equipment. By following the general instructions presented, you will prolong the life of the equipment, while preventing unexpected downtime.

The scope of this manual covers our standard product line and is not intended to cover specially engineered equipment.

Table of Contents

SECTION I

RECEIVING

All shipments are F.O.B. factory, Fairfield, Ohio. It is, therefore, in the interest of the buyer to carefully inspect all shipments before they are accepted from the freight carrier. Upon delivery, be sure that all items listed on the bill of lading and packing list (inserted in the plastic envelope attached to the shipment) have been received. Partial shipments are sometimes made.

Units are usually completely assembled except when specifications call for unit less motor. They are then skidded, boxed or crated to fully comply with rail or trucking requirements for shipment. Accessories are sometimes shipped separately due to handling space requirements.

Although all equipment is carefully inspected and prepared for shipment at the factory, damage to fan and/or drive parts may occur due to rough handling during shipment.

Any shortage, breakage or damage noticed at time of delivery should be indicated to the carrier's representative. Damage noticed after delivery should be reported to the carrier at once. Request their inspection of the shipment and fill out a concealed damage inspection report.

EXTENDED STORAGE

Units that will be held in storage for a period of up to two years, should have special provisions so operation-readiness can be maintained. Motors should be equipped with internal space heaters kept on continuously. Units should be crated and covered with polyethylene film. In addition, impellers should be hand-rotated once a month. For best results, keep units sheltered in a cool, dry location.

HANDLING

Small units should be handled carefully and lifted only by the base, never by the shaft, coupling, motor or housing. Large units should be lifted by the base or by lifting eyes. Precaution should be taken to avoid dropping or jarring equipment as this can cause damage to the shaft or wheel, which is not visibly noticeable, but can cause vibration problems.

INSTALLATION

Fans and motors should be mounted on structurally sound foundations. Concrete is the best, however, other types designed properly are acceptable. Equipment should be leveled on the foundation and shimmed or grouted in place. This will prevent putting the fan structure into a bind by bolting down on an uneven surface.

As a general rule, if vibration isolators are used, the fan should first be bolted to structural steel base and the isolation takes place between the structural steel base and the foundation. This prevents the fan base from floating due to uneven weight distribution and/or drive forces when mounted directly to vibration isolators.

ARRANGEMENT 8 BLOWER MOUNTING PROCEDURE

1. Motor and coupling should be mounted with blower resting on level, flat surface, but not bolted to surface.

2. After blower is situated in its final mounting location, feeler gauges should be used between mounting feet and mounting surface at each bolt hole location to determine thickness of shims required. Since the blower base is a weldment, it will be warped to some degree. If it is not shimmed to the foundation properly when bolted down, a bind in the frame will result. This may cause a bent shaft, coupling, motor and/or bearing misalignment resulting in high vibration levels and premature failure of drive components.

3. After shimming is done, each frame mounting bolt should be finger snugged. Then going from bolt to bolt, progressively tighten each one with a torque wrench until the proper torque value is achieved for the size foundation bolt being used.

4. After the unit is completely tightened down to foundation, coupling alignment should be rechecked. If coupling is now mis-aligned, loosen foundation bolts and recheck coupling alignment. If after loosening foundation bolts, coupling is aligned, then a bind was introduced in the bolt-down procedure. It will then be necessary to re-shim so that the bind is no longer present.

5. Once the unit is tightened down to foundation and coupling alignment is maintained, replace guards and check duck work, etc. Unit is now ready for start-up.

6. Jog motor to make sure unit is rotating in proper direction. If so, bring up to speed and check amperage to motor to make sure enough static pressure is present in system to prevent motor from overloading.

7. Vibration levels should be checked and if they are above values shown in table on page 4, a qualified balancing technician should trim balance the unit to achieve these levels.

SECTION II

BEFORE START-UP

1. Fasteners – all foundation bolts, wheel hub setscrews, wheel locking bolts and bearing locking collars must be tight.
2. Bearings - check bearing alignment and make certain they are properly lubricated.
3. Fan Wheel – turn over rotating assembly by hand to see that it runs free and does not bind or strike fan housing. If wheel strikes housing the wheel may have to be moved on the shaft or the bearing pillow blocks moved and re-shimmed.
4. Motor – check electrical wiring to motor. The current characteristics of the supply line must agree with the motor nameplate rating. Motor should be wired and fused in accordance with the National Electric Code and local codes.
5. V-belt drive must be in alignment with belts at proper tension.
6. Duct connections (if required) from fan to duct work must not be distorted. Ducts should never be supported by the fan. Expansion joints between duct connections should be used where expansion is likely to occur or where fan is mounted on vibration isolators. All duct joints should be sealed to prevent air leaks. All debris should be removed from ductwork and fan.

START UP

1. "Jog" the motor to check for proper wheel rotation. The motor should be started in accordance with the manufacturer's recommendations. Arrows on fan indicate the proper direction of rotation and airflow.

2. Fan may now be brought up to speed. Watch for anything unusual such as vibration, overheating of bearings and motor, etc. Check fan speed on V-belt driven units and adjust motor sheave (on adjustable drives) to give desired RPM.

3. Check motor amperage against nameplate amperage to make sure motor is not overloading.

BALANCE AND VIBRATION

All fan impellers are dynamically balanced prior to installation in the fan assembly. After assembly, fans supplied with motors are test run and fine-tune balanced to reduce vibration levels to acceptable limits as shown in table below (from AMCA Standard 204-96). After field installation, fans will need to be checked prior to commissioning, to assure that the vibration levels do not change significantly from those achieved at the factory. It is recommended that the velocity values in the table below are not exceeded by more than 10% when field installed.

Fan Application Category	Rigid Mounted		Flexible Mounted	
	mm/sec.	(in./sec.)	mm/sec.	(in./sec.)
BV-3	3.8	(0.15)	5.1	(0.20)

The installed vibration level of any fan is not solely dependent on the balance grade. Installation factors such as the mass and stiffness of the supporting system, will influence the "as installed" vibration level (Refer to AMCA Publication 202, ***Troubleshooting***). Therefore, the "as installed" fan vibration level is not the responsibility of the fan manufacturer unless specified in the purchase contract.

START-UP OF HIGH TEMPERATURE CONSTRUCTION FANS AND BLOWERS

In addition to normal start-up procedure described above, certain measures must be taken against thermal expansion deformation.

1. Fan or blower should be brought to speed between 40°F and 150°F. It may be necessary to throttle back air entering fan or blower and slowly bleeding in heated air to accomplish this. (Note: If motor horsepower is sized for high temperature operation condition and not cold start-up, throttling inlet air will be mandatory to prevent motor overloading. It is recommended motor amperage be monitored during this procedure.

2. The maximum recommended rate of temperature rise is 15°F per minute.

3. The reverse situation of fan or blower shut-off also applies. That is the temperature must be lowered slowly before turning fan or blower off to prevent damage.

SECTION III

GENERAL MAINTENANCE

1. A definite time schedule for inspecting all rotating parts and accessories should be established. The frequency of inspection depends on the severity of operation and the locality. Inspections might be weekly at first in order to set up the schedule.

2. Alignment – shaft must not be cocked in the bearings. Misalignment can cause overheating, wear to dust seals, bearing failure and vibration.

3. Hardware – check tightness of all bolts and setscrews.

4. Lubrication – check fan and motor bearings and add lubricant if necessary. Be careful not to over grease as this can damage bearing seals.

5. Air flow – make sure there is no debris and no unnecessary obstructions to airflow in outlet or inlet ductwork.

6. Bearings on high-speed fans tend to run hot. Therefore, do not replace a bearing because it feels hot to the touch. Place a pyrometer or contact thermometer against the pillow block and check the temperature. Pillow block and flange mount bearings can have housing surface temperatures of 200°F (93°C) before the cause of overheating be investigated.

7. Wheel- inspect wheel blades for accumulation of dust and dirt. Clean thoroughly with stream of water jet, compressed air or a wire brush. This will help prevent an unbalanced condition. If blades are aluminum, be careful not to damage them. Cover the bearings so water won't enter the pillow block. The wheel should have proper clearances to prevent the blades from striking the housing. Make sure wheel is rotating in proper direction. Never run the fan at a higher speed or temperature than is shown on the fan nameplate. Contact American Fan Company with any questions.

FAN BEARING MAINTENANCE

For most applications, a lithium base grease (such as Mobilith AW2) conforming to a NLGI grade 2 consistency should be used. This type of grease inhibits rust, is water resistant, and has a temperature range of -30°F to 200°F with intermittent highs of 250°F. For extreme duty and higher temperature applications, use Mobilith SHC220, synthetic hydrocarbon grease.

Because oil lubricated bearings are usually used on high-speed or high temperature applications, refer to American Fan Co. factory for the type of oil you should use in your particular application.

When greasing bearings, it is important not to overgrease. This is especially true if the bearings are equipped with extended grease lines and the bearings are not visible. In this case, more bearing failures occur due to overgreasing than undergreasing. It is best to give the bearing just one "shot" of grease periodically if the bearings are not visible. When the bearings are visible, pump in grease until a small bead of grease forms around the bearing seals. It is very important that fan bearing greasing take place while the fan is operating. Caution should be taken while working on and near rotating equipment to avoid personal injury.

When oiling oil-lubricated bearings, oil should be poured into cup at top of bearing until it reached the overflow point at the lower oil cup.

MOTOR MAINTENANCE

Lubricate motor bearings to the manufacturer's recommendations. Lubrication recommendations are included with the packet attached to the fan. Should this packet be missing, the following will apply:

A. Fractional Horsepower Sleeve Bearing Motors:
Under normal operation at ordinary temperatures and clean surroundings, these motors will operate for three years without re-lubrication. Then lubricate annually with electric motor oil or SAE 10 oil. Under continuous operation higher temperatures (but not to exceed 104°F ambient) re-lubricate annually.

B. Fractional Horsepower Ball Bearing Motors:
Under normal conditions, ball bearing motors will operate for five years without re-lubrication. Under continuous operation at higher temperatures, (but not to exceed 104°F ambient) re-lubricate after one year. To re-lubricate where motors are not equipped with pressure fittings, disassemble motor and clean the bearings thoroughly. Repack each bearing one-third full with ball bearing grease.

C. Integral Horsepower Ball Bearings Motors:
Motors having pipe plugs or grease fittings should be re-lubricated while warm and at standstill. Replace one pipe plug on each end shield with grease fitting. Remove other plug for grease relief. On low pressure, grease, run and lubricate until new grease appears at grease relief. Allow motor to run for ten minutes to expel excess grease. Replace pipe plugs. Motors not having pipe plugs or grease fittings can be re-lubricated by removing end shield, cleaning grease cavity and refilling three-fourths or circumference of cavity.

Recommended re-lubrication intervals (General guide only)

H.P Range	Standard Duty 8 Hr./Day	Severe Duty 25 Hr./Day Dirty-Dusty	Extreme Duty Very Dirty High Ambients
1 ½ - 7 ½	5 Yrs.	3Yrs.	9 Mos.
10 – 40	3 Yrs.	1 Yr.	4 Mos.
50 – 150	1 Yr.	9 Mos.	4 Mos.

Recommended Motor Greases
Polyrex EM – Exxon Oil Company
SRI #2 – Chevron Oil Company

V-BELT DRIVE MAINTENANCE

If belts squeal at start-up, they are too loose and should be tightened. Periodically check belt and sheave wear, alignment, and tension. When belts show wear, replace all belts at once with a new matched set of belts. New belts will not work properly in conjunction with used belts due to difference in length. Belts and sheaves should be clean and free from grease. After installing new belts, check tension midway between sheaves. Belts should deflect about 1/64" per inch of

span length with approx. 20-lb. force. Allow unit to run for 4 – 6 hours, then it will be necessary to re-tighten belts again because new belts tend to stretch initially.

VIBRATION LEVEL OF REPLACEMENT IMPELLERS

All replacement impellers are dynamically balanced at our factory prior to shipment. Occasionally, an impeller that has been factory-balanced will yield poor balance/vibration results when installed and operated. This does not mean that the impeller was incorrectly balanced at the factory. It can result from differences between test-stand conditions and operating conditions. A factory test stand has different bearings, bearing spans, structural response, stiffness, mechanical impedance, and by necessity, running speed. The test stand cannot duplicate the actual "fan system" and its response. For these reasons, the "fan system" vibration levels must be checked after installing a replacement impeller. Refer to page 4 for acceptable vibration levels.

SECTION IV.

PROBLEM TROUBLESHOOTING

In the event that trouble is experienced in the field, listed below are the most common fan difficulties. These points should be checked in order to prevent needless delay and expense of factory service.

1. CAPACITY OR PRESSURE RATING
   - A. Total resistance of system higher than anticipated.
   - B. Speed too low.
   - C. Dampers or variable inlet vanes not properly adjusted.
   - D. Poor fan inlet or outlet conditions.
   - E. Air leaks in system.
   - F. Damaged wheel.
   - G. Incorrect direction or rotation.
   - H. Wheel mounted backwards on shaft.

2. VIBRATION & NOISE
   - A. Misalignment of bearings, couplings, wheel, or V-belt drive.
   - B. Unstable foundation, fan bolted to uneven foundation, not shimmed or grouted.
   - C. Foreign material in fan causing unbalance.
   - D. Worn bearings.
   - E. Damaged wheel or motor.
   - F. Broken or loose bolts and setscrews.
   - G. Bent shaft.
   - H. Worn Coupling.
   - I. Fan wheel or driver unbalanced.
   - J. 120 cycle magnetic hum due to electrical input. Check for high or unbalanced voltage.
   - K. Fan delivering more than rated capacity.
   - L. Loose dampers or variable inlet vanes.
   - M. Speed too high or fan rotation in wrong direction.
   - N. Vibration transmitted to fan from some other source.

3. OVERHEATED BEARINGS
   - A. Too much grease.
   - B. Poor alignment.
   - C. Damaged wheel or driver.
   - D. Bent shaft.

E. Abnormal end thrust.
F. Dirt in bearings.
G. Excessive belt tension.

ORDERING SPARE PARTS

American Fan Co. Service and Parts
Phone: (513) 874-2400, Extension 3011
Fax: (513) 874-3932
e-mail: af-serv@amfan-woods.com

Contact the local American Fan Co. sales representative or AFC Service and Parts Department and supply the following information:

1. Fan serial number stamped on nameplate.
2. Fan code and model stamped on nameplate.
3. Fan arrangement.
4. Description of part required.
5. Part number if part is a casting.
6. Special materials, paints or coatings.

WHEEL – Be sure to indicate direction of rotation as viewed from drive side, type of wheel and the operating speed.

SHAFT – Length and diameter.

MOTORS – The name of the motor manufacturer, motor model number, and serial number from the motor nameplate must be supplied to the factory for repairs or replacement.

BEARINGS – The following information should be indicated when ordering various types of bearings:

ANTI-FRICTION BEARINGS
1. State whether ball or roller.
2. Manufacturer.
3. Size and number.
4. Fixed or floating.

RECOMMENDED SPARES:
1. V-belts on V-belt driven fans.
2. Fan bearings
3. Wheel (s)
4. Motor (if blower is critical to your operation).

SECTION V

AMERICAN FAN COMPANY TERMS OF SALE AND WARRANTY

1. **Authority of agents:** No order or contract shall be binding upon us unless signed by an authorized employee of the company. Sales representatives and other agents are not authorized to bind us. Unless a statement representation or guarantee made by an agent is specifically provided for herein, it shall not constitute a warranty or be part of this contract. Typographical errors contained in the quotation or invoice are not binding.

2. **Acceptance, exclusive terms:** Our quotations are subject to acceptance within thirty (30) days from the date of quotation. Acceptance of our quotation includes acceptance of our terms, including those contained herein, which constitute the complete and exclusive contract between the parties. We do not accept any additional or different terms proposed by the buyer's acceptance of this offer. Our failure to specifically object to additional or different terms included in the buyer's acceptance shall not be deemed a waiver of exclusivity of our terms. This agreement may not be modified except by prior written agreement signed by an authorized employee. No course of performance, usage of trade or course of dealing may be used to supplement or explain the terms of this agreement or the obligations and rights of the parties hereunder.

3. **Seller's performance:** We shall not be held responsible for any loss, delay, failure to deliver or damage caused by reasons beyond our control, including but not limited to: our inability to obtain labor, materials, fuel or supplies; fire, accidents, floods or adverse weather conditions; strikes, lockouts or other labor disputes; embargoes, governmental acts or requirements; wars, acts of terrorism, insurrections or riots, or actions of subcontractors.

4. **Payment:** Net payment is due of the invoiced amount (hereinafter "Contract Price") and shall be paid in cash or check only within thirty (30) days F.O.B. our factory unless otherwise specified in our quotation.
   (a) Inadequate shipping instructions: If we are unable to ship the goods when ready due to your (or your representative's) instructions or lack of instructions, invoicing will be submitted and payment in full shall be due within thirty (30) days of notification that we are ready to ship.
   (b) Set-off: No retention, set-offs or counterclaims may be exercised against our invoices without prior written authorization.
   (c) Late payment charges: We shall be entitled to charge interest on overdue accounts (in addition to storage charges referred to below) at the rate of 2% per annum above the prime rate for any amount overdue and unpaid. Overdue accounts will also be charged reasonable costs of collection, including attorney fees to the extent permitted by the laws of the State of Ohio.

5. **Price:** Our quotation only includes such goods, services, accessories, and work as specified therein, unless otherwise specified in our quotation:
   (a) Packaging: Packing in accordance with our current standards is included in our quoted price; otherwise, packing charges will be added to the invoice price.
   (b) Samples: Any samples submitted to you and not returned to our factory within sixty (60) days from date of receipt shall be paid for by you.
   (c) Taxes: All applicable taxes will be added to the invoice price unless we receive your signed Tax Exempt Certificate.
   (d) Shipping: Our quotations do not include shipping. If you request delivery other that F.O.B. our factory, you will be charged extra for any shipping, handling, loading and/or insurance.
   (e) Storage: If we do not receive adequate forwarding instructions within thirty (30) days after notice to you that the goods are ready for collection or that we are ready to ship, we are entitled, but not obligated, to arrange storage at your sole expense (including storage, handling, demurrage and insurance).
   (f) Alteration of: This Quotation/Job does not include alterations to buyer's premises, electrical or other utilities required to install the equipment provided here under.

6. **Price escalation:** We reserve the right to adjust the Contract Price if we incur extra costs due to changes or delays caused by you or your agents including, but not limited to, inadequate or improper instructions, designs or specifications. We reserve the right to adjust the Contract Price if we incur extra costs due to governmental acts, which affect performance of our obligations under contract.
   (a) Our equipment: Prices on equipment of our manufacture are firm for shipments to be made within one hundred twenty (120) days from date of order. [After one hundred twenty (120) days, prices will be adjusted in accordance with increases in the cost of labor, materials and overheads. The increase will be calculated by the FORMULA FOR CONTRACT PRICE ADJUSTMENT specified in our quotation. Or, after one hundred twenty (120) days, prices will be adjusted to our prices in place at the time of shipment.]
   (b) Supplier equipment: Prices on equipment of our manufacture are subject to adjustment by the same percentage of price change as may be made effective by our supplier prior to shipment of the equipment to you.

7. **Shipping:** Unless otherwise agreed, equipment shall be delivered F.O.B. our factory. We are authorized, but not required, to arrange shipping at the buyer's sole cost, by common carrier. For goods to be exported outside the continental United States, we are authorized, but not required, to arrange shipment, at the buyer's sole cost, from our factory alongside a vessel named by you at the port stated on our quotation. This clause does not affect the risk of loss or other incidents of the sale. Our obligations are deemed fulfilled and the risk of loss shifted to the buyers as soon as conforming goods are delivered to a common carrier or to the customer in the event that no common carrier is involved.

8. **Delay in Shipping:** Lead times quoted for shipping are estimated and we are not responsible for any losses resulting from delays. If we specifically agree in writing to a fixed time for shipment, we are not liable for damages caused by delay unless we have also specifically agreed in writing to a liquidated damages clause. In that event, our liability is limited to the amount of the agreed upon liquidated damages or the losses directly caused by our delay, whichever is less. A fixed time period for shipment does not start until we receive a written order with all information necessary to proceed with the job, including, but not limited to, your acceptance and approval of our specifications and drawings, licenses and government approvals, and arrangements for payment which meet our satisfaction. We are not responsible for delays caused by any reason in paragraph (3) above or caused by your instruction or lack thereof. No agreement for a fixed time for shipment is binding on us unless accompanied by an agreed upon liquidated damage clause, signed by an authorized employee.

9. **Cancellation:** Contracts and purchase orders may not be canceled without our prior written consent. You will be subject to cancellation charges. Cancellation charges include the amount necessary to compensate us for all materials ordered and work performed prior to the date of termination, lost profits and reasonable overheads and any other expenses resulting from the cancellation. Payment of all cancellation charges shall be made within thirty (30) days of the date of the invoice itemizing such charges.

10. **Drawings, samples, models and other descriptions:** Descriptive materials do not constitute a warranty that the goods shall conform to the description, and are not part of this contract. All descriptive materials including, but not limited to shipping models, catalogs, price-lists and other advertising materials are for illustrative purposes only. Unless drawings have been approved, we reserve the right at any time to change without notice the design, construction or specification of any equipment, machinery or system provided the revisions do not prejudice the operation of the equipment.

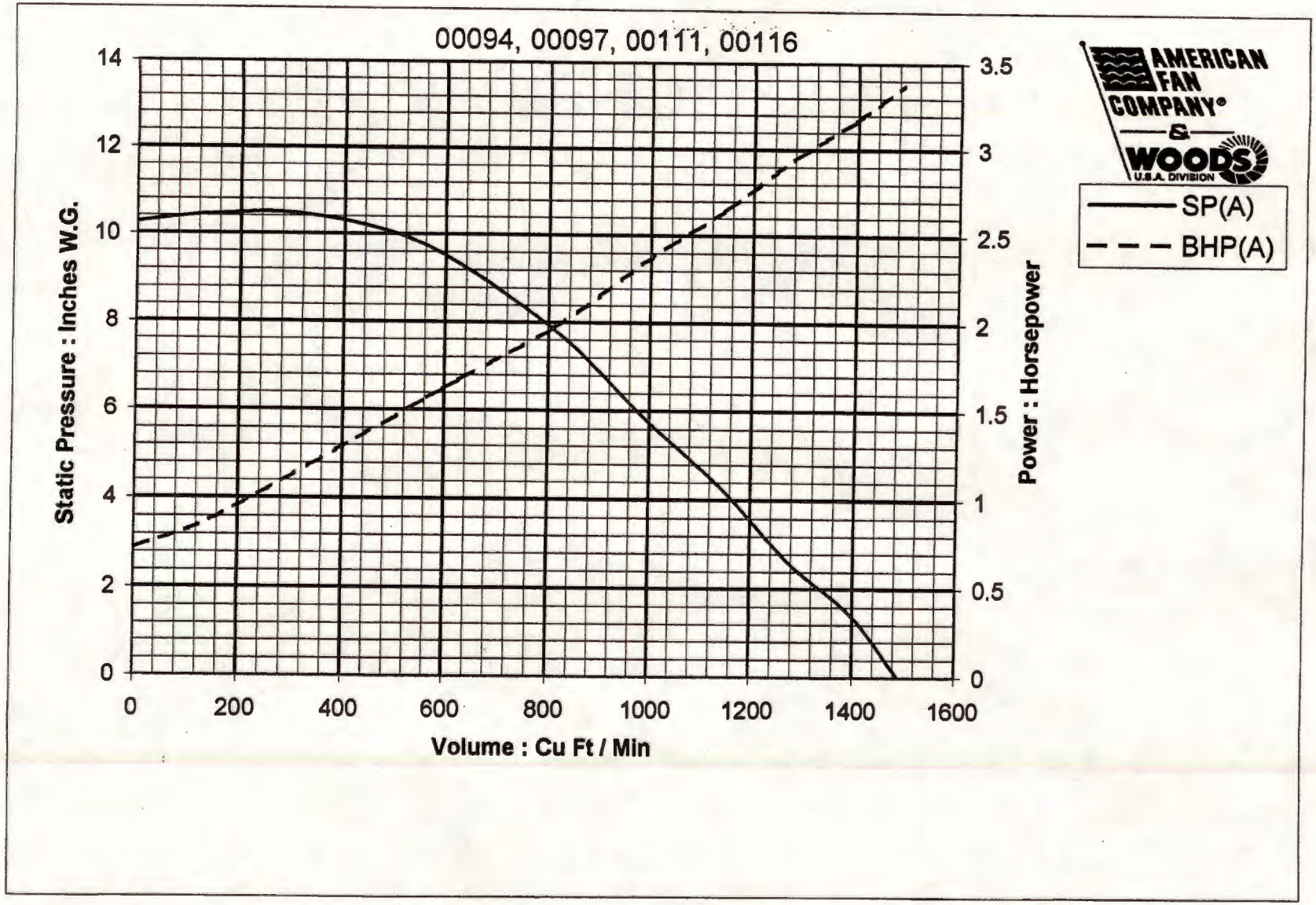
11. **Product Performance:** All performance figures given by us are approximate and are based on our laboratory experience and you agree that we accept no liability in the event of failure to achieve such performance figures. The figures only reflect performance we expect to obtain in our laboratory when tested to the relevant Air Movement and Control Association (AMCA) standards with test and tolerances detailed in our current technical literature. You assume responsibility for your own system design and for the goods being sufficient for your purpose. We will accept neither responsibility nor liability for the performance or suitability of our goods in their final operating environment, whether or not details of the final operating environment have been made available to us. We are not responsible for any performance curves that have been altered. If we specifically agree in writing to guarantee performance, we are only responsible for proven performance deficiencies if, and to the extent, we have agreed in writing to a liquidated damage clause which shall not in any event result in our incurring liability in excess of the Contract Price. No performance guarantees are binding on us unless in writing and signed by an authorized employee.

12. **Inspection and tests:** Our products are subjected to standard quality control inspection procedures before shipping. Standard inspections proceed without notice to you unless you request otherwise. If you require other tests, personal inspection, or that test/inspections be conducted in your presence, you will be charged extra. Any special inspections or tests shall be at our factory and will be made within seven (7) days after we give you notice that the equipment is ready for shipment. Failure to inspect the equipment at this time shall constitute a waiver of your right of inspection. Acceptance of goods occurs when (a) after inspection, you signify to us that the goods are conforming or (b) you fail to timely exercise your inspection right in accordance with this paragraph.

13. **Subcontracting:** We reserve the right to sub-contract the fulfilment of any contract or part thereof.

14. **Governing Law:** The parties acknowledge that the transaction that is the subject matter of this agreement bears a reasonable relation to the State of Ohio and that this agreement shall be governed by the laws of the State of Ohio, including the Uniform Commercial Code as enacted in that State. It is specifically understood and agreed that this agreement is for the sale of "goods" as that term is used in the Uniform Commercial Code.

15. **Severability:** The invalidity or unenforceability of any one or more phrases, sentences, clauses, paragraphs, or sections contained in this agreement shall not affect the validity or enforceability of the remaining portions of this agreement.



A SIZE = AF-12-R12327-7 ; RPM = 3450 ; Density = 0.0750 Lb/CF ; Width = 100.00%

1008654

SUPER SINGLE® pump switch

Mercury-activated, wide-angle switch designed to control pumps up to 1 HP at 120 VAC and 2 HP at 230 VAC.

This mercury-activated, wide-angle pump switch provides automatic control of pumps in non-potable water and sewage applications.

This switch is not sensitive to rotation or turbulence. For certain pump applications, one Super Single® may be wired in place of two control switches to operate a relay control panel.

The Super Single® pump switch is suitable for use with intrinsically safe circuits.

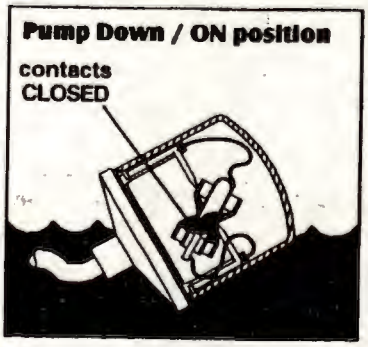
LSHH-204	LSH-205	LSL-205

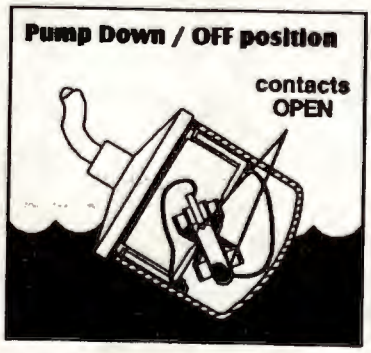
FEATURES

- Patented tumbler assembly gives positive pump on or pump off.
- Controls pumps up to 1 HP at 120 VAC and 2 HP at 230 VAC.
- Adjustable pumping range of 6.5 to 13.5 inches (17 to 34 cm).
- Includes standard mounting clamp and boxed packaging.
- UL Listed for use in non-potable water and sewage.
- CSA Certified.
- Three-year limited warranty.

LR94246 LISTED 83N2

Hydraulic





OPTIONS

This switch is available:

- for pump down or pump up applications.
- with a 120 VAC or 230 VAC piggy-back plug.
- without a plug for direct wiring in 120 VAC or 230 VAC applications.
- in standard cable lengths of 10, 15, 20, or 30 feet and 3, 5, 6, or 10 meters (longer lengths available).

CABLE: flexible 14 gauge 2 conductor (UL, CSA) SJOW, water-resistant (CPE)

FLOAT: 3.38 inch diameter x 4.25 inch long (8.58 x 10.80 cm) high impact, corrosion resistant, PVC housing for use in sewage and non-potable water up to 140°F (60°C)

MERCURY SWITCH: mercury-to-mercury contacts, hermetically sealed in a steel capsule

ELECTRICAL:

120 VAC 50/60Hz Single Phase:
Maximum Pump Running Current:
15 amps
Maximum Pump Starting Current:
55 amps
Recommended Pump HP:
1 HP or less

230 VAC 50/60Hz Single Phase:
Maximum Pump Running Current:
15 amps
Maximum Pump Starting Current:
35 amps
Recommended Pump HP:
2 HP or less

Note: This switch must be used with pumps that provide integral thermal overload protection.

SJE Rhombus
SJE ELECTRO SYSTEMS, INC.
PO Box 1708, Detroit Lakes, MN 56502
1-888-DIAL-SJE • 1-218-847-1317
1-218-847-4617 Fax
email: sje@sjerhombus.com
www.sjerhombus.com

Super Single® pump switch installation instructions

⚠WARNING

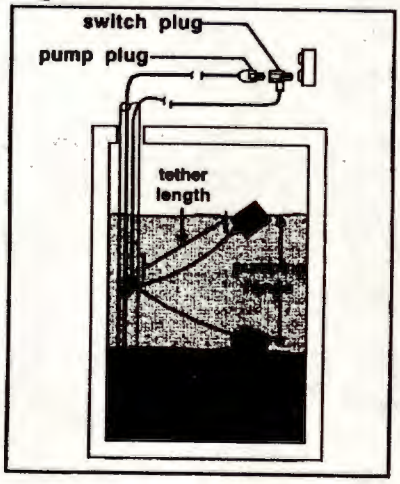
⚠WARNING

MOUNTING THE SWITCH

1. Determine the required cord tether length as shown in Figures A and B.
2. Place the cord into the clamp as shown in Figure C.
3. Secure the clamp to the discharge pipe as shown in Figure C. **Note:** Do not install cord under hose clamp.
4. Tighten the hose clamp using screwdriver. Over tightening may result in damage to the plastic clamp. Make sure the float cable is not allowed to touch the excess hose clamp band during operation.
5. Check installation. Allow system to cycle to insure proper operation.

Note: All hose clamp components are made of 18-8 stainless steel material. See your SJE-Rhombus supplier for replacements.

Figure A



PIGGY-BACK PLUG INSTALL

- Electrical outlet must not be located in pump chamber.
- Electrical outlet voltage, piggy-back plug voltage, and pump voltage must match.

1. Follow steps 1 through 4 of "Mounting The Switch."
2. Insert switch's piggy-back plug into outlet.
3. Plug pump into piggy-back plug as shown in Figure A.
4. Check installation. Allow system to cycle to insure proper operation.

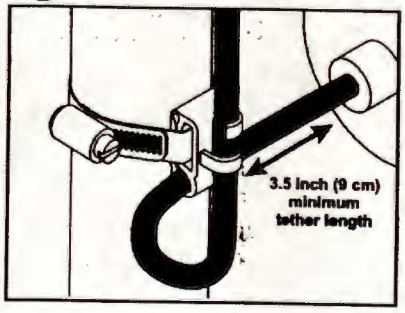
Figure B

Determining Pumping Range
In Inches (1 inch = 2.5 cm)

tether length	3.5	5	7	9	11	13	15
pumping range	6.5	7.5	8.5	10	11	12.5	13.5

Use only as a guide. Pumping ranges are based on testing in non-turbulent conditions. Range may vary due to water temperature and cord shape. **Note:** As the tether length increases, so does the variance of the pumping range.

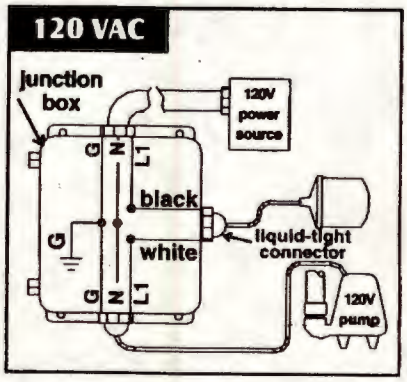
Figure C



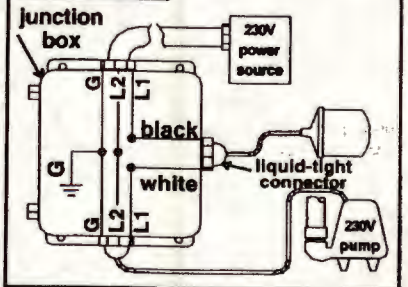
DIRECT WIRE INSTALL

1. Follow steps 1 through 4 of "Mounting The Switch."
2. Wire switch as shown below.
3. Check installation. Allow system to cycle to insure proper operation.

120 VAC



230 VAC



⚠WARNING In 230 VAC pump installations, one side of the line going to the pump is always HOT. This condition exists if the switch is on or off. Install double pole disconnect on all 230 VAC pump circuits.

CONTROLS SJE Rhombus
SJ ELECTRO SYSTEMS, INC.
22650 County Highway 6 ■ P.O. Box 1708 ■ Detroit Lakes, Minnesota 56502 USA
1-888-DIAL-SJE (1-888-342-5753) ■ Phone: 218-847-1317 ■ Fax: 218-847-4617
E-mail: sje@sjerhombus.com

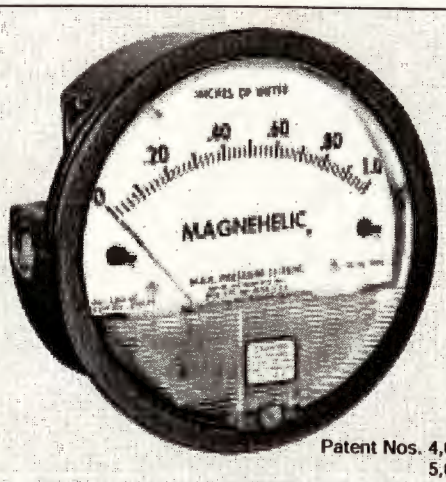
Instl. Instr. PN 1009475A
Cat. Page PN 1009505A

Printed in USA 03/00

Series 2000 Magnehelic® Differential Pressure Gages

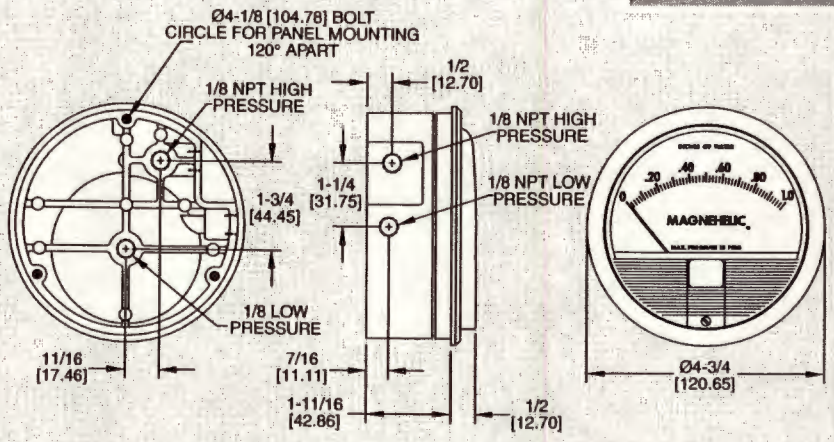
Indicate positive, negative or differential. Accurate within 2%.

PI-202



Patent Nos. 4,030,365
5,012,678

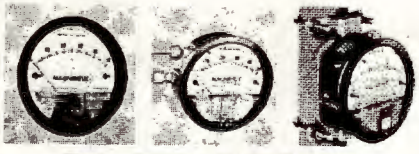
Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

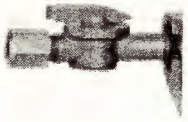
Select the Dwyer Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 ranges available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

Widely used to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.



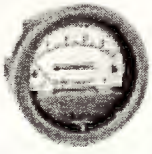
Flush ...Surface...or Pipe Mounted

MOUNTING. A single case size is used for most ranges of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1¼" - 2" pipe. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4⅜" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.



VENT VALVES

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.



HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4⅛" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available in all ranges. Because of larger case, will not fit in portable case. Weight 1 lb., 10 oz (Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

PHYSICAL DATA

Ambient temperature range: 20° to 140°F* (–7° to 60°C).
Rated total pressure: –20" Hg. to 15 psig† (–68 kPa to 103 kPa).
Overpressure: Relief plug opens at approximately 25 psig (172 kPa).
Connections: ⅛" NPT(F) high and low pressure taps, duplicated — one pair side and one pair back.
Housing: Die cast aluminum. Case and aluminum parts iridite-dipped to withstand 168 hour salt spray test. Exterior finish is dark gray.
Accuracy: Plus or minus 2% of full scale (3% on -0 and 4% on -00 ranges), throughout range at 70°F (21°C).
Standard accessories: Two ⅛" NPT plugs for duplicate pressure taps, two ⅛" pipe thread to rubber tubing adapters and three flush mounting adapters with screws. (Mounting ring and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)
Weight: 1 lb. 2 oz. (460 g)

*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

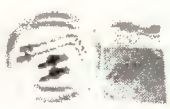
OPTIONS AND ACCESSORIES

Transparent overlays
Furnished in red and green to highlight and emphasize critical pressures.

Adjustable signal flag
Integral with plastic gage cover. Available for most ranges except those with medium or high pressure construction. Can be ordered with gage or separate

LED Setpoint Indicator
Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel

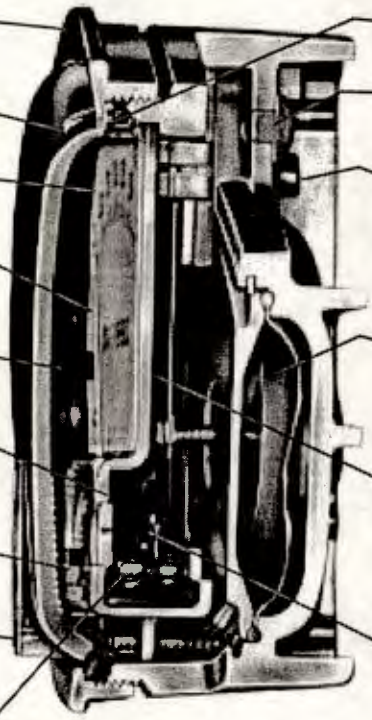
Portable units
Combine carrying case with any Magnehelic® gage of standard range (not high pressure). Includes 9 ft. (2.7 m) of ⅜" I.D. rubber tubing, standhang bracket and terminal tube with holde



Air filter gage accessory package
Adapts any standard Magnehelic® for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of ¼" aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves

Dwyer Instruments, Inc. P.O. Box 373/Michigan City, Indiana 46361/Phone 219 879-8000/Fax 219 872-9057 • U.K. Phone (01494)-461707 • Australia Phone (02) 9756-5355

Quality design and construction features



Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in plastic cover, accessible without removing cover. O-ring seal provides pressure tightness.

Helix is precision milled from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely to align with magnetic field of magnet to transmit pressure indication to pointer.

O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 PSIG rated models. Opens at approximately 25 PSIG.

Die cast aluminum case is precision made. Iridite-dipped to withstand 168 hour salt spray test. Exterior finished in baked dark gray hammerloid. One case size used for all standard pressure ranges, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

SERIES 2000 MAGNEHELIC®— MODELS AND RANGES
STOCKED MODELS in bold

The models below will fulfill most requirements. Page 4 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range Inches of Water
2000-00†	**0-.25**
2000-0†	**0-.50**
2001	**0-1.0**
2002	**0-2.0**
2003	**0-3.0**
2004	**0-4.0**
2005	**0-5.0**
2006	**0-6.0**
2008	**0-8.0**
2010	**0-10**
2015	**0-15**
2020	**0-20**
2025	**0-25**
2030	**0-30**
2040	**0-40**
2050	**0-50**
2060	**0-60**
2080	**0-80**
2100	**0-100**
2150	**0-150**

Model Number	Range Zero Center Inches of Water
2300-0†	**.25-0-.25**
2301	**.5-0-.5**
2302	**1-0-1**
2304	**2-0-2**
2310	**5-0-5**
2320	**10-0-10**
2330	**15-0-15**

Model Number	Range PSI
2201	**0-1**
2202	**0-2**
2203	**0-3**
2204	**0-4**
2205	**0-5**
2210*	**0-10**
2215*	**0-15**
2220*	**0-20**
2230**	**0-30**

*MP option standard
**HP option standard

Dual Scale Air Velocity Units

Model Number	Range in W.C.I Velocity, F.P.M.
2000-00AV	**0-.25/300-2000**
2000-0AV	**0-.50/500-2800**
2001AV	**0-1.0/500-4000**
2002AV	**0-2.0/1000-5600**
2010AV	**0-10/2000-12500**

For use with pitot tube.

Model Number	Range MM of Water
2000-6MM†	**0-6**
2000-10MM	**0-10**
2000-25MM	**0-25**
2000-50MM	**0-50**
2000-80MM	**0-80**
2000-100MM	**0-100**

Zero Center Ranges

2300-20MM†	**10-0-10**

Model Number	Range, CM of Water
2000-15CM	**0-15**
2000-20CM	**0-20**
2000-25CM	**0-25**
2000-50CM	**0-50**
2000-80CM	**0-80**
2000-100CM	**0-100**
2000-150CM	**0-150**
2000-200CM	**0-200**
2000-250CM	0-250
2000-300CM	0-300

Zero Center Ranges

2300-4CM	**2-0-2**
2300-10CM	**5-0-5**
2300-30CM	**15-0-15**

†These ranges calibrated for vertical scale position.

Model Number	Range, Pascals
2000-60 Pa†	**0-60**
2000-125 Pa†	**0-125**
2000-250 Pa	**0-250**
2000-500 Pa	**0-500**
2000-750 Pa	**0-700**

Zero Center Ranges

2300-250 Pa	**125-0-125**
2300-500 Pa	**250-0-250**

Model Number	Range, Kilopascals
2000-1 kPa	**0-1**
2000-1.5 kPa	**0-1.5**
2000-2 kPa	**0-2**
2000-3 kPa	**0-3**
2000-4 kPa	**0-4**
2000-5 kPa	**0-5**
2000-8 kPa	**0-8**
2000-10 kPa	**0-10**
2000-15 kPa	**0-15**
2000-20 kPa	**0-20**
2000-25 kPa	0-25
2000-30 kPa	**0-30**

Zero Center Ranges

2300-1 kPa	**.5-0-.5**
2300-3 kPa	**1.5-0-1.5**

Accessories
A-310A, 3-Way Vent Valve
A-321, Safety Relief Valve
A-432, Portable Kit
A-605, Air Filter Kit
A-610, Pipe Mount Kit

Options — To order, add suffix: I.E. 2001-ASF
ASF (Adjustable Signal Flag)
HP (High Pressure Option)
LT (Low Temperatures to -20°F)
MP (Med. Pressure Option)
SP (Setpoint Indicator

Scale Overlays — Red, Green, Mirrored or Combination, Specify Locations

Special Purpose Ranges
Scale No. 2401 Square Root Specify Range
Scale No. 2402 Blank Scale Specify Range

Model 2000-00N. range -.05 to +.20" W.C. For room pressure monitoring

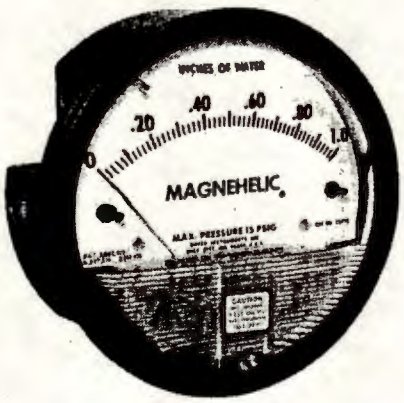
Dual Scale English/Metric Models		
Model Number	Range, In. W.C.	Range, Pa or kPa
2000-0D	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-700 Pa
2004D	0-4.0	0-1.0 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa

1011R01-0298P

BULLETIN NO. A-27B

Magnehelic® Differential Pressure Gage

OPERATING INSTRUCTIONS



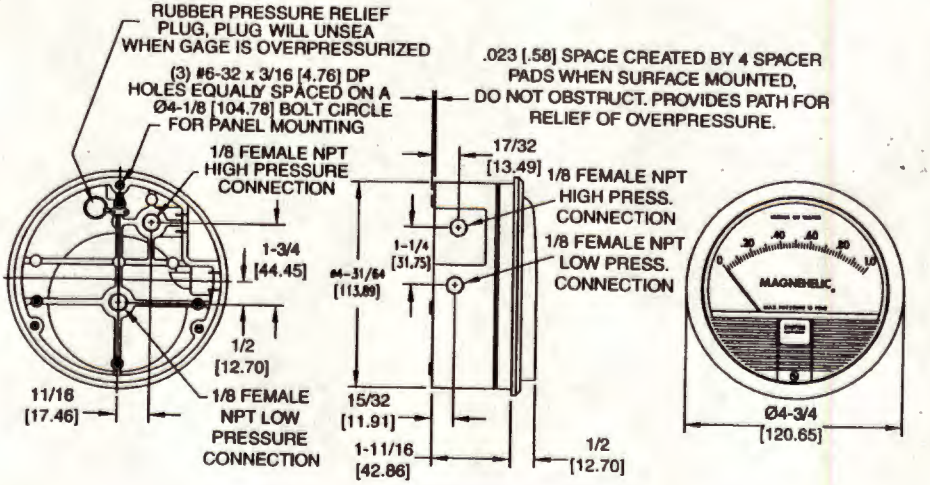
SPECIFICATIONS

Dimensions: 4-3/4" dia. x 2-3/16" deep.
Weight: 1 lb. 2 oz. (510 g)
Finished: Baked dark gray enamel.
Connections: 1/8" female NPT high and low pressure taps, duplicated, one pair side and one pair back.
Accuracy: Plus or minus 2% of full scale, at 70°F (21.1°C). (Model 2000-0, 3%; 2000-00, 4%).
Pressure Rating: 15 PSI (1.03 bar)
Ambient Temperature Range: 20° to 140°F (-7 to 60°C).
Standard gage accessories include two 1/8 male NPT plugs for duplicate pressure taps, two 1/8" male NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.

Caution: For use with air or compatible gases only.

For repeated over-ranging or high cycle rates, contact factory.

Not for use with Hydrogen gas. Dangerous reactions will occur.



DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361 U.S.A.
Phone: 219/879-8000 • www.dwyer-inst.com
Fax: 219/872-9057 • e-mail: info@dwyer-inst.com

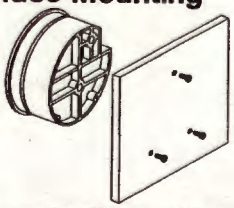
MAGNEHELIC® INSTALLATION

Overpressure Protection: Standard Magnehelic gages are rated for a maximum pressure of 15 psig and should not be used where that limit could be exceeded. Newer models employ a rubber plug on the rear which functions as a relief valve by unseating and venting the gage interior when over pressure reaches approximately 25 psig. To provide a free path for pressure relief, there are four spacer pads which maintain .023" clearance when gage is surface mounted. Do not obstruct the gap created by these pads.

1.Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F (60°C). Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines my be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.

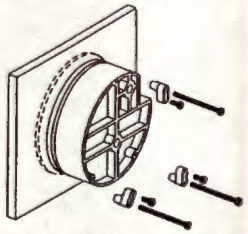
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range Model 2000-00 and metric equivalents must be used in the vertical position only.

3. Surface Mounting



Locate mounting holes, 120° apart on a 4-1/8" dia. circle. Use No. 6-32 machine screws of appropriate length.

4. Flush Mounting



Provide a 4-9/16" dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place. To mount gage on 1-1/4"-2" pipe, order optional A-610 pipe mounting kit.

5. To zero the gage after installation

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

Operation

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.

Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.

Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.

When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8" pipe thread to rubber tubing adapter and connect to source of pressure with rubber or Tygon tubing.

B. For permanent installation, 1/4" O.D., or larger, copper or aluminum tubing is recommended. See accessory bulletin S-101 for fittings.

MAINTENANCE

Maintenance: No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves, (bulletin S-101), should be used in permanent installations.

Calibration Check: Select a second gage or manometer of known accuracy and in an appropriate range. Using short lengths of rubber or vinyl tubing, connect the high pressure side of the Magnehelic gage and the test gage to two legs of a tee. Very slowly apply pressure through the third leg. Allow a few seconds for pressure to equalize, fluid to drain, etc., and compare readings. If accuracy unacceptable, gage may be returned to factory for recalibration. To calibrate in the field, use the following procedure.

Calibration:

1. With gage case, held firmly, loosen bezel, by turning counterclockwise. To avoid damage, a canvas strap wrench or similar tool should be used.
2. Lift out plastic cover and "O" ring.
3. Remove **scale screws and scale assembly.** Be careful not to damage pointer.
4. The calibration is changed by moving the clamp. Loosen the clamp screw(s) and move slightly toward the helix if gage is reading high, and away if reading low. Tighten clamp screw and install scale assembly.
5. Place cover and O-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw.
6. Secure cover in place by screwing bezel down snug. Note that the area under the cover is pressurized in operation and therefore gage will leak if not properly tightened.
7. Zero gage and compare to test instrument.

Make further adjustments as necessary.

Ordering Instructions:

When corresponding with the factory regarding Magnehelic® gage problems, be sure to include model number, pressure range, and any special options. Field repair is not recommended; contact the factory for repair service.

Caution: If bezel binds when installing, lubricate threads sparingly with light oil or molybdenum disulphide compound.

Warning: Attempted field repair may void your warrenty. Recalibration or repair by the user is not recommended. For best results, return gage to the factory. Ship prepaid to:

Dwyer Instruments, Inc.

Attn: Repair Dept.

102 Indiana Highway 212

Michigan City, IN 46360

Trouble Shooting Tips:

•*Gage won't indicate or is sluggish.*

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F (-7°C), order gage with low temperature, (LT) option.

•Pointer stuck-gage can't be zeroed.

1. Scale touching pointer.
2. Spring/magnet assembly shifted and touching helix.
3. **Metallic particles clinging to magnet and interfering with helix movement.**
4. Cover zero adjust shaft broken or not properly engaged in adjusting screw.

We generally recommend that gages needing repair be returned to the factory. Parts used in various sub-assemblies vary from one range of gage to another, and use of incorrect components may cause improper operation. After receipt and inspection, we will be happy to quote repair costs before proceeding.

Consult factory for assistance on unusual applications or conditions.

Use with air or compatible gases only.

Printed in U.S.A. 6/02 FR# 12-440212-04 Rev. 2

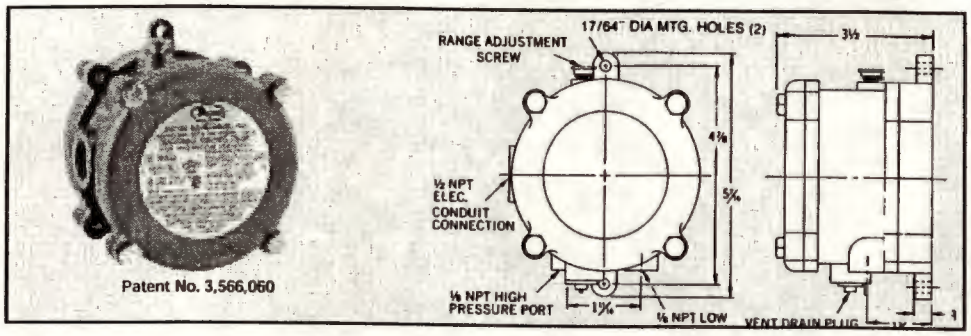
PSL-203

Dwyer®

Series 1950

Explosion-Proof Differential Pressure Switches

Compact, Low cost, Explosion-proof and Weatherproof.



Model 1950 Explosion-Proof Differential Pressure Switch combines the best features of the popular Dwyer series 1900 with an integral explosion-proof and weather-proof housing, making it an exceptional value for either application. It is C.E., U.L. and C.S.A. Listed, F.M. approved for use in Class I Groups C and D, Class II Groups E, F, and G and Class III hazardous atmospheres (NEMA 7 & 9). Weather-proof features include a drain plug and O-ring seal in cover. Electrical connections are easily made by removing front cover. For convenience the set point adjustment screw is located on the outside of the housing. Twelve models offer set points from .03 to 20" (.8 to 508 mm) w.c. and from .5 to 50 psi (3.4 to 345 kPa). The unit is very light and compact – about half the weight and bulk of other explosion-proof or weather-proof switches with separate enclosures.

PHYSICAL DATA

Temperature Limits: -40°F to 140°F (-40°C to 60°C). 0°F to 140°F (-18°C to 60°C) for 1950P-8, 15, 25, and 50 -30°F to 130°F (34°C to 54°C) for 1950-02
Maximum Surge Pressure: 1950-10 psi (.7 bar), 1950P - 50 psi (3.4 bar) 1950P-50 only - 90 psi (6.2 bar)
Rated Pressure: 1950 - 45" (.1 bar) w.c., 1950P - 35 psi (2.4 bar), 1950P-50 only - 70 psi (4.8 bar)
Pressure Connection: 1/8" NPT(F).
Electrical Rating: 15 amps, 125, 250, 480 volts, 60 Hz. AC. Resistive1/8" H.P. @125 volts,1/4" H.P. @ 250 volts, 60 Hz. A.C.
Wiring Connections: 3 screw type; common, norm. open and norm. closed.
Conduit Connection: 1/2" NPT(F).
Set Point Adjustment: Screw type on top of housing. Field adjustable.
Housing: Anodized cast aluminum.
Diaphragm: Molded fluorosilicone rubber. 02 model, silicone on nylon.
Calibration Spring: Stainless steel.
Installation: Mount with diaphragm in vertical position.
Weight: 3 1/4 lbs. (1.5 kg) 02 model, 4 lbs., 7 oz. (2 kg)

SERIES 1950 SWITCHES — STOCKED MODELS, OPERATING RANGES AND DEAD BANDS

Model Number	Range, Inches W.C.	Approximate Dead Band at	
		Min. Set Point	Max. Set Point
1950-02	.03 to .10	.025	.05
1950-00	.07 to .15	.04	.05
1950-0	.15 to .50	.10	.15
1950-1	.4 to 1.6	.15	.20
1950-5	1.4 to 5.5	.30	.40
1950-10	3 to 11	.40	.50
1950-20	4 to 20	.40	.60

Model Number	Range, PSID	Approximate Dead Band at	
		Min. Set Point	Max. Set Point
1950P-2	0.5 to 2	.3	.3
1950P-8	1.5 to 8	1.0	1.0
1950P-15	3 to 15	.9	.9
1950P-25	4 to 25	.7	.7
1950P-50	15 to 50	1.0	1.5

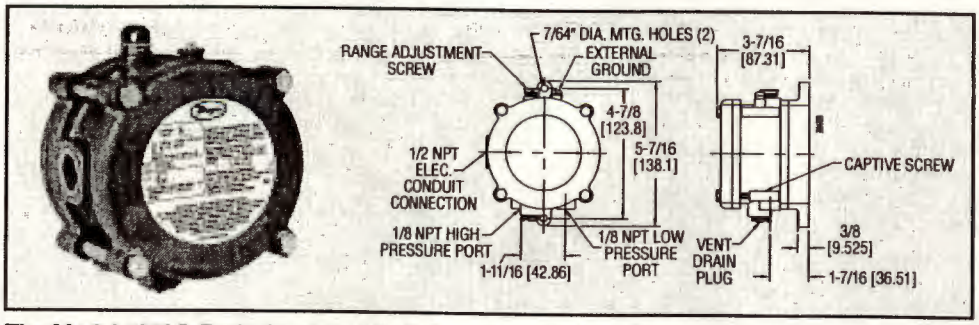
CAUTION: For use only with air or compatible gases. Applications with hazardous atmospheres and a single positive pressure may require special venting.

Dwyer®

Model 1950G

Explosion-Proof Differential Pressure Switch

Explosion-Proof, Weatherproof, Compatible with Natural Gases



The Model 1950G Explosion-Proof Switch combines the best features of the popular Dwyer Series 1950 Pressure Switch with the benefit of natural gas compatability.

Units are rain-tight for outdoor installations, and are U.L. listed for use in Class I, Groups A, B, C, & D; Class II, Groups E, F, & G and Class III atmospheres, CENELEC approved for EExd IIB & Hydrogen T6, and CSA & FM approved for Class I, Div 1, Groups B, C, D; Class II, Div 1, Groups E, F, G and Class III atmospheres. The 1950G is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

Easy access to the SPDT relay and power supply terminals is provided by removing the top plate of the aluminum housing. A supply voltage of 120 or 240 VAC is required. A captive screw allows the cover to swing aside while remaining attached to the unit. Adjustment to the set point of the switch can be made without disassembly of the housing.

PHYSICAL DATA

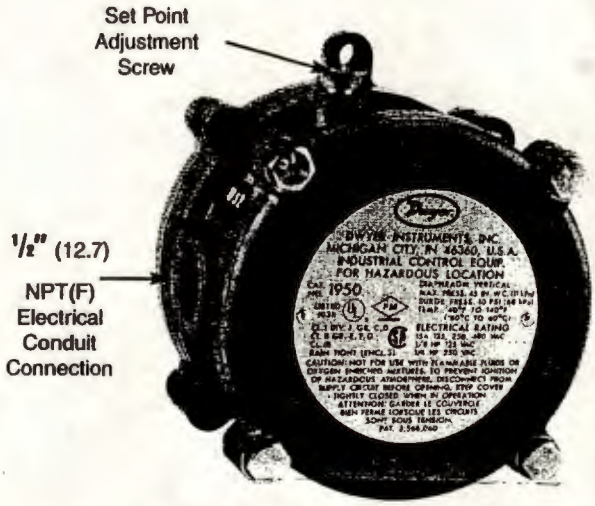
Temperature Limits: 0°F to 140°F (17.7° to 60°C). Note: Setpoint drift may occur with ambient temperature changes.
Rated Pressure: 45 IN. w.c.
Maximum Surge Pressure: 10 psi.
Pressure Connections: 1/8" NPT(F).
Electrical Rating: 10A, 120/240 VAC, 28 VDC Resistive 50mA, 125 VDC.
Supply Voltage: 120/240 VAC.
Wiring Connections: Internal Terminal Block.
Conduit Connections: 1/2" NPT(F).
Set Point Adjustment: Screw type on top of housing. Field adjustable.
Housing: Anodized cast aluminum.
Diaphragm: Buna-N. **Weight:** 3¼ lbs.
Calibration Spring: Stainless Steel.
Installation: Mount with diaphragm in vertical position.
Response Time: Switch response time may be as much as 10-25 seconds where applied pressures are near set point.

STOCKED MODELS

Model Number	Range, Inches W.C.	Approximate Dead Band at	
		Min. Set Point	Max. Set Point
1950G-00	.07 to .15	.04	.06
1950G-0	.15 to .50	.06	.11
1950G-1	.4 to 1.6	.11	.29
1950G-5	1.4 to 5.5	.4	.9
1950G-10	3 to 11	.9	1.8
1950G-20	4 to 20	1.2	3.0

Series 1950 – Explosion-Proof Differential Pressure Switches

Specifications – Installation and Operating Instructions



Series 1950 Explosion-Proof Differential Pressure Switches combine the best features of the Dwyer Series 1900 Pressure Switch with an integral explosion-proof and weather-proof housing. Each unit is UL & CSA listed; FM approved for use in Class I, Groups C & D; Class II, Groups E, F, & G; and Class III atmospheres (NEMA 7 & 9). They are totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches w.c. and from .5 to 50 psi (3.4 to 345 kPa).

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembling the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION
For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

NOTE: The last number-letter combination in the model number identifies the switch's electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC; ⅛ H.P. 125 VAC; ¼ H.P. 250 VAC; a number 5 or 6 rating is 1A 125 VAC. Letter B indicates a Buna-N diaphragm; N = Neoprene; S = Silicone; and V = Viton®.

UL and CSA Listed, FM Approved For
CL. I GR. C, D - CL. II GR. E, F, G - CL. III

Series 1950 Switches
Operating ranges and deadbands

To order specify Model Number	Operating Range: Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02	0.03 to 0.10	0.025	0.05
1950-00	0.07 to 0.15	0.04	0.05
1950-0	0.15 to 0.5	0.10	0.15
1950-1	0.4 to 1.6	0.15	0.20
1950-5	1.4 to 5.5	0.3	0.4
1950-10	3.0 to 11.0	0.4	0.5
1950-20	4.0 to 20.0	0.4	0.6
Model Number	**Operating Range: PSI**	**Approximate Dead Band**	
		Min. Set Point	Max. Set Point
1950P-2	0.5 to 2.0	0.3 PSI	0.3 PSI
1950P-8	1.5 to 8.0	1.0 PSI	1.0 PSI
1950P-15	3.0 to 15.0	0.9 PSI	0.9 PSI
1950P-25	4.0 to 25.0	0.7 PSI	0.7 PSI
1950P-50	15.0 to 50	1.0 PSI	1.5 PSI

PHYSICAL DATA

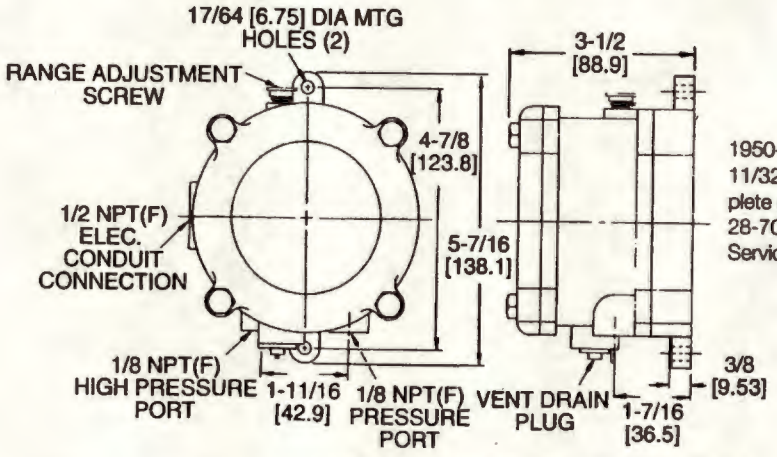
Temperature Limits: -40° to 140°F (-40° to 60°C); 1950P-8, -15, -25, -50: 0° to 140°F (-17.8° to 60°C); 1950-02: - 30° to 130°F (-34.4° to 54.4°C).
Rated Pressure: 1950: 45 in. w.c. (0.1 bar); 1950P: 35 psi (2.4 bar); 1950P-50 only: 70 psi (4.8 bar).
Maximum Surge Pressure: 1950: 10 psi (0.7 bar); 1950P: 50 psi (3.4 bar); 1950P-50 only: 90 psi (6.2 bar).
Pressure Connections: ⅛" NPT(F).
Electrical Rating: 15A, 125, 250, 480 volts, 60 Hz. AC Resistive ⅛ H.P. @ 125 volts, ¼ H.P. @ 250 volts, 60 Hz. AC.
Wiring Connections: 3-screw type; common, normally open and normally closed.
Conduit Connections: ½" NPT(F).
Set point adjustment: Screw type on top of housing, field adjustable.
Housing: Anodized cast aluminum.
Diaphragm: Molded fluorosilicone rubber, 02 model: silicone on Nylon.
Calibration Spring: Stainless Steel
Installation: Mount with diaphragm in vertical position.
Weight: 3 ¼ lbs (1.5 kg), 02 model; 4 lbs, 7 oz. (2 kg).

RESPONSE TIME: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-25 seconds where applied pressures are near set point.

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361 U.S.A.
Phone: 219/879-8000
FAX: 219/872-9057
http://www.dwyer-inst.com
e-mail: info@dwyer-inst.com

Series 1950 – Explosion-Proof Differential Pressure Switches

Specifications – Installation and Operating Instructions



1950 Switch Outline Dimensions

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Physical Data on page 1. Switch may be installed outdoors or in areas where the hazard of explosion exists. See page 1 for specific types of hazardous service.

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical.

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" NPT(F) pressure ports as noted below:

A. Differential pressures – connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS, and from source of lower pressure to low pressure port marked LOW PRESS.

B. Pressure only (above atmospheric pressure) – connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere.

C. Vacuum only (below atmospheric pressure) – connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.

4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of terminals marked "COM" (common), "NO" (norm open), "NC" (norm closed). The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT: To Change the Set point

1. Remove the plastic cap and turn the slotted Adjust-ment Screw at the top of the housing clockwise to raise the s[illegible] point pressure and counter-clockwise to lower the set po[illegible]. After calibration, replace the plastic cap and re-check the set point.

2. The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

3. For highly critical applications check the set point adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

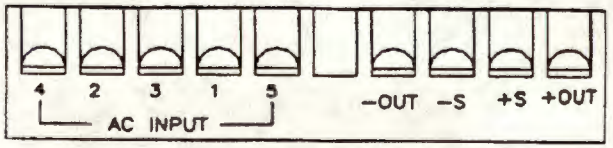
The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the set point. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated, then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.

Printed in U.S.A. 6/01
FR# 26-440332-00 Rev. 9

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361 U.S.A.
Phone: 219/879-8000
Fax: 219/872-9057
Ult-by-Fax: 888/891-2963
www.dwyer-inst.com
e-mail: info@dwyer-inst.com

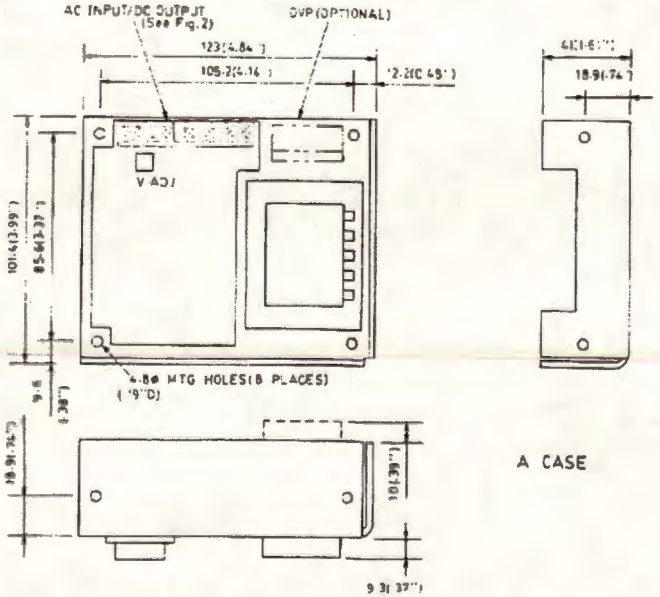
nput AC Connections: (See Fig.2)

FOR USE AT	CONNECT	APPLY AC TO:	PRIMARY FUSE (SLS-05-030-1T)	PRIMARY FUSE (SLS-12-017T) (SLS-15-015T) (SLS-24-012T)
100VAC	1-3,2-4	1 & 5	0.5A/125V	1.0A/125V
120VAC	1-3,2-4	1 & 4	0.5A/125V	1.0A/125V
220VAC	2-3	1 & 5	0.25A/250V	0.5A/250V
230VAC	2-3	1 & 4	0.25A/250V	0.5A/250V
240VAC	2-3	1 & 4	0.25A/250V	0.5A/250V



(Fig.2 Terminal Block)

Mechanical Dimensions: mm (Inches)

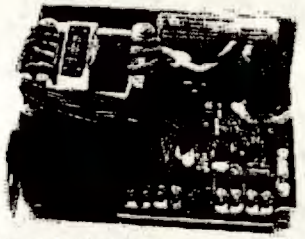


A CASE

EGS Electrical Group
SOLAV HEVI-DUTY
POWER SUPPLY GROUP

LINEAR OPEN FRAME DC POWER SUPPLIES

SILVER LINE



Models:

SLS-05-030-1T
SLS-12-017T
SLS-15-015T
SLS-24-012T

FEATURES:

- Easy installation with strip terminal
- 12VOLT output adjustable to 15VOLT
- Tight regulation: 0.05% Line; 0.05% Load
- Full Output Ratings to +50°C
- Built in OVP on 5 Volt Outputs
- OVP Option for 12V , 15V, and 24V
- Foldback Current Limiting Overload Protection With Automatic Recovery
- Multi-tap AC Inputs
- 100% Four-Hour Burn-In
- Limited Warranty for one Year
- UL Recognized
- cUL, UL Recognized for Canada
- TUV Certified
- Cover optional available(See drawing)

GENERAL SPECIFICATIONS:

Voltage/ Current Ratings:

MODEL NUMBER	OUTPUT
SLS-05-030-1T	5V/3.0A
SLS-12-017T	12V/1.7A or 15V/1.5A
SLS-15-015T	15V/1.5A or 12V/1.7A
SLS-24-012T	24V/1.2A

Refer to adjustment section.

Operating Temperature Range: 0 to +50°C (Derate to 40% at +70 °C)

Temperature Coefficient (typical): +/-0.01% / °C

Stability: Within +/- 0.05% (for 24 hours after warm-up)

Vibration: Per MIL-STD-810C, Method 514

Shock: Per MIL-STD-810C, Method 516

EMI/RFI: Linear power supplies have inherently low conducted and radiated noise levels. For most system applications, these power supplies will meet the requirements of FCC Class "B" and VDE 0871 for Class "B" equipment without additional noise filtering.

Cooling: Convection.

INPUT SPECIFICATIONS:

Multi Input (all units): 100/120/220/230/240 VAC selectable +/- 10% except 230 VAC is +15%, -6%.

Frequency Range: 47-63 Hz. (Typical is 60 Hz. derate output 10% at 50Hz.)

Transient Response Time: 50 μ SEC at 50% load changes for outputs rated up to 6A.
100 μ SEC at 50% load changes for outputs rated 6A and over.

Fuse Requirements: Units are *not* fused internally. For safe operation, user must provide input line fuse as per values given in table.

OUTPUT SPECIFICATIONS:

Line Regulation: 0.05% for +/-10% change

Load Regulation: 0.05% for 50% change

Ripple: 3.0 mV maximum peak-to-peak

DC Output Adjustment Range: +/- 5% minimum

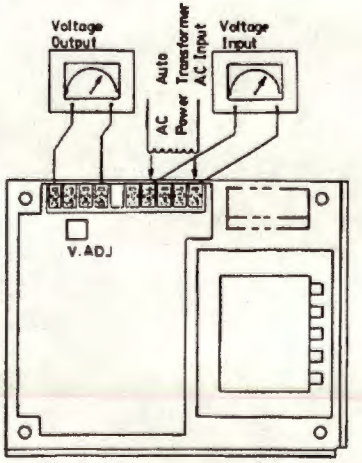
Overvoltage Protection: All 5 volt outputs include built-in OVP as standard (setting is 6.2V +/- 0.4V).OVP is optionally available on other outputs.

Remote Sensing: All units listed have remote sensing capability.

Overload Protection: 125 to 150% foldback current limit .

Dielectric Withstand voltage (min.): 3750 VAC input/output
1250 VAC input/safety ground
500 VAC output/safety ground

CONNECTION CHART



(Fig.1)

OUTPUT ADJUSTMENT

Step 1: Check the input Ac connections.

Step 2: Adjust the AC input according to the AC connections.

Step 3: Adjust +V.ADJ to +15V or +12V.

Step 4: Adjust –V.ADJ to –15V or –12V.

Limited Warranty

EGS Electrical Group
SOLA/ HEVI-DUTY

Sola warrants this product against defective material* or workmanship for a period of one year from the date of purchase by the end user. The warranty on repaired products is for ninety days on the repairs made, or the remainder of the warranty, whichever is greater.

Sola will repair or replace the defective product at no charge to the buyer and will pay all reasonable two-way surface freight charges.

The warranty is void if Sola determines that the product was subjected to conditions outside the normal operating characteristics stated in the manual, or if there is shipping damage.

Any advice furnished before or after delivery in regards to the use or application of Sola products is furnished without charge and on the basis that it represents Sola's best judgement under the circumstances, but it is used at the recipient's sole risk.

Sola shall in no event be liable for other direct, special, incidental, consequential, indirect or penal damages.

There are no warranties which extend beyond the description of the face hereof.

The following products are covered by the above-stated warranty:

- Electronic UPS products (26, 56 and 57 series)
  0.4, 0.6, 0.75, 1.0, 1.5, 3.0, 5.0, 7.5, 10.0 and 15.0 KVA ratings
- Standby power supply products (56 series)
  0.3, 0.4, 0.8 and 1.2 KVA ratings
- DC power supply products (28, 81, 82, 83, 84, 85 and 86 series)
- Electronic power conditioners (66 series)
  0.5, 1.0 and 2.0 KVA ratings

* Excludes normal consumable items such as fuses, lamps, and metal oxide varistors (MOVs), etc. Batteries must be maintained per the manufacturer's instructions.

P/N 35809-1
REV. 3/87

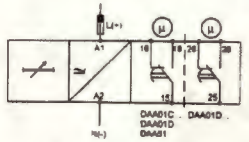
DAAX1XM24
PAA01XM24
DMBX1XM24
PMB01XM24

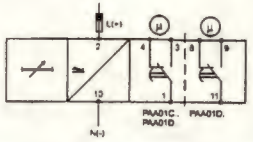
Electronic timers
Elektronische zeitrelais
Minuteris électroniques
Temporizador electronico
Temporizzatore elettronico
Elektroniske timere

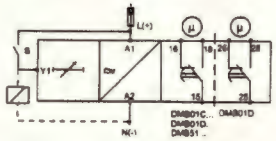
Installation instructions
Installationshinweise
Notice d'installation
Instrucciones de instalación
Istruzioni per l'installazione
Installationsvejledning

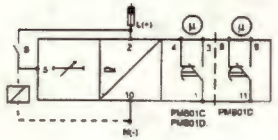
Mounting and installation by skilled people only!
Montage und Installation nur durch Fachpersonal!
Montage et installation par des personnes habilitées seulement!
El montaje y instalación ha de realizarlo solo personal con experiencia!
Il montaggio e l'installazione va eseguito da parte di personale addestrato!
Montering og installation må kun foretages af faguddannede personer!

CARLO GAVAZZI

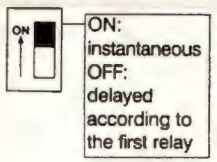








DIP-Switch setting (XAA01D and XMB01DM24B002):



ON: instantaneous
OFF: delayed according to the first relay

ENGLISH

① Connections (DAA, DMB)

Connect the power supply to the terminals A1 and A2. Connect the trigger input S between terminals A1 and Y1 (DMBX1 versions only). Connect the relay output according to the ratings as shown in the side diagrams.

Keep power OFF while connecting!

② Connections (PAA, PMB)

Connect the power supply to the terminals 2 and 10. Connect the trigger input S between terminals 2 and 5 (PMB01 versions only). Connect the relay output according to the ratings as shown in the side diagrams.

Keep power OFF while connecting!

③ Setting of function, time range and delay time

Select the desired time range by the lower knob on front as shown on the left. Adjust the time period on relative scale: 1 to 10 with respect to the chosen range, setting the centre knob as shown on the left.

XAA01D and XMB01DM24B002:
Select the desired function of the second relay output by the DIP-switch on the front (OFF=delayed according to the first relay, ON= instantaneous).

DMBX1 and PMB01:
Select the desired function

DEUTSCH

① Anschlüsse: (DAA, DMB)

Schliessen Sie die Betriebsspannung an die Klemmen A1 und A2 und den Schalteingang S zwischen A1 und Y1 an (Nur bei Typ DMX01). Schliessen Sie den Relaisausgang entsprechend den Betriebsdaten an, wie in den Bildern links dargestellt.

Achten Sie während dem Anschließen auf Spannungsfreiheit!

② Anschlüsse: (PAA, PMB)

Schliessen Sie die Betriebsspannung an 2 und 10 und den Schalteingang S zwischen 2 und 5 an (Nur bei Typ PMB01). Schliessen Sie den Relaisausgang entsprechend den Betriebsdaten an, wie in den Bildern links dargestellt.

Achten Sie während dem Anschließen auf Spannungsfreiheit !

③ Einstellung von Funktion, Zeitbereich und Verzögerungszeit

Wählen Sie den gewünschten Zeitbereich mit dem unteren Drehknopf, wie links im Bild dargestellt. Stellen Sie, wie links dargestellt, mit dem mittleren Knopf die Zeit auf der relativen Skala ein: Von 1 bis 10, bezogen auf den gewählten Zeitbereich.

XAA01D und XMB01DM24B002:
Stellen sie die gewünschte Funktion des zweiten Relais über die DIP-Schalter an der Gehäusefront ein. (Aus= verzögert nach dem 1. Relais schaltend, Ein= fort schaltend).

DMBX1 und PM0B1:
Wählen Sie eine Funktion

FRANÇAIS

① Raccordements (DAA, DMB)

Raccorder l'alimentation aux bornes A1 et A2. Raccorder l'entrée S du circuit de déclenchement entre les bornes A1 et Y1 (versions DMBX1 seulement). Raccorder le relais de sortie en fonction des caractéristiques comme indiqué dans les diagrammes de côté.

Couper l'alimentation lors des raccordements!

② Raccordements (PAA, PMB)

Raccorder l'alimentation aux bornes 2 et 10. Raccorder l'entrée S du circuit de déclenchement entre les bornes 2 et 5 (versions PMB01 seulement). Raccorder le relais de sortie en fonction des caractéristiques comme indiqué dans les diagrammes de côté.

Couper l'alimentation lors des raccordements!

③ Paramétrage de la fonction, gamme de temps et durée temporisation

Sélectionner la gamme de temps souhaitée au moyen du bouton inférieur en face avant comme indiqué à gauche. Ajuster la période de temps en échelle relative: 1 à 10 par rapport à la gamme choisie, au moyen du bouton central de réglage comme indiqué à gauche.

XAA01D et XMB01DM24B002:
La sélection de la fonction du deuxième relais de sortie se fait via le commutateur sur la face avant du relais (OFF= retardé par rapport au premier relais, ON= instantané)

DMBX1 et PMB01:
Sélectionner la fonction sou-

ESPAÑOL

① Conexiones (DAA, DMB)

Conectar la alimentación a los terminales A1 y A2. Conectar la entrada de disparo S entre los terminales A1 e Y1 (sólo para la versión DMBX1). Conectar la salida de relé según las escalas, como se muestra en los diagramas laterales.

Desconecte la alimentación antes de realizar las conexiones!

② Conexiones (PAA, PMB)

Conectar la alimentación a los terminales 2 y 10. Conectar la entrada de disparo S entre los terminales 2 y 5 (sólo para la versión PMB01). Conectar la salida de relé según las escalas, como se muestra en los diagramas.

Desconecte la alimentación antes de realizar las conexiones!

③ Ajuste de la función, escala de tiempo y retardo

Seleccionar la escala de tiempo deseada con el potenciómetro inferior situado en el frontal, como se muestra en la figura. Con el potenciómetro central, ajustar el periodo de tiempo en la escala relativa de 1 a 10 según el rango respectivo elegido, como se muestra en la figura.

XAA01D y XMB01DM24B002:
Seleccionar la función deseada para el relé de la segunda salida por medio de los DIP-swich del frontal (OFF=retardado de acuerdo al primer relé de salida, ON=instantáneo).

DMBX1 and PMB01:
Seleccionar la función dese-

ITALIANO

① Collegamenti (DAA, DMB)

Collegare l'alimentazione ai terminali A1 e A2. Collegare l'ingresso trigger S tra i terminali A1 e Y1 (solo versioni DMBX1). Collegare l'uscita relè secondo i valori di carico indicati nel diagramma a sx.

Staccare l'alimentazione prima di collegare lo strumento!

② Collegamenti (PAA, PMB)

Collegare l'alimentazione ai terminali 2 e 10. Collegare l'ingresso trigger S tra i terminali 2 e 5 (solo versioni PMB01). Collegare l'uscita relè secondo i valori di carico indicati nel diagramma a sx.

Staccare l'alimentazione prima di collegare lo strumento!

③ Programmazione di funzione, gamma tempi e tempo di ritardo

Selezionare la gamma tempi desiderata tramite la manopola inferiore sul fronte dello strumento. Regolare il periodo di tempo su scala relativa: da 1 a 10 rispetto alla gamma tempi impostata regolando la manopola centrale (vedere figura a sx).

XAA01D e XMB01DM24B002:
Selezionare la funzione della seconda uscita relay agendo sul DIP-switch frontale (OFF=ritardata come il primo relay, ON=istantanea).

DMBX1 e PMB01:
Selezionare la funzione desi-

DANSK

① Forbindelser (DAA, DMB)

Slut strømforsyningen til terminal A1 og A2. Forbind triggerindgang S mellem terminal A1 og Y1 (kun DMBX1-udgaver). Tilslut den relæstyrede udgang i forhold til belastningen, som vist i diagrammerne ved siden af.

Forsyningen skal være koblet fra, mens forbindelserne etableres!

② Forbindelser (PAA, PMB)

Slut strømforsyningen til terminal 2 og 10. Forbind triggerindgang S mellem terminal 2 og 5 (kun PMB01-udgaver). Tilslut den relæstyrede udgang i forhold til belastningen, som vist i diagrammerne ved siden af.

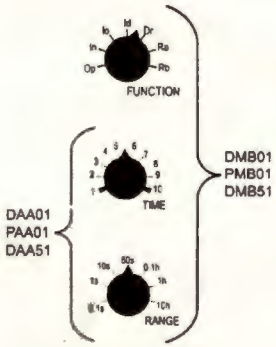
Forsyningen skal være koblet fra, mens forbindelserne etableres!

③ Indstilling af funktion, tidsområde og forsinkelsesperiode

Vælg det ønskede tidsområde ved hjælp af den nederste knap på fronten, som vist til venstre. Indstil tidsperioden på relativ skala: 1 til 10 i forhold til det valgte område. Brug den midterste knap på fronten til indstillingen, som vist til venstre.

XAA01D og XMB01DM24B002:
Vælg ønsket funktion for udgang 2 ved at indstille en af DIP-switchene bag dækslet på forsiden. (OFF=forsinkelse som udgang 1, ON=momentan).

DMBX1 og PMB01:
Vælg den ønskede funktion



by the upper knob as shown on the left:

Op: Delay on Operate
In: Interval
Io: Interval on trigger open
Id: Double Interval
Dr: Delay on release
R: Symmetrical recycler (ON first)
Rb: Symmetrical recycler (OFF first)

Incorrect selection of the time range causes fast blinking of the yellow LED

④ **Mechanical mounting (DAA and DMB)**

Hang the device to the DIN-rail being sure that the spring closes. Use a screwdriver to remove the product as shown on the left.

⑤ **Startup and adjustment**

Check if the connections are correct. Turn the power supply ON, the green LED switches ON. The working mode, according to the selected function, is schematized on the side label.
The yellow LED is ON when the relay is energized, it blinks slowly during timing and blinks fast in case of wrong set-up.

⑥ **Note**

The packing material should be kept for redelivery in case of replacement or repair.

DAA, DMB	PAA, PMB
A1, A2	2, 10
A1, Y1	2, 5
15, 16, 18	1, 3, 4
25, 26, 28	8, 9, 11

⑦ **Terminals**

Power supply.
Trigger input (DMB, PMB)

Relay output.
2nd relay output (DPDT versions).
Each terminal can accept up to 2.5 mm² wires for DAA51 and DMB51 and 2 x 2.5 mm² wires for DAA01 and DMB01.

mit dem oberen Drehknopf wie links im Bild dargestellt:

Op: Ansprechverzögerung
In: Intervall
Io: Intervall mit Schalteingang offen
Id: Zweifaches Intervall
Dr: Rückfallverzögerung
R: Symmetrischer Taktgeber (zuerst EIN)
Rb: Symmetrischer Taktgeber (zuerst AUS)

Bei einer falschen Einstellung des Zeitbereich-es beginnt die gelbe LED schnell zu blinken

④ **Montage (DAA und DMB)**

Hängen Sie das Relais in die DIN-Schiene ein; die Feder muss einrasten. Bauen Sie das Relais mit eine Schraubendreher aus, so wie links dargestellt.

⑤ **Einschalten und Einstellungen**

Prüfen Sie die Anschlüsse auf Fehlerfreiheit. Schalten Sie die Betriebsspannung EIN, die grüne LED leuchtet. Die Funktionsweise, abhängig von der gewählten Funktion, ist auf der Seite des Relais dargestellt. Die gelbe LED leuchtet, wenn die Relaisspule stromführend ist. Sie blinkt langsam während der Funktion und schnell bei falscher Einstellung.

⑥ **Hinweis**

Bitte heben Sie die Originalverpackung für eventuelle Rücksendungen auf.

⑦ **Anschlussklemmen**

Betriebsspannung
Schalteingang (DMB, PMB)

Relaisausgang
Zweiter Relaisausgang (Typen mit 2-pol. Wechsler).
Leiterquerschnitt pro Anschlußklemme:
bis 1 x 2,5 mm² (DAA51 und DMB51)
und 2 x 2,5 mm² (DAA01 und DMB01)

haitée au moyen du bouton du haut comme indiqué à gauche:
Op: temporisation travail
In: Intervalle
Io: Calibreur d'impulsions - Démarrage au relâchement
Id: Double Intervalle
Dr: temporisation au relâchement
R: Clignoteur symétrique (ON d'abord)
Rb: Clignoteur symétrique (OFF d'abord)

Lorsque la gamme de temps sélectionnée est incorrecte, la LED jaune clignote rapidement.

④ **Montage mécanique (DAA et DMB)**

Accrocher l'instrument sur le rail DIN en s'assurant du verrouillage du ressort. Pour déposer l'instrument, faire levier avec un petit tournevis comme indiqué.

⑤ **Démarrage et réglage**

Constater que les raccordements sont corrects. Mettre l'instrument sous tension (ON) LED verte s'allume.
Selon la fonction sélectionnée, le mode de fonctionnement figure sur l'étiquette sur le côté de l'instrument. Lorsque le relais est sous tension, la LED est allumée; elle clignote lentement pendant l'écoulement de la temporisation et rapidement en cas de configuration incorrecte de l'instrument.

⑥ **Note**

The packing material should be kept for redelivery in case of replacement or repair.

⑦ **Bornes**

Alimentation
Entrée circuit de déclenchement (DMB, PMB)
Relais de sortie
2ème relais de sortie (2 inverseurs)
Chaque borne des DAA51-DMB51 accepte des sections jusqu'à 2,5 mm². Chaque borne des DAA01-DMB01 accepte des sections jusqu'à deux fois 2,5 mm².

ada con el potenciómetro superior situado en el frontal, como se muestra en la figura:
Op: Retardo a la conexión
In: Intervalo
Io: intervalo con disparo
Id: intervalo doble
Dr: Retardo a la desconexión
R: cíclico simétrico (comienzo en ON)
Rb: cíclico simétrico (comienzo en OFF)

La selección incorrecta de la escala de tiempo provoca que el LED amarillo parpadee con rapidez

④ **Montaje mecánico (DAA y DMB)**

Colocar el equipo en el carril DIN, asegurándose que el muelle se ajusta. Utilizar un destornillador para quitar el equipo, como se muestra en la figura.

⑤ **Inicio y ajustes**

Comprobar que las conexiones están realizadas correctamente.
Conectar la alimentación, el LED verde se enciende. El modo de funcionamiento, según la función seleccionada, se muestra en la etiqueta lateral del equipo. Cuando el relé está activado, el LED amarillo parpadea con lentitud durante la temporización y parpadea con rapidez si el ajuste no se ha realizado correctamente.

⑥ **Note**

Procure conservar el embalaje original en caso de que fuera necesario reparar o devolver el equipo.

⑦ **Terminales**

Alimentación
Entrada de disparo (DMB, PMB)
Salida de relé
2ª sali da de relé (versiones DPDT)
Cada terminal puede aceptar hilos de hasta 2,5 mm² para DAA51 y DMB51, e hilos de hasta 2 x 2,5 mm² para DAA01 y DMB01.

derata tramite la manopola superiore come indicato nella figura a sx:
Op: Ritardo all'eccitazione
In: Intervallo
Io: intervallo all'apertura del contatto di comando
Id: doppio intervallo
Dr: Ritardo alla diseccitazione
R: ciclico simmetrico (partenza in ON)
Rb: ciclico simmetrico (partenza in OFF)

Una selezione errata della gamma tempi causa il lampeggiamento veloce del LED giallo.

④ **Montaggio sulla guida DIN (DAA e DMB)**

Agganciare lo strumento alla guida DIN verificando la chiusura della molla. Per rimuovere l'apparecchio dalla guida usare un cacciavite come mostrato in figura.

⑤ **Avviamento e regolazioni**

Controllare che i collegamenti siano corretti. Collegare lo strumento alla tensione di alimentazione, il LED verde si accende. Il modo di funzionamento, a seconda della funzione selezionata, viene schematizzato sull'etichetta laterale.
Il LED giallo si accende appena il relè si attiva, lampeggia lentamente durante la temporizzazione e lampeggia velocemente in caso di errata regolazione.

⑥ **Note**

Conservare l'imballo originale in caso di sostituzione o riparazione.

⑦ **Terminali**

Alimentazione
Contatto di comando (DMB, PMB)
Uscita relè
2da uscita relè (versioni DPDT)
Ciascun terminale può accettare cavi fino a 2.5mm² per DAA51 e DMB51 e cavi fino a 2 x 2.5mm² per DAA01 e DMB01.

ved hjælp af den øverste knap, som vist til venstre:

Op: Indkoblingsforsinkelse
In: Interval
Io: Interval ved åben trigger
Id: Dobbelt interval
Dr: Udkoblingsforsinkelse
R: Symmetrisk taktgiver (aktiveret først)
Rb: Symmetrisk taktgiver (deaktiveret først)

Hvis det forkerte tidsområde vælges, begynder den gule lysdiode at blinke hurtigt.

④ **Mekanisk montering (DAA og DMB)**

Når enheden monteres på DIN-skinnen, skal det sikres, at fjederen lukker. Brug en skruetrækker til at fjerne produktet som vist til venstre.

⑤ **Opstart og justering**

Kontrollér, om alle tilslutninger er foretaget korrekt. Tænd for strømforsyningen. Derved tændes den grønne lysdiode.
Driftsfunktionen i henhold til den valgte funktion fremgår af sidemærkaten.
Den gule lysdiode er aktiveret, når relæet er aktiveret, den blinker langsomt under tidsudmåling og blinker hurtigt, hvis der er fejl i opsætninger.

⑥ **Bemærk**

Emballagematerialet skal opbevares og anvendes til returnering ved udskiftning eller reparationer.

⑦ **Terminaler**

Strømforsyning
Triggerindgang (DMB, PMB)

Relæstyret udgang
2. relæstyret udgang (2-polede udgaver)
Hver terminal er klassificeret til ledninger på op til 2,5 mm² (DAA51 og DMB51) og ledninger på 2 x 2,5 mm² (DAA01 og DMB01).

Form 270
Sheet P/N 100274-1
Rev. G

Warrick® Series 27 Controls
Installation and Operation Bulletin

This bulletin should be used by experienced personnel as a guide to the installation of Series 27. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Gems Sensors or its local representative if further information is required.

Important!
Before proceeding to install and wire the control, read and thoroughly understand these instructions.

When installing according to these instructions, the sensing circuit is intrinsically safe for Class I and II, Division 1, Groups A, B, C, D, E, F and G.

Electrical equipment connected to associated apparatus should not exceed maximum voltage marked on product.

Location: The control must be situated in a non-hazardous area where an explosive atmosphere will not exist at any time.

Wiring:

1. Intrinsically safe wiring must be kept separate from non-intrinsically safe wiring.
2. Intrinsically safe and non-intrinsically safe wiring may occupy the same enclosure or raceway if they are at least 2 inches (50mm) apart and separately tied down. Inside panels, field wiring terminals for intrinsically safe circuits must be separated by at least 2 inches (50 mm) from non-intrinsically safe terminals.
3. Wire the control device(s) to the Series 27 relay as shown in the specific application wiring diagram in this bulletin. A separate rigid metallic conduit should be used to enclose the conductors of the intrinsically safe control circuit.
4. An approved seal should be used at the point where the intrinsically safe control circuit wiring enters the hazardous area.

For intrinsically safe output wiring, use #14 or #16 AWG type MTW or THHN wire. By using these wire types in conjunction with the following distance recommendations, you will not exceed the maximum capacitance for field wiring. Use the following chart as a guide for maximum wire runs for differential level service (3wire) field wiring.

Model	Max. Sensitivity (K Ohms)	Distance (FT.)
27XXD0	3	4,000
27XXE0	10	900
27XXH0	24	800
27XXG0	100	75

One of the two grounding terminals provided on the intrinsically safe output terminal strip must be connected as reference to the same conductive media presented to terminals "H" and "L" ***(See applicable wiring diagram in this bulletin)*** Terminal G ***on the supply line***/load side terminal strip is a redundant system ground terminal and should be connected to the earth ground buss of the control's AC supply line feeder.

Note:

1. Intrinsically safe terminals can be connected to any non-energy generating or storing switch device such as a pushbutton, limit or float type switch or any Warrick electrode and fitting assembly.
2. To prevent electrical shock from supply line/load side powered connections, Series 27 should be mounted in a tool accessible enclosure of proper NEMA rated integrity.
3. For additional guidance on "Hazardous Location Installation" and "Intrinsically Safe Devices", consult ANSI/ISA standard RP 12-6 or NEC articles 500-516.

27 - X- X - X - X

- **Enclosure**: 0- none, 1- NEMA 1, 4- NEMA 4, 7- NEMA 7
- **Sensitivity (Ohms)**: D- 3K, E- 10K, H- 24K, G- 100K
- **Voltage**: 1- 120 VAC, 2- 240 VAC
- **Mode of Operation**: A- Direct, B- Inverse

Grounding: Both mounting tabs of the Series 27 provide an electrical connection for earth grounding between the control's internal solid state circuitry and the enclosure chassis. To insure proper grounding, use only metal screws and lock washers when mounting this control.

Contact Design
SPDT (1 form C): One normally open (N.O.) and one normally closed (N.C.), non-powered contacts
Contact Ratings: 8A @ 240 VAC resistive, 8Amps @ 30 VDC resistive

Contact Life
Mechanical: 10 million operations.
Electrical: 100,000 operations minimum at rated load

Electronics Module
Solid state components epoxy encapsulated in a black nylon shell

Supply Voltage
120 or 240 VAC models ±10%, 50/60 Hz.

Supply Current
Relays energized - 1.7 VA.

Secondary Circuit
11 VAC RMS voltage on probes, 2.3 milli-amp current

Sensitivity
Models operate from 0-100,000 ohms maximum specific resistance (factory set)

Temperature
-40° to 150° F ambient

Terminals
Size 6 pan head screws with captivated wire clamping plate

Time Delays
Standard: 0.5 seconds rising level
LLCO probe: 3 seconds lowering level

Listings
U.L. Intrinsically Safe (UL 913)

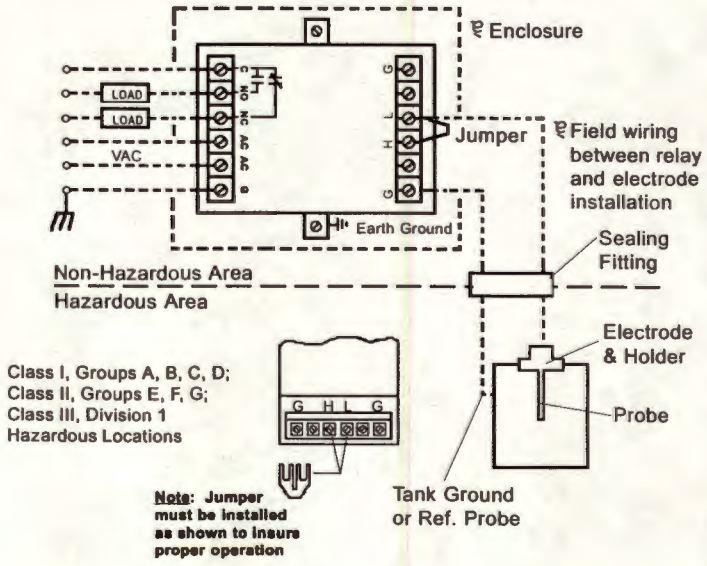
Wiring Diagram
Single Level Service
- Conductance Actuated

1. Connect (both terminals AC, AC) and G to appropriate VAC supply line.
2. Install metallic jumper between terminals H and L.
3. Connect terminal L to the electrode.

Terminal G must be grounded to the tank if metallic. When the tank is non-metallic, terminal G must be connected to an additional electrode of length equal to the longest electrode.

4. Wire contacts (C-NO) normally open and (C-NC) normally closed into load circuit as required.

Note: Jumper must be installed as shown to insure proper operation.

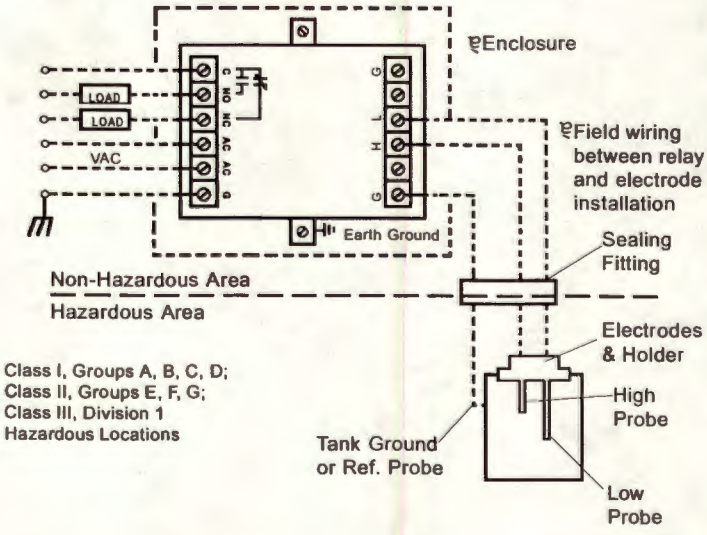


Wiring Diagram
Differential Level Service
- Conductance Actuated

1. Connect (both terminals AC, AC) and G to appropriate VAC supply line.
2. Connect terminal H to high electrode and terminal L to low electrode.

Terminal G must be grounded to the tank if metallic. When the tank is non-metallic, terminal G must be connected to an additional electrode of length equal to the longest electrode.

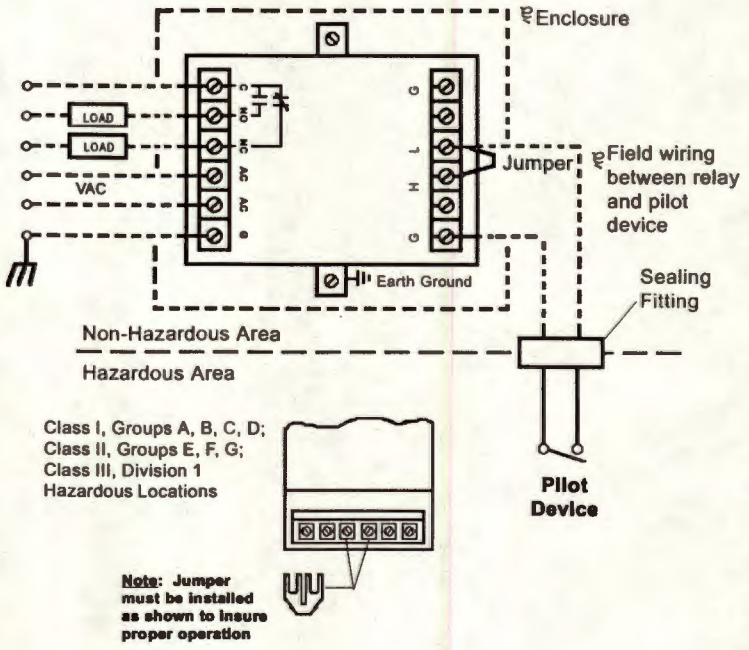
3. Wire contacts (C-NO) normally open and (C-NC) normally closed into load circuit as required.



Wiring Diagram
Single Input (Non Latching)
- Pilot Contact Actuated

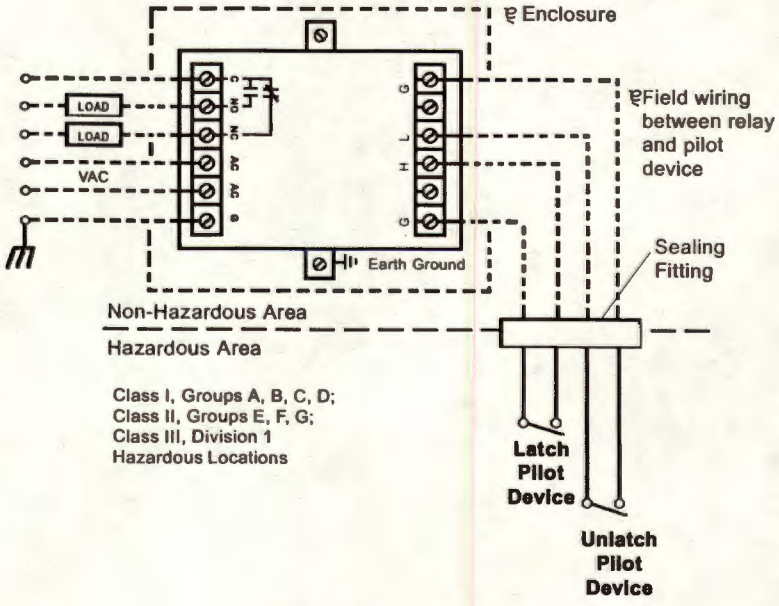
1. Connect (both terminals AC, AC) and G to appropriate VAC supply line.
2. Install metallic jumper between terminals H and L.
3. Wire contacts (C-NO) normally open and (C-NC) normally closed into load circuit as required.
4. Connect the pilot contact to terminals G and L.

Note: Jumper must be installed as shown to insure proper operation.



Wiring Diagram
Dual Input Latching
- Pilot Contact Actuated

1. Connect (both terminals AC, AC) and G to appropriate VAC supply line.
2. Wire contacts (C-NO) normally open and (C-NC) normally closed into load circuit as required.
3. Connect the latch pilot contact to terminals G and H and the unlatch pilot contact to terminals G and L



ADTECH
Analog-Digital Technology, Inc.
3750 Monroe Avenue
Pittsford, New York 14534-1302
(716) 383-8280 • FAX (716) 383-8386

SRT 30
Non-Isolated Square Root Extractor
Instruction Manual

1.0 INTRODUCTION

These instructions refer to the above model. Supplementary sheets are attached if the unit has special options or features. For detailed specifications, see page 4 or refer to the Data Bulletin. All ADTECH instruments are factory calibrated and supplied with a label detailing the calibration. Adjustments are therefore not necessary. Adjustments are normally not necessary. A simple check should be performed to verify calibration before installation to ensure that it matches the field requirement.

2.0 GENERAL DESCRIPTION

The ADTECH SRT 30 is a Non-Isolated Square Root Extractor that accepts a process input signal of 1-5 vdc or 4-20 ma dc and converts it into any of the standard control signal outputs such as 4-20 ma dc The output is directly proportional to the square root of the input.

Power Option P 1 Non-Isolated 24 vdc provides negative output signal and negative DC power common rail connection.

The output is a true current source and provides process signals such as 4-20 ma, 0-1 ma, 0-10 ma, 1-5 ma and 10-50 ma dc or alternatively, a voltage signal of 5 vdc full scale. Other current and voltage **Inputs/Outputs (I/O)** are available as specified on the Data Bulletin.

3.0 INSTALLATION

The instrument is supplied in a general purpose enclosure as standard. NEMA 4, 7 or 12 and plug in chassis enclosures are optionally available. Installation area/location must agree with the supplied instruments including operating temperature and ambient conditions.

Mounting

Refer to the appropriate outline drawing for mounting and clearance dimensions. The instrument is surface mounted with two #10-32 screws on 8.00 inch centers.

Electrical Connections

The wire used to connect the instrument to the control system I/O should be a twisted pair(s) and sized according to normal practice. Shielded cable is not normally necessary (if used, the shield must be grounded at the input negative of the ADTECH instrument and left floating at the sensor).

A 12 position barrier terminal block with #6-32 screws and 3/8" spacing is provided for I/O and power connection. A housing ground terminal marked G is also provided.

Controls

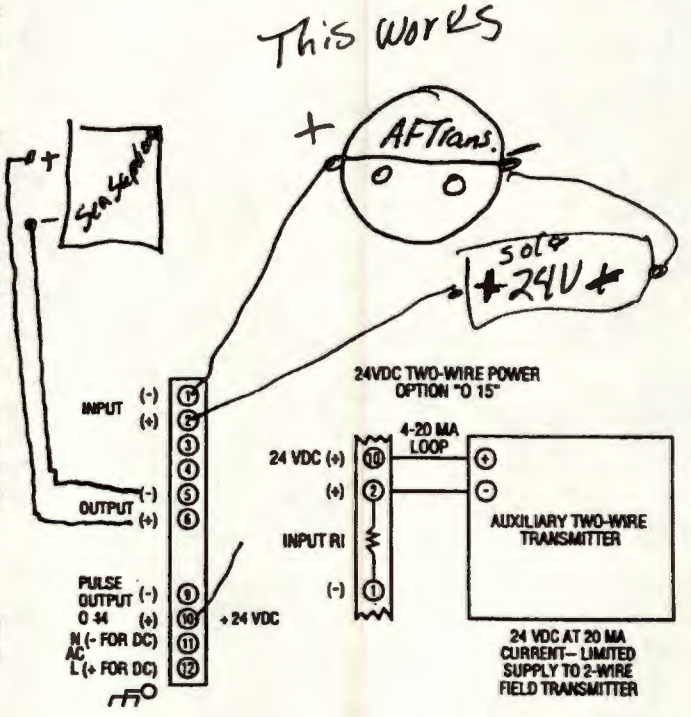
Multiturn INPUT ZERO, OUTPUT ZERO, SPAN, DROPOUT and Optional RATE controls are provided to calibrate the instrument. The multiturn controls are accessible through the instrument front panel and are clearly marked for ease of use.

4.0 MAINTENANCE

These instruments are electronic and require no maintenance except periodic cleaning and calibration verification. If the unit appears to be mis-operating it should be checked as installed per section 6.0 or removed for a bench check per sections 6.0-7.0. MOST problems are traced to field wiring and/or associated circuits. If the problem appears to be with the instrument, proceed to sections 6.0 and 7.0.

5.0 CONNECTIONS

Standard connections are shown below and on the instrument face plate, Data Bulletin or on attached supplementary sheets.



(Sola)
Power Supply: 24 VDC

6.0 CALIBRATION

To perform a calibration check or re-calibration of the instrument follow this procedure.

A. Make sure the unit I/O wiring is properly connected and that the correct power source per the label is also connected. The instrument must be at normal power for a minimum of 2 minutes before proceeding to B.

B. The input signal source(s) must be adjustable from 0 to 100% in steps of 10% or at least 25%. The source(s) should be either precalibrated or an accurate meter must be used to monitor the input(s).

C. The output may be monitored either as a direct voltage for a voltage output signal or as a current that can be represented as a voltage across a resistor shunt.

D. First turn the DROPOUT potentiometer fully counterclockwise (CCW).

*E. Set the input source to the minimum input value (4.00 ma dc or1.000 vdc) and connect a meter to Terminals #1(-) and #8(+). Adjust the multiturn potentiometer marked INPUT ZERO until the meter reading is 0.000 ± 0.001 vdc.

*F. With the input source at the minimum value, short Terminals #1 and #8 and connect the meter to the output signal terminals #5(-) and #6(+). Adjust the multiturn potentiometer marked OUTPUT ZERO to provide the minimum calibrated output (e.g.) 4.00 ma ± 0.01 ma dc.

*G. Remove the short from Terminals #1 and #8.

H. Set the input source to the maximum value and adjust the multiturn potentiometer marked SPAN to provide the maximum calibrated output (e.g.) 20.00 ma ± 0.01 ma dc.

I. Set the input at 1.00% of the input span (e.g.) 4.16 ma dc. The output should read 10% of the output span (e.g.) 5.60 ma. If correction is required adjust the INPUT ZERO potentiometer to provide the desired output.

J. Repeat steps F, G and H until no further adjustment is requried.

K. Check linearity per the I/O relation table.

L. To adjust the Drop Out, set the input signal at the desired drop out level and adjust the multiturn potentiometer marked DROP OUT CW until the output drops to the output zero value.

M. This completes the calibration.

6.1 PULSE OUTPUT

If the SRT 30 has been supplied with Option O 44 pulse output refer to O 44 Supplement sheet for calibration details.

*NOTE: For contact output option use terminal #3 instead of #8 in steps E, F & G

7.0 FIELD TROUBLE SHOOTING GUIDE

This section offers a simple, first level trouble-shooting aid for an apparent instrument malfunction.

SYMPTOM	CORRECTIVE ACTION
No output	1. Check the input and output connections carefully.
	2. Check that the power supply polarity is correct and that power is present on the instrument terminals.
	3. Check that the input source(s) is correct and that it changes magnitude between zero and full scale values when so adjusted.
	4. If the output is a current signal (4-20 ma, etc.), make sure the output loop is complete and that the correct meter range is selected.
	All external checks are complete. Problem seems to be internal.

The following information is provided for a qualified technician or serviceman as check points for use in internal troubleshooting.

CHECKPOINT/ COMPONENT		VOLTAGE/ RANGE
(across)	C3	10.5 ± 0.5 vdc
(across)	C22	26 ± 4 vdc
(across)	C23	12 ± 0.6 vdc
(from com.)	+R	+ 6.9 ± 0.35 vdc
(across)	R3	0.2 - 1.0 vdc

INPUT/OUTPUT RELATION TABLE

INPUT % of SPAN	OUTPUT % of SPAN
1.00	10.00
10.00	31.62
20.00	44.72
25.00	50.00
40.00	63.24
50.00	70.71
60.00	77.46
75.00	86.60
80.00	89.44
100.00	100.00

8.0 TABLES, PCB LAYOUT

INPUT TABLE

INPUT SIGNAL FULL SCALE	INPUT SHUNT RI
50 ma dc	100 ohm, 1/2 W
20 ma dc	250 ohm, 1/2 W
10 ma dc	499 ohm
1 ma dc	4.99K ohm
10 vdc	See Note 1
5 vdc	None

All selected resistors are 1%, M.F., 1/4 W, 50 PPM, unless otherwise noted.

NOTE 1: RS4 = 150 K, RC19 = 100K where RC19 is a resistor connected across C19.

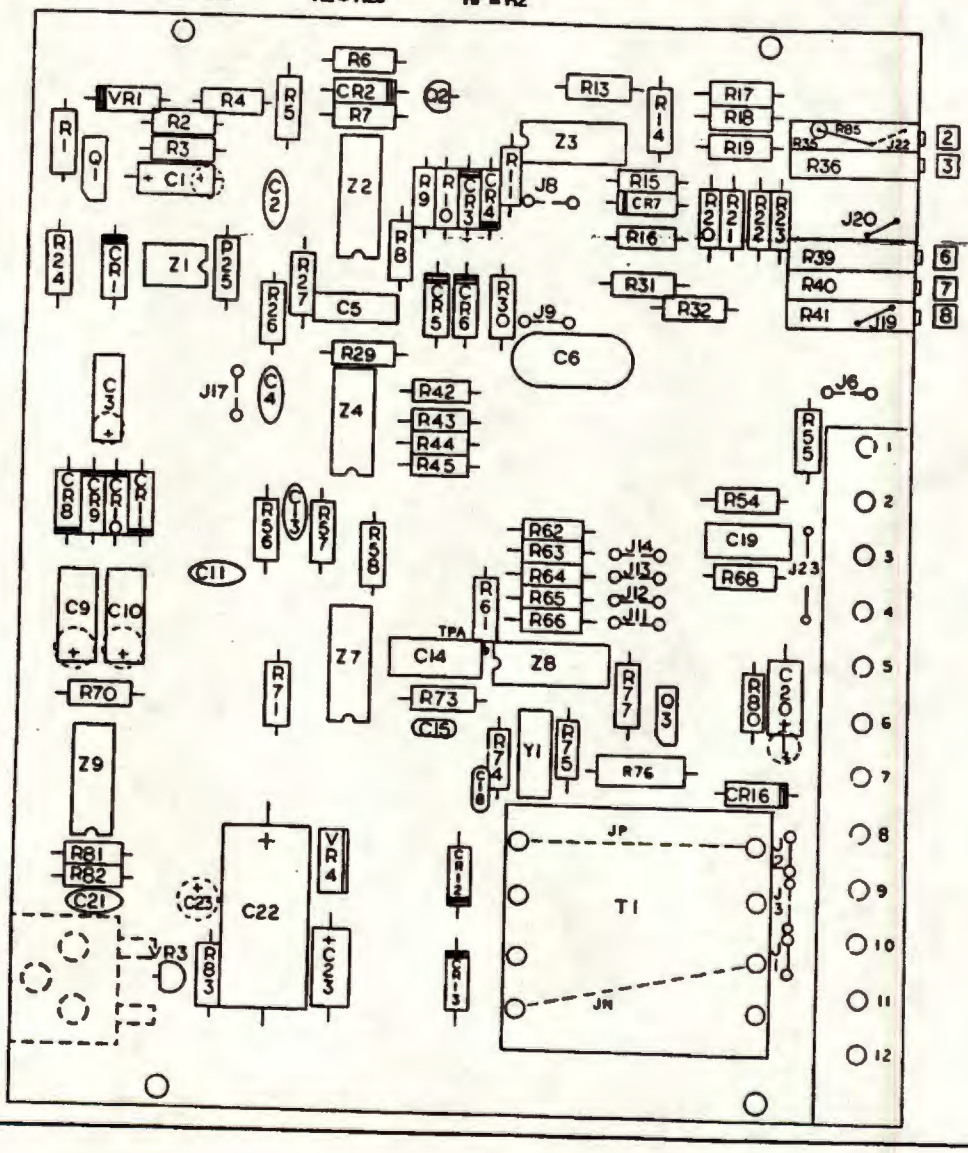
OUTPUT TABLE

OUTPUT SIGNAL FULL SCALE	OUTPUT SHUNT RL	FEEDBACK RES RF
50 ma dc	NONE	20 ohm
20 ma dc	NONE	49.9 ohm
10 ma dc	NONE	100 ohm
1 ma dc	NONE	1K ohm
10 vdc	604 ohm, 1/4 W	49.9 ohm
5 vdc	250 ohm, 1/2 W	49.9 ohm

All selected resistors are 1%, M.F., 1/4 W, 50 PPM, unless otherwise noted.

NOTE A: Components as shown may or may not be present on the p.c. board due to design updates or options.

SRT 30 RI = RS5 RL = R20 RF = R2



9.0 SPECIFICATIONS

INPUT/OUTPUT

INPUT SIGNALS

a. 4-20 ma dc (Z in 250 ohms)
b. 10-50 ma dc (Z in 100 ohms)
c. 0-1 ma dc (Z in 5K ohms)
d. 0-10 ma dc (Z in 500 ohms)
e. 1-5 vdc (Z in 10 megohms)
f. 0-5 vdc (Z in 10 megohms)
g. 0-10 vdc (Z in 100K ohms)
h. Other zero based current and voltages available
i. Low impedance current inputs, 1/10 standard (Option I 18)

OUTPUT SIGNALS/OUTPUT DRIVE

	AC Power	DC Power
a. 4-20 ma dc	0-1000 ohms max.	0-900 ohms max.
b. 10-50 ma dc	0-400 ohms max.	0-350 ohms max.
c. 0-1 ma dc	0-20,000 ohms max.	0-18,000 ohms max.
d. 1-5 vdc	250 ohms Z out	250 ohms Z out
e. 0-10 vdc	500 ohms Z out	500 ohms Z out

Zero based current and voltages in the above ranges are standard (e.g.) 0-20 ma, 0-5 vdc. Other voltage and currents optional.

PERFORMANCE

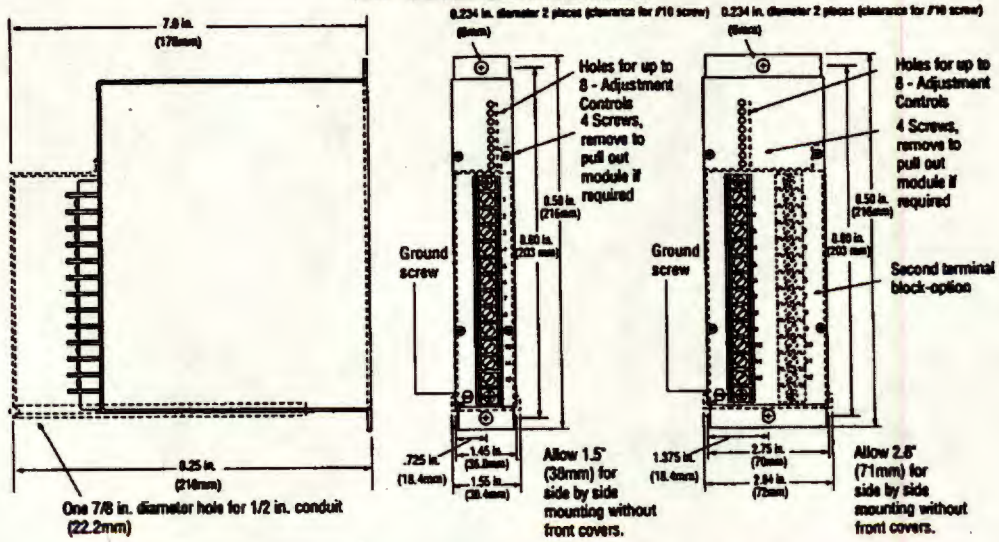
a. **Calibrated Accuracy:** ± 0.1% for 1-100% of input
b. **Linearity:** ± 0.1% maximum, ± 0.04% typical
c. **Repeatability:** ± 0.05% maximum
d. **Temperature Stability:** ± 0.01%/°F maximum, ± 0.004%/°F typical
e. **Load Effect:** ± 0.01% zero to full load
f. **Output Ripple:** 10 mv P/P maximum
g. **Response Time:** 150 milliseconds
h. **Temperature Range:** 0° to 140°F (-18° to 60°C) operating
-40° to 185°F (-40° to 85°C) storage
i. **Power Supply Effect:** ± 0.05% for a ± 10% power variation
j. **Zero Dropout:** 0-20%

Note: All accuracies are given as a percentage of span

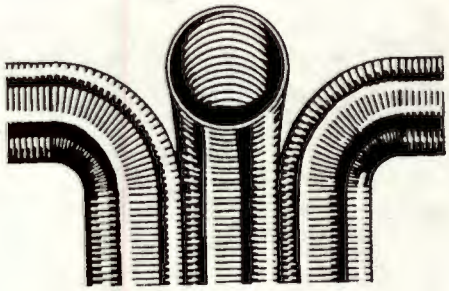
POWER

a. 115 vac: ± 10%, 50/60 Hz, 3 watts, 0.7 Pf (standard)
b. 24 vdc: ± 10% non-isolated, 3 watts (Option P1)
c. 24 vdc: ± 10% isolated, 3 watts (Option P2)
d. 48 vdc: ± 10% isolated, 3 watts (Option P3)
e. 125 vdc: Nominal (105-140 vdc) isolated, 3 watts (Option P4)
f. 230 vac: ± 10%, 50/60 Hz, 3 watts, 0.7 PF (Option P5)

10.0 OUTLINE & MOUNTING



CLEVAFLEX



HIGH VELOCITY ATTENUATOR

SIL-200

CONSTRUCTION:

Inner Liner consists of Clevaflex Type S single-ply aluminum perforated flexible duct.

This Inner Core is covered by 1" thick fiberglass of one pound density.

Outer Liner consists of Clevaflex Type 12 two-ply bonded aluminum with inlet and outlet collars.

UNDERWRITERS LABORATORY LISTED

PHYSICAL DATA

Nominal Diameter—Inches	4	5	6	7	8	10	12	14
Inside Diameter—Inches	← NOMINAL—EXACT →							
Outside Diameter—Inches	6	7	8	9	10	12	14	16
Standard Length	← FIVE FEET—CUSTOM DESIGN AVAILABLE →							
Operating Temperature Range	← 0°—350° →							
Working Pressure—Inches of Water	← 20" POSITIVE OR NEGATIVE →							

SPECIFICATIONS

High velocity attenuator, where indicated, shall be a double wall product with a perforated inner liner of single-ply aluminum with a minimum of seven mechanically formed corrugations per joint, covered by a one inch thick by one pound density, fiberglass blanket. The outer liner shall be a bonded two-ply laminate, closely corrugated for strength and air-tightness, capable of 20" of positive or negative pressure. Spun aluminum inlet and outlet collars shall be factory sealed to the inner and outer liners. This unit shall be tested by a recognized, independent acoustical laboratory in accordance with Air Diffusion Council standards for acoustics FD 72-R,. High Velocity Acoustical Attenuator shall be manufactured by Clevaflex, Inc., Cleveland, Ohio 44135.

Clevaflex, Inc.

4081 West 150th Street
Cleveland, Ohio 44135
Telephone (216) 941-6505
Fax (216) 941-8742

CLEVAFLEX
HIGH VELOCITY ATTENUATOR

8" ø CLEVAFLEX DUCT RADIATED NOISE REDUCTION IN dB

OCTAVE BAND NO.	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CENTER FREQ. Hz	125	250	500	1000	2000	4000	8000
NOISE REDUCTION @ 0 FLOW	19	24	38	36	36	29	24
NOISE REDUCTION @ 2500 fpm	17	23	36	35	35	29	24

Note: Radiated noise reduction does not vary substantially with diameter. All values shown are available for diameters 4"-14".

SOUND ATTENUATION WITH AND WITHOUT AIR FLOW

STRAIGHT ATTENUATOR INSERTION LOSS (I.L.) IN DB

OCTAVE BAND NO.	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CENTER FREQUENCY (Hz)	125	250	500	1000	2000	4000	8000
I.L. @ 0 FLOW							
4" Attenuator	12	15	30	40	42	28	18
6" Attenuator	9	10	21	30	35	18	12
8" Attenuator	6	7	19	26	25	13	11
14" Attenuator	4	6	18	22	20	10	9
I.L. @ 2500FPM							
4" Attenuator	11	14	29	38	42	27	18
6" Attenuator	8	9	20	28	32	17	12
8" Attenuator	4	6	17	25	24	13	11
14" Attenuator	3	5	15	21	19	10	9

ELBOW ATTENUATOR LOSS (I.L.) IN dB

OCTAVE BAND NO.	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CENTER FREQUENCY (Hz)	125	250	500	1000	2000	4000	8000
I.L. @ 0 FLOW							
4" Attenuator	5	13	29	41	35	38	6
6" Attenuator	2	4	17	32	34	15	7
8" Attenuator	5	4	16	28	31	11	6
14" Attenuator	5	4	15	26	29	9	7
I.L. @ 2500 FPM							
4" Attenuator	4	13	29	36	33	19	6
6" Attenuator	2	4	17	33	33	14	7
8" Attenuator	5	3	16	28	30	12	6
14" Attenuator	5	4	15	26	29	10	7

As tested by Kodaras Acoustical Laboratories, Division Electrical Testing Laboratories, Inc. Aug. 31-Sept. 2, 1979

Note: Insertion Loss values should not be directly compared with similar data for single wall flexible duct. Single wall data includes the effect of noise transmitted through the wall into the surrounding space.

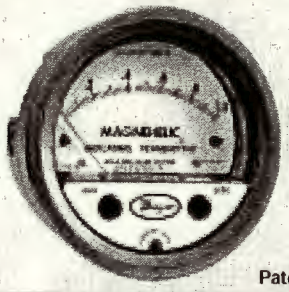
While the herein published data is the result of performance under accurate laboratory conditions, Clevaflex cannot be responsible for exact reproduction of performance characteristics in the field due to the many outside variables associated with any installation.

Test Procedures: A smooth, straight empty metal duct equal in diameter and length (5 feet) of Clevaflex High Velocity Attenuator is installed in a duct system. Test signals are generated at one end of the duct and then measured in a reverberation room at the other end. The empty metal duct is removed and replaced with a Clevaflex High Velocity Attenuator and the test repeated. These procedures are followed for different air flows as well as for both straight and "elbowed" (90°) flex.

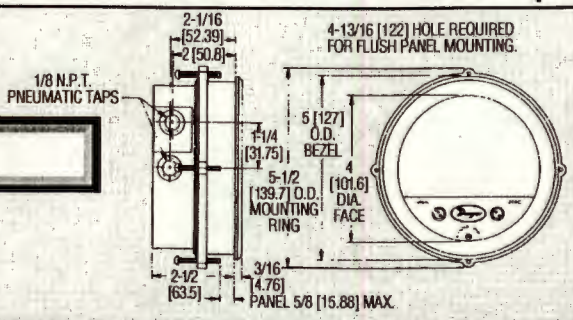
Series 605

Magnehelic® Differential Pressure Indicating Transmitter

Dial Gage Indication, Two-Wire 4-20 mA Output CE



FIT-201



Patent No. 4,890,497

The Dwyer Series 605 Magnehelic® Indicating Transmitter provides for both visual monitoring and electronic control of very low differential pressure. The Series 605 is ideal for control applications in building HVAC systems where local indication is desired during routine maintenance checks or necessary when trouble shooting the system. The easily read dial gage is complemented by the two-wire, 4-20 mA control signal utilizing the time-proven Dwyer Magnehelic® gage mechanical design and Series 600 strain-gage transmitter technology. The two-wire design with terminal strip on the rear simplifies connection in any 4-20 mA control loop powered by a 12.3-35 VDC supply.

STOCKED MODELS in bold

Model Number	Range in w.c.	Model Number	Range in w.c.
605-00N	.05-0-.20	605-30	0-30
605-11	.25-0-.25	605-50	0-50
605-0	0-.50	Model Number	Range in Pa
605-1	0-1.0	605-250 Pa	0-250
605-2	0-2.0	605-500 Pa	0-500
605-3	0-3.0	Model Number	Range in kPa
605-6	0-6.0	605-1.5kPa	0-1.5
605-10	0-10		
605-20	0-20		

PHYSICAL DATA

GENERAL
Maximum Pressure: 25 PSIG
Media Compatibility: Air & non-combustible, non-corrosive gases.

ELECTRICAL
Power Supply: 12.3 to 35 VDC
Output Signal: 4 to 20 mA DC, 2 wire (limited at 38 mA max.)
Loop Resistance: 0-1135 ohms from 12.3 to 35 VDC
Current Consumption: 38 mA DC (max.)

MATERIAL
Die cast aluminum case with baked dark gray hammerloid finish, acrylic cover.

MECHANICAL
Weight: 2 lb., 8 oz.
Span and Zero adjustments: Protected potentiometers
Pressure connections: ⅛" NPT(F) high and low pressure taps

PERFORMANCE AT 70°F
Zero output: 4 mA
Full span output: 20 mA
Accuracy (includes linearity, hysteresis, repeatability): ±2% of full span output
Stability: ±1% F.S.O. /yr
Warm-up time: 10 minutes

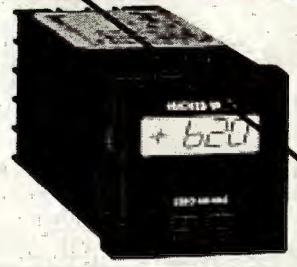
ENVIRONMENTAL
Operating temperature: 30° to 120°F
Thermal Error: ±1%/50°F typical

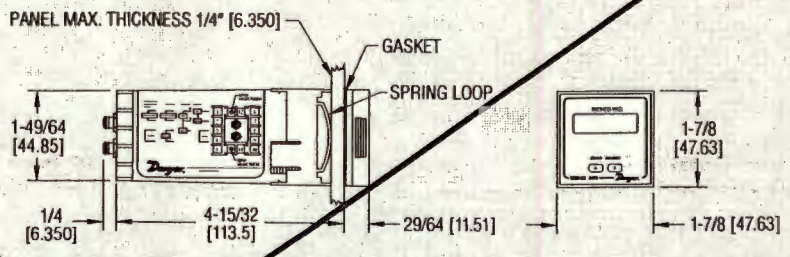
STANDARD ACCESSORIES
Span and zero adjust tool, mounting hardware kit

Series 620

Differential Pressure Indicating Transmitter

1/16 DIN Housing, Digital Readout, 4 - 20 mA Ouput CE





The Series 620 Pressure Indicating Transmitter is a 1/16 DIN instrument for measuring, controlling and indicating positive, negative or differential pressures of air and compatible gases. Pressure measurements are displayed on an easy-to-read 3½ digit display and converted to a standard 4 to 20 mA ouput signal. Versatile circuit design enables use in 2, 3, or 4-wire current loops.

STOCKED MODELS

MODEL NUMBER	RANGE	MAXIMUM PRESSURE
620-3	0-3 in. w.c.	5 psig
620-6	0-6 in. w.c.	5 psig
620-10	0-10 in. w.c.	5 psig
620-20	0-20 in. w.c.	11 psig
620-40	0-40 in. w.c.	11 psig
620-100	0-100 in. w.c.	29 psig
620-200	0-200 in. w.c.	29 psig
620-1000	0-1000 in. w.c.	150 psig
620P-10	0-10 psid	58 psig
620P-20	0-20 psid	58 psig
620P-30	0-30 psid	58 psig
620P-50	0-50 psid	150 psig
620P-100	0-100 psid	150 psig

PHYSICAL DATA

GENERAL
Pressure Connections: Barbed for 1/8" (3mm) I.D. tubing
Media: Air and non-corrosive gases
Electrical Connections: Terminal block
Housing: PVC type I
Weight: 8.5 oz (241 g)
Adjustments: Accessible potentiometers

ELECTRICAL
Power Supply: 10 - 35 VDC (2, 3, or 4-wire)
16 - 26 VAC (4-wire)
Output Signal: 4 to 20 mA DC (limited @ 38 mA DC)
Loop Resistance: 0 - 1300 Ω DC max, 0 - 1200 Ω AC max
Current Consumption: 38 mA max (DC), 76 mA max (AC)

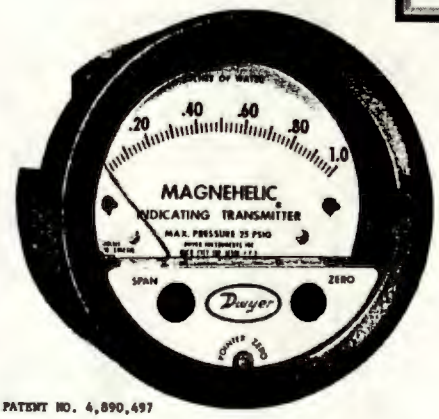
PERFORMANCE @ 70°F (21.1°C)
Zero Output: 4 mA DC
Full Span Output: 16 mA DC
Accuracy: ±0.5% F.S. (includes linearity, hysteresis, and repeatability)
Stability: ±1% F.S./yr.
Warm-up Time: 10 minutes

ENVIRONMENTAL
Operating Temperature: 20 to 120°F (-6.7 to 49°C)
Thermal Errors: ±0.02% / °F typical

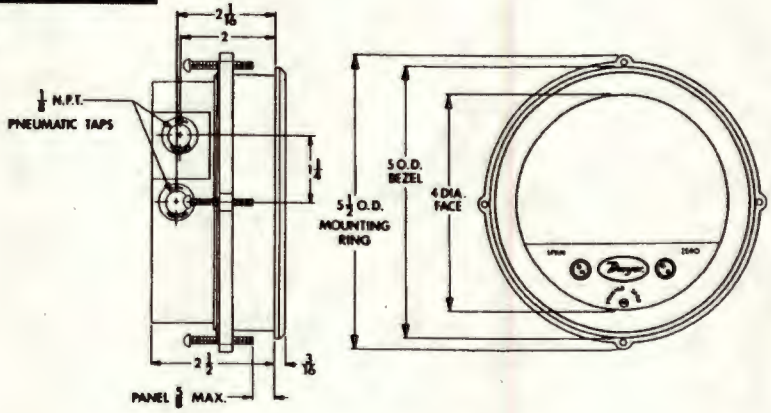
SERIES 605 MAGNEHELIC®
DIFFERENTIAL PRESSURE INDICATING TRANSMITTER

Specifications - Installation and Operating Instructions

FIT-201



PATENT NO. 4,890,497



The Dwyer Series 605 Magnehelic® indicating transmitter simultaneously provides local indication on a large, easily read analog scale while also converting that pressure into a standard two-wire, 4-20 mA signal for ranges from 0-0.5 to 0-50"w.c. Positive, negative or differential air and compatible gas pressure can be measured with an accuracy of ± 2% of full scale. The basic mechanical components of the Series 605 Magnehelic® indicating transmitter are similar to those used in the popular, time-proven Magnehelic® differential pressure gage. However, the Series 605 models add electrical conditioning and amplification of a resistance change produced by a silicon strain gage which is cemented to the range spring. This resistance change is the result of the slight flexing which results from spring deflection as pressure is applied to the diaphragm which is directly linked to the spring. Refer to bulletin E-50 for additional information on the design, operation and construction of the Magnehelic® indicating transmitter.

SERIES 605 MODELS & RANGES

MODEL NUMBER	RANGE, INCHES W.C.	MINOR DIVS.
605-0	0-.5	.01
605-1	0-1.0	.02
605-2	0-2.0	.05
605-3	0-3.0	.10
605-6	0-6.0	.20
605-10	0-10	.20
605-20	0-20	.50
605-30	0-30	1.0
605-50	0-50	1.0
MODEL NUMBER	**RANGE, PASCALS**	**MINOR DIVS.**
605-250Pa	0-250	5
605-500Pa	0-500	10
MODEL NUMBER	**RANGE, KILO PASCALS**	**MINOR DIVS.**
605-1.5kPa	0-1.5	.05

SPECIFICATIONS

GENERAL

Maximum Pressure: 25 PSIG
Media Compatibility: Air & noncombustible, noncorrosive gases

ELECTRICAL

Power Supply: 12.3 to 35 VDC.
Connections: 2 screw terminal block, positive and negative.
Output Signal: 4 to 20 mA DC. (limited at 38 mA)
Loop Resistance: 0 to 1135 ohms

$$R_{Lmax} = \frac{V_{ps} - 12.3V}{20mA}$$

Warm-up Time: 5-10 Minutes
Current Consumption: 38 mA max. DC

PERFORMANCE AT ROOM TEMPERATURE

Zero Output: 4 mA
Full Scale Span: 16 mA
Static Accuracy: ± 2% Span
Span & Zero: Adjustable to 0.05%
Repeatability: 0.5% Span
Resolution: Infinitesimal

ENVIRONMENTAL

Operating Temperature: 20 to 120°F (dry air)
Compensated Temperature: 30 to 120°F
Thermal Errors: ± 1%/50°F

MECHANICAL

Weight: 1 lb. 10 oz.
Span & Zero Adjustments: Protected potentiometers, externally accessible.
Pressure Connections: ⅛-27 NPT female

STANDARD ACCESSORIES

Mounting ring
Snap ring
(4) 6-32 x 1-1/4 screws (panel mtg.)
(3) 6-32 x 5/16 screws (surface mtg.)
(2) Tubing to 1/8" NPT adapters
(2) 1/8" NPT plugs
Adjustment key

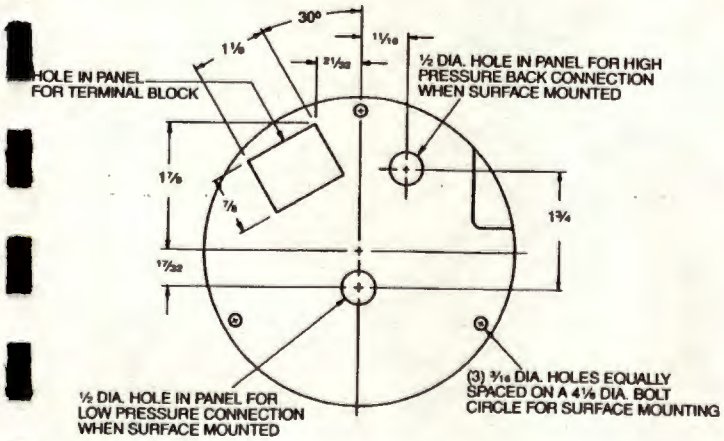
DWYER INSTRUMENTS INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360 U.S.A.
Telephone 219/879-8000
Fax 219/872-9057

INSTALLATION

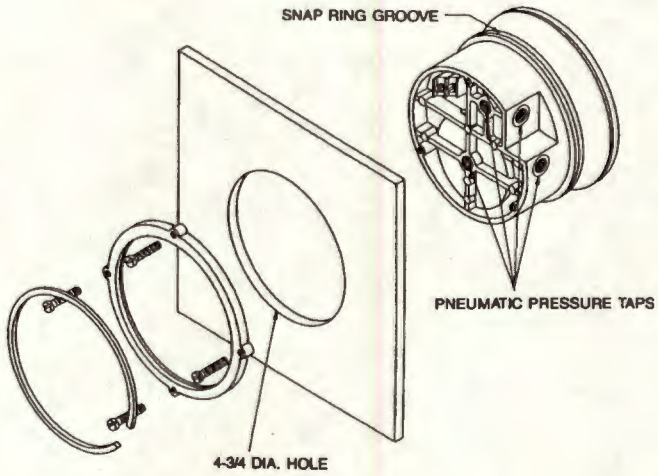
1. **LOCATION:** Select a location where the temperature of the unit will be between 20°F and 120°F. Distance from the receiver is limited only by total loop resistance. See "Electrical Connections." The tubing feeding pressure to the instrument can be run practically any length required but long lengths will increase response time slightly. Avoid surfaces with excessive vibration.

2. **POSITION:** All standard models are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If your application requires mounting in other than a vertical position, be sure to specify this when ordering.

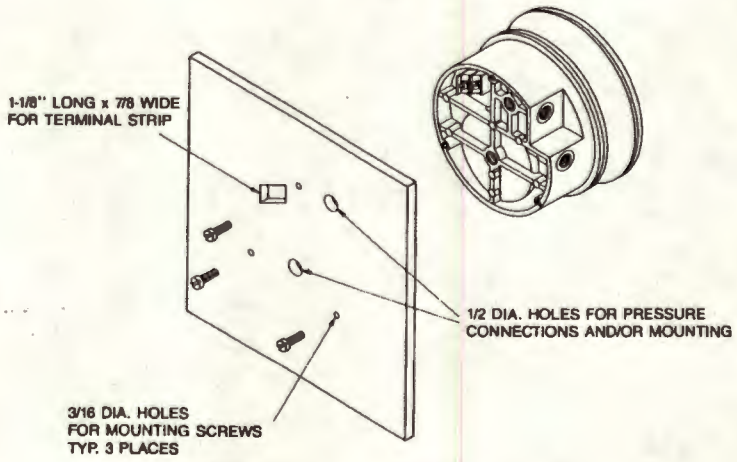
3. **PRESSURE CONNECTIONS:** For convenience, two sets of 1/8" NPT female ports are available. Plug the unused set with pipe plugs provided. Attach tubing from positive pressure source to port marked "HI" or from negative (Vacuum) source to port marked "LOW". In either case, opposite port must be vented to atmosphere. In dusty environments, we recommend use of an A-331 Filter Vent Plug to keep interior of instrument clean. For differential pressures the higher source is connected to the "HI" port and lower to the "LOW" port.



4. **MOUNTING:** The Series 605 Transmitter may be either panel mounted or surface mounted.



A. **PANEL MOUNTING:** Cut a 4¾" or 120mm dia. hole in panel and insert the complete unit from the front. Slip on the mounting ring and install the split snap ring in the groove on the bezel. Seat the mounting ring against the snap ring and thread the four screws thrcugh the tapped holes. Tighten screws against rear of panel.



B. **SURFACE MOUNTING:** Drill (3) 3/16" dia. holes for mounting screws and cut (1) 7/8" x 1-1/8" hole for access to terminal strip as shown in hole location drawing. Insert screws from rear of panel and thread into tapped holes on back of transmitter case. If rear pressure connections are to be used, make 1/2" dia. holes located as shown in hole location drawing in left column.

5. **ZEROING:** Once gage/transmitter is mounted in its final position, check to be sure pointer aligns with zero on scale, when no pressure is applied and both low and high pressure ports are vented to atmosphere. To adjust, turn small slotted screw at center-bottom of gage face. Do not move the larger black knobs labeled SPAN and ZERO. These are for use only if a calibration check shows the 4-20 mA output signal to need adjustment. See page 3 under heading OUTPUT RANGING.

ELECTRICAL CONNECTIONS

CAUTION: DO NOT EXCEED SPECIFIED SUPPLY VOLTAGE RATINGS. PERMANENT DAMAGE NOT COVERED BY WARRANTY WILL RESULT. THIS UNIT IS NOT DESIGNED FOR AC VOLTAGE OPERATION.

Electrical connections to the Series 605 Transmitter are made to the two-screw terminal strip on the rear of the case. Polarity is indicated by + and − signs stamped on side. The schematic diagram of the Series 605 transmitter is illustrated in Figure B.

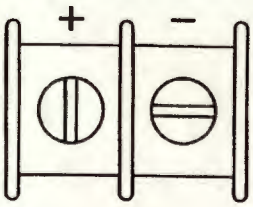


FIG. A

An external power supply delivering 12.3 to 35 VDC with a minimum current capability of 40 milliamps must be used to power the control loop in which the Series 605 transmitter is connected. Refer to Fig. B for connection of the power supply, transmitter and receiver. The range of appropriate receiver load resistances (R_L) for the power supply voltage available is given by the formula and graph in Fig. C. Shielded two wire cable is recommended for control loop wiring and the negative side of the loop may be grounded if desired. Note also that the receiver may be connected in either the negative or positive side of the loop, whichever is most convenient. Should polarity of the transmitter or receiver be inadvertantly reversed, the loop will not function properly but no damage will be done to the transmitter.

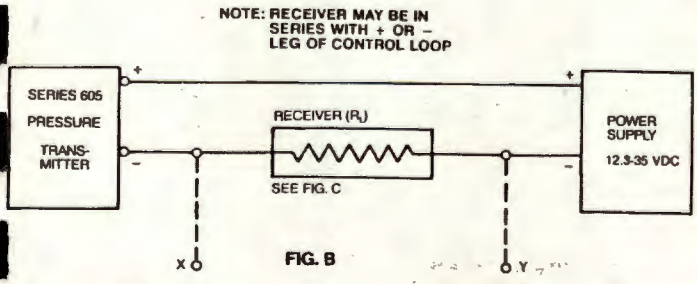


FIG. B

The maximum length of connecting wire between the transmitter and the receiver is a function of wire size and receiver resistance. That portion of the total current loop resistance represented by the resistance of the connecting wires themselves should not exceed 10% of the receiver resistance. For extremely long runs (over 1,000 feet), it is desirable to select receivers with higher resistances in order to keep the size and cost of the connecting leads as low as possible. In installations where the connecting run is no more than 100 feet, connecting lead wire as small as No. 22 Ga. can be used.

The Series 605 transmitters can be used with receivers requiring 1-5 volt input rather than 4-20 mA. If the receiver requires a 1-5 volt input, insert a 250 ohm, ½ watt resistor in series with the current loop but in parallel with the receiver input. Referring to Figure B, R_L becomes the 250 ohm resistor and points X and Y are connected to the receiver input, point X being positive (+) and point Y negative (−) or ground. The resistor should be connected at the panel end of the transmitter current loop close to the receiver input to take advantage of the immunity of the current loop to electrical noise pickup. Most electronic component distributors stock a 249 Ω, ½ watt, ±1% tolerance metal film resistor which is adequate for this application.

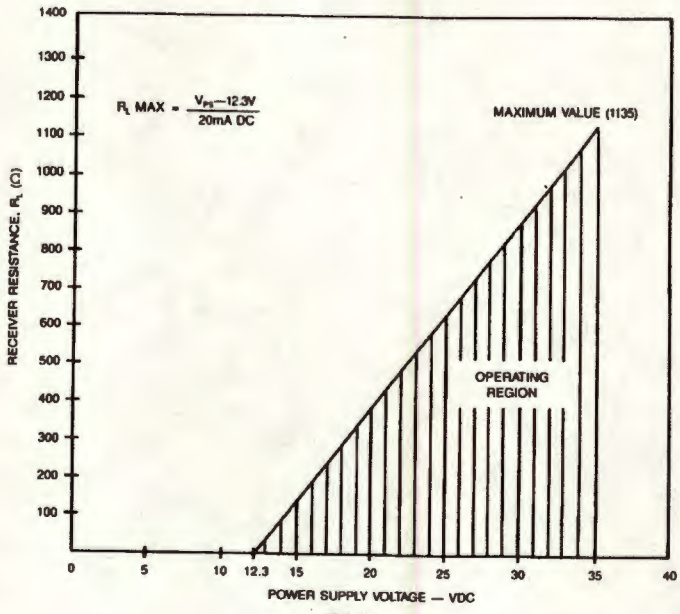


FIG. C

OUTPUT RANGING

Each Series 605 Magnehelic® indicating transmitter is factory calibrated to produce 4 mA at zero scale reading and 20 mA at full scale reading. The following procedure should be used if the pressure versus output signal relationship needs to be checked.

1. With unit connected to the companion receiver per preceding instructions, insert an accurate milliammeter with a full scale reading of approximately 30 mA in series with the current loop.
2. Vent both pressure ports to atmosphere and, if necessary, adjust pointer zero screw to align pointer with zero on scale. A controllable pressure source capable of reaching the full scale range should be connected to either high pressure port. Plug the other high pressure port and vent one or both low pressure ports to atmosphere. The instrument must be ranged in the same position in which it will be used. Standard factory calibration and ranging is done with unit vertical.
3. Apply electrical power to the system and check for proper operation by slowly increasing pressure and observing whether the loop current increases above the 4 mA zero pressure reading.
4. A spanner type key is supplied to adjust span and zero. This helps to reduce unauthorized tampering. Apply pressure until pointer aligns with full scale reading and adjust the SPAN knob for a 20 mA reading.
5. Relieve all pressure, allow a few seconds for settling and adjust the ZERO knob for a 4 mA current loop reading.
6. The SPAN and ZERO controls are slightly interactive so steps 4 & 5 should be repeated a few times until readings of 4 and 20 mA are obtained consistently.
7. Remove the milliammeter from the current loop and proceed with final installation of the transmitter and receiver.

MULTIPLE UNITS WITH COMMON POWER SUPPLY

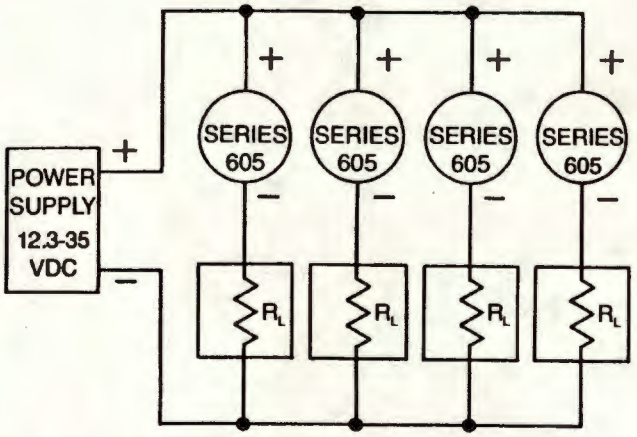


FIGURE D

Several Series 605 transmitters can be operated with a single power supply as depicted above in Figure D. Be careful to specify a supply with sufficient capacity. The minimum current requirement at a given voltage can be calculated by multiplying the number of units x 20 mA. In the example shown this would be 4 x 20 or 80 mA minimum.

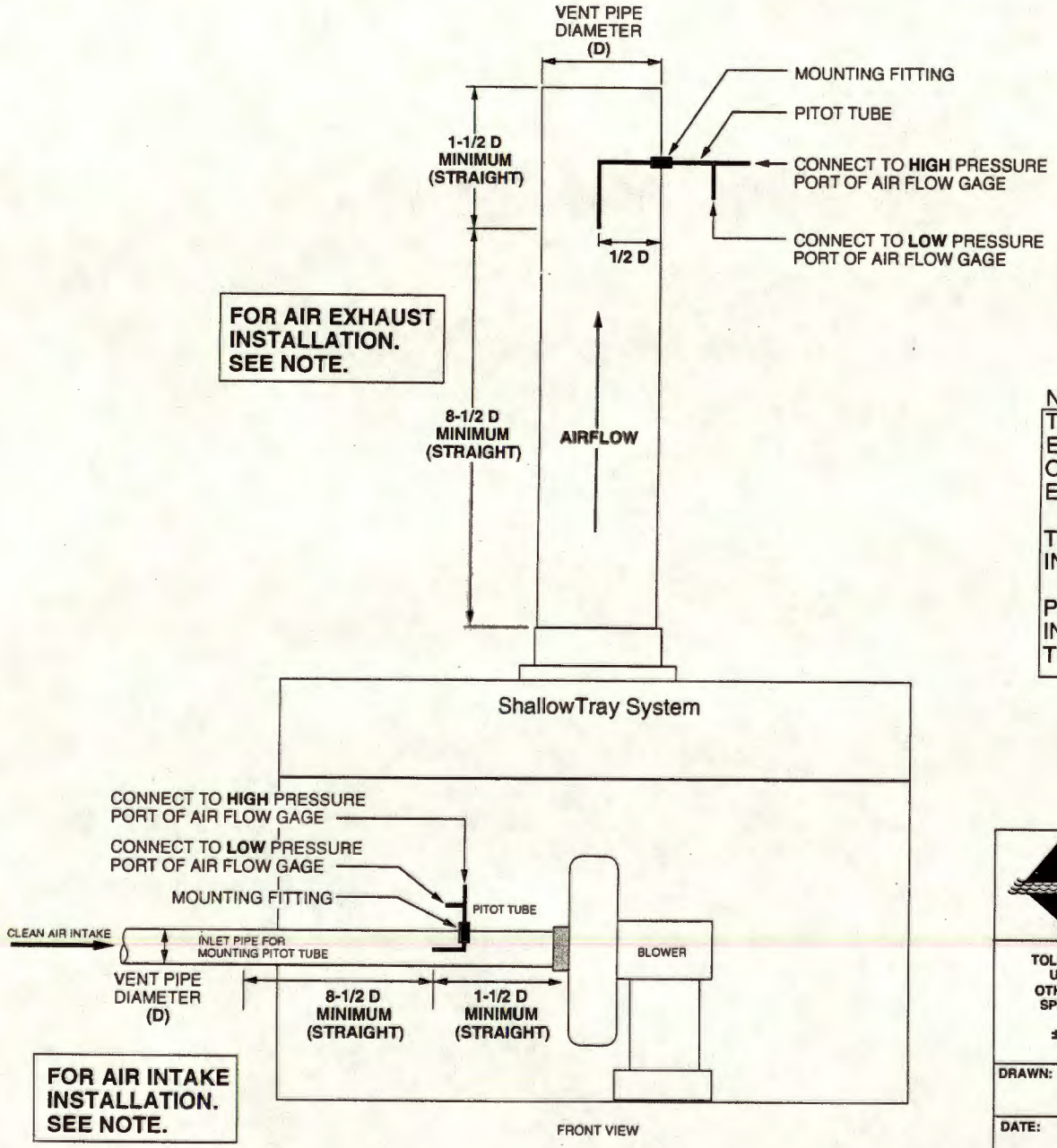
MAINTENANCE

Upon final installation of the Series 605 Transmitter and the companion receiver, including the A-701 Digital Readout, no routine maintenance is required. A periodic check of system calibration is recommended. The Series 605 Differential Pressure Transmitter is not field serviceable and should be returned to the factory if service is required. The A-701 Digital Readout should be returned to the manufacturer if service is required. Refer to the A-701 instruction sheet.

Printed in U.S.A. 10/92

FR NO. 01-440559-00

DWYER INSTRUMENTS, INC.
P.O. Box 373 • Michigan City, Indiana 46361 U.S.A.
Phone: 219/879-8000 • Fax: 219/872-9057



NOTE:

THE PITOT TUBE CAN BE INSTALLED IN EITHER AN AIR INTAKE PIPE (1ST CHOICE), OR IT CAN BE MOUNTED IN AN AIR EXHAUST PIPE (2ND CHOICE).

THIS DRAWING DEPICTS PROPER INSTALLATION FOR EITHER CHOICE.

PLEASE ALSO READ THE INSTALLATION INSTRUCTIONS PROVIDED WITH THE PITOT TUBE AND AIR FLOW METER.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 in.	DRAWING NAME: SINGLE POINT PITOT TUBE LOCATION / INSTALLATION		
	DRAWING #: 900-130-00009		
DRAWN: KM	CUSTOMER:		
DATE: 10/24/95	SCALE: NTS	SIZE: A	SHEET :1 OF :1

SSP & SSPC Product Description

The models SSP and SSPC are similar pumps. The model SSP is the open-impeller version, and the model SSPC is the enclosed-impeller version of the same pump. The dimensions of both pumps are identical. The SSP(C) is a single-stage, close-coupled, back-pullout centrifugal pump, fabricated of 304 stainless steel.

The SSP(C) was designed primarily for the commercial OEM marketplace. Our goal was to provide a new pumping alternative that met the following conditions:

Lower Cost

The model SSP(C) is priced lower than any other comparable stainless steel pump on the market. In fact, in most cases the SSP(C) is less expensive than similar cast iron or plastic pumps.

Durability

The SSP(C) was designed to provide long lasting service. The stainless steel materials of construction, heavy-duty nozzles and impellers, rigid case design, and large mechanical seal selection assure a long pump life.

Versatility

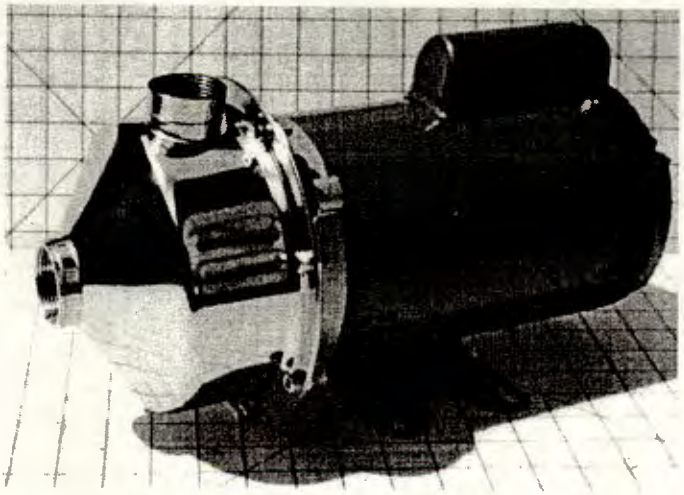
We wanted the SSP(C) to be able to perform well in a variety of applications; and we knew that our customers all had different requirements. That's why we designed our pump to be easily modified or customized, to fit each application's essentials. We have over 50 different impeller designs, and can mount our pump in almost any configuration.

High Efficiency

The SSP(C) is often times, more efficient than the competition's pumps. This is attributable to the smooth surface finishes provided by stainless steel sheet, and our computer aided impeller and casing designs. In many cases, an SSP can be installed with a lower horsepower motor than your previous pump.

Better Looking

Judge for yourself. We think the SSP is the best looking pump on the market. If you're using someone else's rusty cast iron pump, or one of our competitor's bulky stainless pumps, the SSP(C) will definitely be an upgrade.



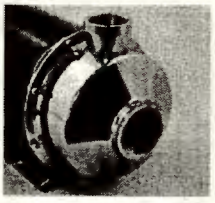
14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS

Stainless Steel Pumps for the Commercial Marketplace

The models SSP & SSPC offer the following features and benefits when compared with other similarly formed stainless steel centrifugal pumps.

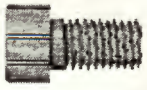
The SSP outer case is a one-piece shell, capable for supporting the pump and motor weight in a vertically mounted position. Many of our competitors formed cases cannot be mounted on the suction nozzle and must use the motor as a support, or have a special mounting base. Our internal design also prevents any air from being trapped in the pump case when mounted vertically, something our competitors cannot say.



The suction and discharge nozzles on the SSP & SSPC are machined from stainless pipe, and have an extra heavy wall thickness. These nozzles cannot be easily damaged in shipment or during installation, as can the nozzles of our competitors' pumps.

Impellers on pumps supplied with 3-phase motors of 1.5-hp or larger, come as standard with a left-hand thread locking screw. This screw prevents the impeller from backing off the motor shaft at start up, if the motor is started in reverse rotation. Our competitors do not have a positive locking mechanism on their equivalent pump, and damaged impellers, cases and motors are often the victims of a reverse rotation start.

The SSP & SSPC do not have a volute design casing, which can put a radial load on the motor bearing; and no diffuser to plug up, wear out, or replace. The unique case/impeller design acts as a vaneless diffuser, to convert velocity to pressure. This results in higher efficiencies, lower horsepower, and increased reliability.



The case bolts on the SSP & SSPC are American National, not metric screws like so many of our competitors use in their pumps.

The SSP & SSPC come as standard with an inexpensive Type 6, carbon v. ceramic, with Buna N elastomers, mechanical seal. This seal is easy to install and replace, can be purchased at any seal supply store, and is relatively inexpensive. We also offer upgraded type 21 seals, with viton or EPR elastomers, and silicon carbide faces as options. Our competitors use a very expensive, non-standard seal as their standard seal, and charge to change to a less expensive seal.

The SSP & SSPC are priced to beat the competition, without the onerous stocking and purchasing conditions set by our competitors. For volume users, the models SSP & SSPC can be customized in many ways, to better fit our customer's requirements. We offer two day shipments on standard product orders, and just in time deliveries for our blanket order customers.

www.aspumps.com

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS

Stainless Steel Pumps for the Commercial Marketplace

SSP & SSPC Product Code

C 1 56 25 B 1 T 1 X Sample code for a model SSPC, size 1x1.25 with a 5.75" diameter impeller, 0.250 Vane height (at 4.38" diameter), Carbon/Ceramic/Buna Type 6 mechanical seal, with a 1 HP, TEFC, 1/60/115-230V motor, and with a special construction code letter.

1/9/2001

1st Symbol	Pump Model	S = SSP: Open Impeller, 304SS Pump, 6 inch case, threaded connections C = SSPC: Closed Impeller, 304SS Pump, 6 inch case, threaded connections
2nd Symbol	Size Code Discharge x Suction	1 = 1.0" x 1.25" NPT 2 = 1.5" x 2.0" NPT
3rd & 4th Symbol	Impeller Diameter	Digits indicate impeller diameter in inches, and eighths of an inch. Examples: 43 = 4.38", 56 = 5.75"
5th & 6th Symbol	Impeller Vane Height (at a reference diameter of 4.38")	Two digits indicate vane height at 4.38" diameter, as indicated on performance curve. Example: 25 indicates an average vane height of approximately 0.250 inch at 4.38". (Note: if the impeller diameter is larger than 4.38", the vane height at the outside diameter will be smaller than the size code.)

7th Symbol — Mechanical Seal Type & Materials

Material Index
Material Format:
Rotating Face/Stationary Face/Elastomer
Car = Carbon
Cer = Ceramic
SiC = Silicon Carbide
TC = Tungsten Carbide

Type 6

B = Car/Cer/Buna	Stock (Std.)
E = Car/Cer/EPR	Stock

X = Special

Type 21

4 = Car/SiC/Viton	Stock
5 = Car/Cer/Viton	Stock
7 = SiC/SiC/EPR	
8 = SiC/SiC/Viton	Stock
9 = Car/TC/Buna	
X = Special	

Note:
Standard case and impeller o-ring material will match seal elastomer as selected above.

8th Symbol	Motor HP	A = 1/3 HP	1 = 1 HP	3 = 3 HP
		B = 1/2 HP	E = 1.5 HP	5 = 5 HP
		C = 3/4 HP	2 = 2 HP	
9th Symbol	Motor Enclosure	D = Dripproof	X = Explosion Proof	
		T = TEFC	W = Washdown Duty	

10th Symbol — Motor Power Details

Power Rating	3500 RPM	1750 RPM	2900 RPM
1/60/115-230V	1	A	
1/60/230V	2	B	
3/60/230-460V	3	C	
3/60/460V	4	D	
3/60/575V	5	E	
1/50 or 1/60 (dual)	V	G	V
3/50 or 3/60 (dual)	S	U	S
Special	X	X	X
1/50/110-220V			W
1/50/220V			Y
3/50/380V			Z

11th Symbol Up	Special Construction Code. Consult factory for pricing and details. May Indicate special OEM configuration.	F = Footed Motor T = Thermal Overload Protection (3 phase motors only) L = Pump less base.

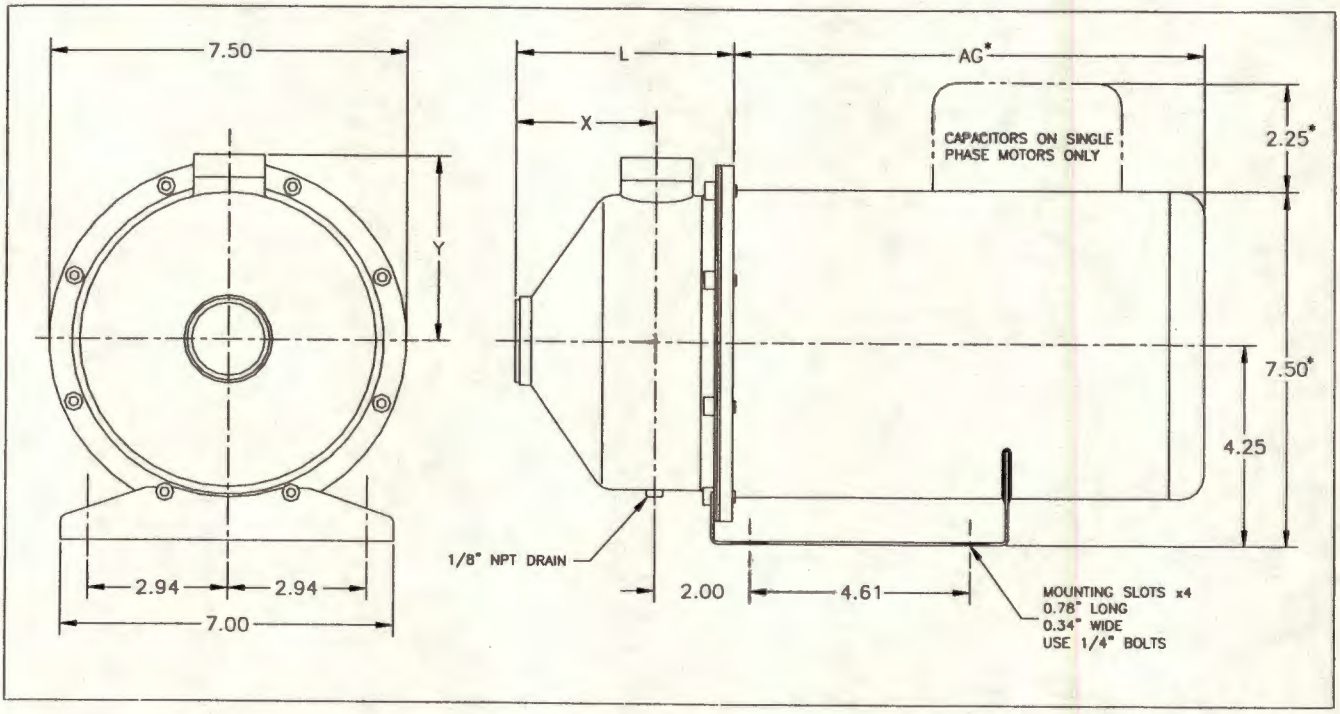
www.aspumps.com
14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS

Stainless Steel Pumps for the Commercial Marketplace

SSP & SSPC Dimensions

With Standard Pump Base



* Dimensions may vary by motor manufacturer and motor enclosure. Weights and dimensions listed are the largest for each motor horsepower size likely to be encountered. "Certified for Construction" drawings are available upon request.

Size	Suction	Discharge	L	X	Y	Motor HP	AG	Ship Wgt.
1SSP/C	1.25 NPT	1.0 NPT	4.7	3.1	3.9	1/2	10.0	29
						3/4	10.3	31
						1.0	11.3	33
						1.5	11.5	37
						2.0	12.1	42
						3.0	12.5	51
2SSP/C	2.0 NPT	1.5 NPT	4.3	2.7	4.5	1.0	11.3	33
						1.5	11.5	37
						2.0	12.1	42
						3.0	12.5	51
						5.0	13.5	55

All dimensions in inches. Shipment weight includes packaging.

3/1/2001

www.aspumps.com

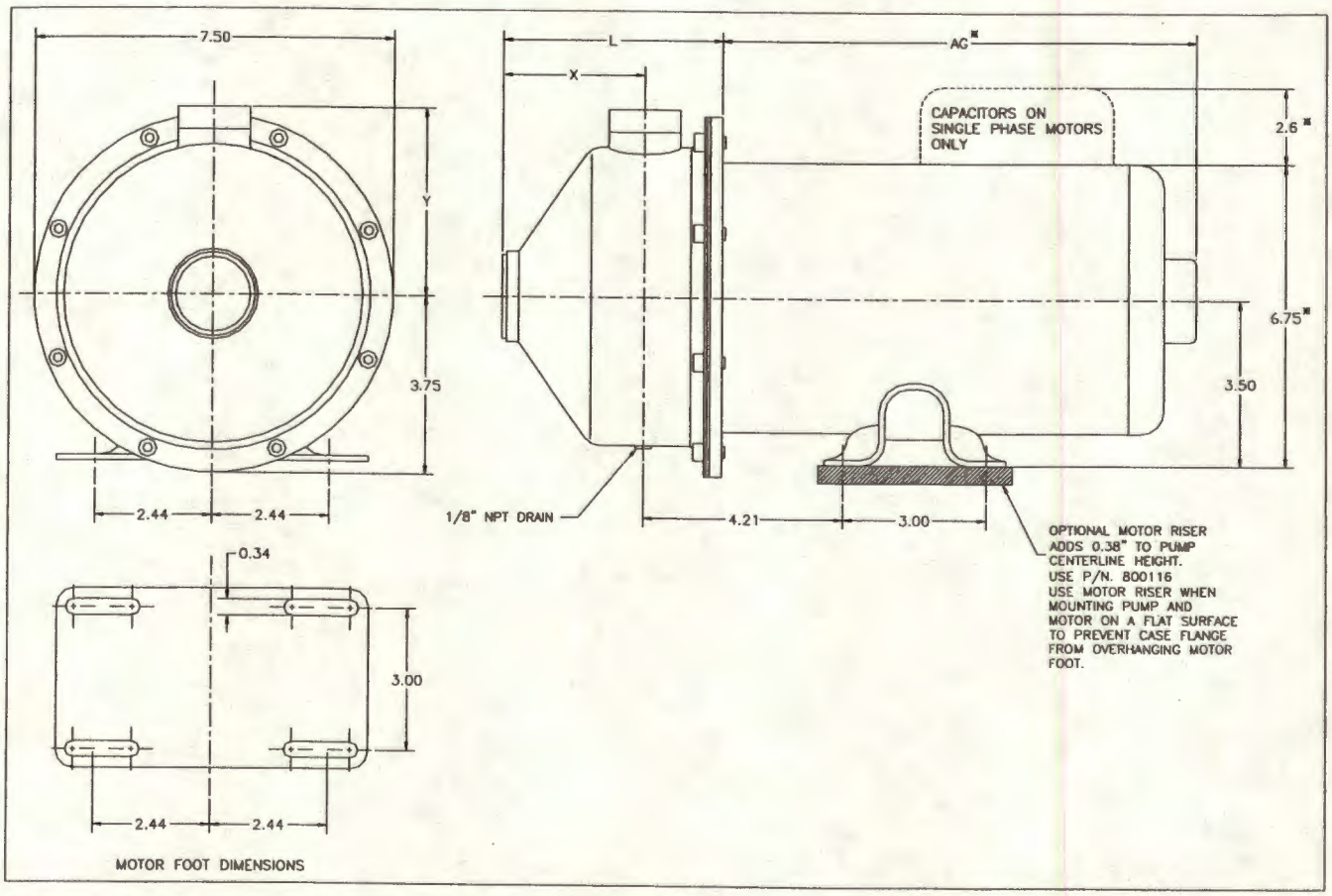
14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS

Stainless Steel Pumps for the Commercial Marketplace

SSP & SSPC Dimensions

With Standard Footed Motor



* Dimensions may vary by motor manufacturer and motor enclosure. Weights and dimensions listed are the largest for each motor horsepower size likely to be encountered. "Certified for Construction" drawings are available upon request.

Size	Suction	Discharge	L	X	Y	Motor HP	AG	Ship Wgt.
1SSP/C	1.25 NPT	1.0 NPT	4.7	3.1	3.9	1/2	10.0	29
						3/4	10.3	31
						1.0	11.3	33
						1.5	11.5	37
						2.0	12.1	42
						3.0	12.5	51
2SSP/C	2.0 NPT	1.5 NPT	4.3	2.7	4.5	1.0	11.3	33
						1.5	11.5	37
						2.0	12.1	42
						3.0	12.5	51
						5.0	13.5	55

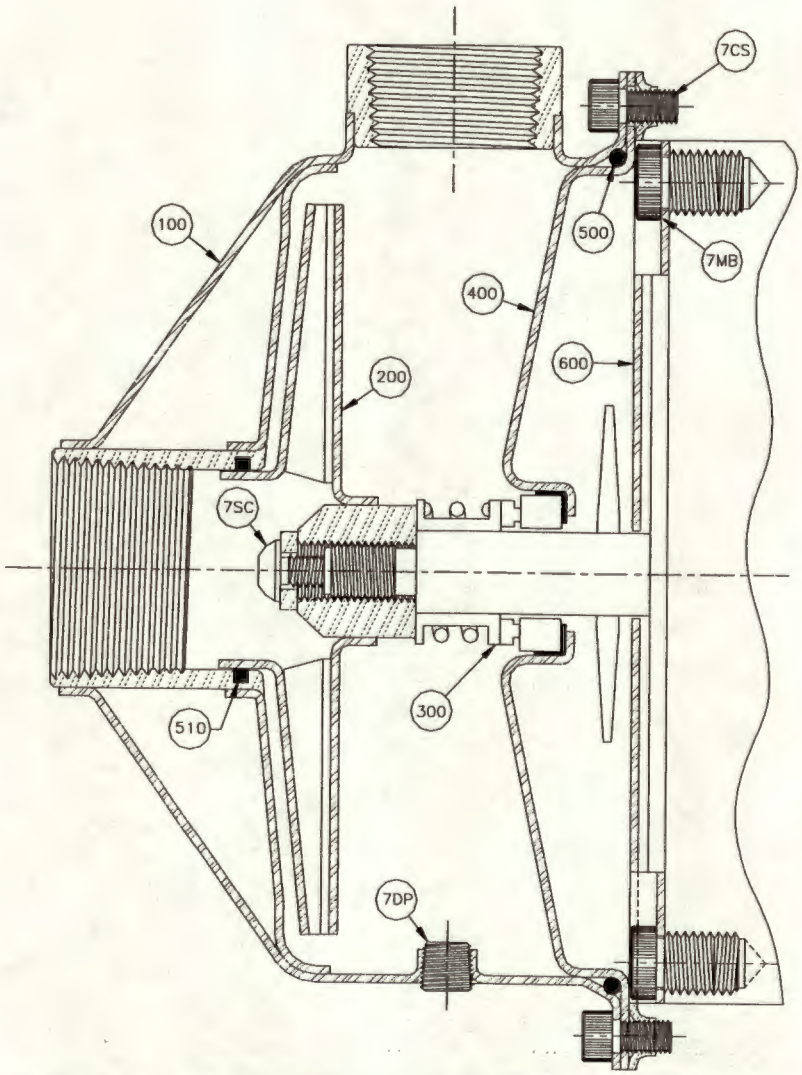
All dimensions in inches. Shipment weight includes packaging.

www.aspumps.com

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

AMERICAN STAINLESS PUMPS
Stainless Steel Pumps for the Commercial Marketplace

SSPC (Enclosed Impeller) Cross Sectional Drawing



Item No.	Part Description	Standard Materials
100	Casing	304 SS
200	Impeller (Enclosed)	304 SS
300	Mechanical Seal - Type 6 (std.) (Other seal types available)	Car/Cer/Buna N/316 SS (Other materials available)
400	Seal Plate	304 SS
500	Casing O-Ring	Buna N (Other materials available)
510	Impeller O-Ring	Buna N (Other materials available)
600	Motor Adapter Plate	304 SS
7CS	Casing Screw - 1/4-20 (3/16 Allen)	Nickle Plated Steel
7DP	Drain Plug - 1/8" NPT	304 SS
7MB	Motor Bolt - 3/8-16 (7/32 Allen)	304 SS
7SC	Impeller Screw - 10-32LH (1/8 Allen) (Standard on 3-Ph motors 1-hp or larger)	304 SS
800 (not shown)	Pump Base (not supplied with footed motors)	304 SS

www.aspumps.com
14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

Installation Operation & Maintenance Instructions

Model SSP & SSPC

Description and Specifications: The Model **SSP** is a close coupled, end suction, single stage, open-impeller, back-pullout centrifugal pump. The model **SSPC** is the enclosed impeller version of the same pump. Connections are NPT threaded. All wetted metal pump parts are 18-8, 304SS, or better. Most parts are formed from stainless steel sheet. O-rings and elastomeric seal parts are Buna (Viton, EPR are optional). Motors are NEMA 56J frame, with a C-Face mounting flange and a threaded shaft. All pumps use a mechanical seal to prevent leakage around the motor shaft.

Operating limits: The models **SSP & SSPC** are designed for 75-PSIG operating pressure at 212 deg. F., with the standard Type-6, carbon vs. ceramic with buna-n elastomers mechanical seal, and a maximum temperature limit of 250 deg. F., with a Type-21 mechanical seal with viton elastomers. The motor is limited to 20 starts per hour, evenly distributed.

Notice: Upon receipt of this equipment, inspect the carton and the equipment for any damages that might have occurred during shipment and notify the carrier immediately. Damage that occurs during shipment is not the responsibility of American Stainless Pumps. Failure to notify the carrier will place responsibility on the purchaser for any repairs or damages occurring during shipment.

Safety Instructions: To avoid serious or fatal injury and/or property damage, read and follow all instructions in this manual. Review all instructions and warnings included in this manual before attempting any work on this pump or pump/motor assembly. Do not remove or alter any decals.

The motor used to drive this pump is an electrical device connected to a potentially lethal voltage power source. Take all precautions required when working with or on the motor and its power source, including but not limited to:

1. Always disconnect and lockout the electrical power source before attempting any connection, maintenance or repairs. Failure to do so can cause electrical shocks, burns and death.
2. Install, ground and wire motors in accordance with all local and national electrical codes.
3. Install an all leg disconnect switch near the motor for quick access.
4. The electrical supply must match the motor nameplate specifications and the motor must be wired per the wiring diagram on the motor to match the selected voltage. **Incorrect wiring can cause fire and motor damage and will void the warranty.**
5. Most single-phase motors and some three phase motors will have automatic thermal protection switches wired in the motor. These switches will open and stop the motor if the motor overheats. As the motor cools, these switches will close and start the motor automatically and unexpectedly.
6. Motors which do not have thermal overloads must have a properly sized contractor or magnetic starters and overload switches (or fuses) in the starter panel. Three phase motors require all leg protection.
7. Use only stranded copper wire to motor and ground. Wire size must limit the maximum voltage drop to 10% of the motor nameplate voltage at the motor terminals.
8. Three phase motors can rotate in either direction. The pump will operate properly only in one direction (clockwise when looking from the motor end, counterclockwise when viewed from the pump end). **Operating the pump in the reverse rotation may damage or destroy the pump and motor and voids the warranty.**

Installation:

Units may be installed horizontally, at an angle or vertically with the motor on top. **Do not mount the motor below the pump as leakage from the pump will damage the motor and can cause a shock, burns or death.**

- ☑ Locate the pump as near to the liquid source as possible. The pump must be primed with little or no air in the case to begin operation. The pump must be located below the liquid level when starting. This pump is not self-priming.
- ☑ Protect the pump and motor from freezing. Although the pump may survive a freeze up, the mechanical seal and O-Rings may not.
- ☑ Allow adequate space around the unit for service and ventilation.
- ☑ Units mounted horizontally should be located on a flat, rigid surface. Unit may be free standing, but some vibrations may occur. If attached to a foundation, tighten hold down bolts before connecting the piping.

Piping:

- ☑ All piping must be independently supported. No piping loads may be carried by the pump.
- ☑ Piping should be the same size or larger than the pump connections.
- ☑ Proper Piping to the suction is critical for proper pump operation. Suction pipe should be short and direct, with a minimum of fittings and turns.
- ☑ Suction pipe must continuously rise to the pump to avoid air pockets. All pipe connections must be airtight.
- ☑ If suction pipe is larger than the pump, an eccentric reducer must be used with the straight side on top to avoid an air pocket.
- ☑ If suction of pump is above the liquid source level, a foot valve or other isolation valve will be needed to prime the pump. A continuous stream of liquid must be made available for the pump suction to hold its prime.
- ☑ Do not use any suction valve for throttling the pump. This will cause loss of prime and damage to the pump that is not covered by warranty.
- ☑ Be sure that the source liquid level is sufficient to prevent vortices from drawing air into the pump.
- ☑ Install a valve on the discharge line for use in regulating the pump flow and for isolating the pump during maintenance and inspection.

Rotation:

The models SSP & SSPC will operate properly only in one direction (clockwise when looking from the motor end, counterclockwise when viewed from the pump end). **Operating the pump in the reverse rotation may cause the impeller to unscrew, breaking the shaft, damaging the pump and/or the motor, and voids the warranty**. Three phase motors can rotate in either direction. Single phase motors normally only rotate in the proper direction.

To check rotation, you must observe the motor shaft from the back of the motor.

1. Remove the end cover from the center of the back of the motor by prying off the cap. You do not need to remove any screws on most motors.
2. Quickly switch on and off the motor and watch the shaft rotation as it slows down. Motor shaft should be turning in the clockwise direction when viewed from the back of the motor.
3. If your three-phase motor is turning in the wrong direction, **have a qualified electrician interchange two of the three motor power wires**. This should reverse the rotation. If a single-phase motor is turning in the wrong direction, it has been wired wrong internally. Consult the motor manufacturer or American Stainless Pumps for instructions.
4. Check the rotation again, if it is correct, replace the end cover cap.

Operation:

- ☑ Pump must be completely primed before starting. Air in the suction lines or case must be vented.
- ☑ **Model SSPC Only:** If the pump case is rotated so that the discharge nozzle is not vertical, an air pocket may form in the case that will prevent the pump from operating properly. Loosen the case bolts until this air is removed for proper operation. Be sure to retighten the bolts before operating the pump.
- ☑ **Do not operate the pump at or near zero flow.** At zero flow, heat will build up in the pump and can cause extreme damage to the pump, property damage and/or possible injury to operating personal. Minimum flows of 10% of the pumps best efficiency point are recommended unless otherwise authorized by ASP.
- ☑ Do not operate the pump beyond the flow rates shown on published curves. Noisy pumps or the sounds of "pumping rocks" may be signs of cavitation or operation beyond the pumps capacity.

Operation Continued:

- ☑ Check pump and motor for vibration. Vibration may be a sign of pipe strain, insufficient mounting or operation beyond the pumps capacity.
- ☑ The pump models SSP & SSPC are not designed for handling large amounts of solids. For the model SSP, Spherical solids size should not exceed the vane height of the impeller, less 0.060". For the model SSPC, solid sizes must be smaller than the impeller vane family expressed in thousandths of an inch, less 0.140".

Maintenance:

There is no scheduled maintenance required. Close-coupled pumps have no bearings. Bearings in the motors are permanently grease lubricated and cannot be re-greased. Mechanical seals will need to be replaced when leaking. O-Rings may harden with age and may need to be replaced when they leak.

Motor Bearings and Pump Thrust: Model SSP Only

Open impellers generate significantly more thrust than do enclosed impellers. The Model SSP with a 4.38" diameter impeller operating at 20 psig generates about 150 pounds of thrust. This thrust load is carried by the motor bearing. The standard jet pump motor and the standard SSP motor uses as a front and rear bearing a size 203 grease lubricated bearing. This bearing has a B10 rated life of approximately 6,000 hours when operated with a thrust load of 150 pounds at 3500 RPM. This rating means that 10% of all bearings operated in this condition will fail within 6,000 hours of operation. The average bearing life will be 3 to 4 times this 6,000 hours.

Pumps and motors which operate intermittently, or only operate 40 hours per week, will usually have acceptable bearing lives with the standard jet pump motor bearing. Pumps that operate continuously, 24 hours per day, will have about 10% of their thrust bearings fail in the first year of operation.

For service applications that are critical, for installations that are difficult to access, or for pumps operating at differential pressures above 25 psig, American Stainless Pumps recommends that motors with a larger thrust bearings and higher load ratings be used. Consult factory for pricing and details.

Disassembly:

Disconnect and lockout the electrical power before attempting any disassembly. Casing may contain hazardous fluids. Drain and flush and take necessary precautions.

It is not necessary to remove piping from the case to disassemble. Pump is a back pullout design and unless casing needs to be repaired or replaced, it can stay in place during servicing.

☑ See page 7 for model SSP, and page 8 for model SSPC cross sectional drawings.

1. Close all valves and drain pump and pipes and flush if necessary.
2. Remove any motor hold down bolts.
3. Remove the eight (8) case bolts (Item 7CS) with a 3/16" allen wrench.
4. Pull the motor and pump internals back out of the case. The baseplate (Item 800) will slip off when the bottom two case bolts are removed and can be left with the pump case. Remove the case o-ring (item 500) and inspect for damage or hardness.
5. If the motor is a three phase motor, a locking mechanism (item 7SC) is used to prevent the impeller (item 200) from unthreading if started in the wrong direction. If motor horsepower is less than 1 HP, the starting torque is relatively weak. ASP uses a locking compound to prevent the impeller from unthreading at start-up. If the motor horsepower is equal to or greater than 1.0 HP, ASP will provide a left hand threaded, button head locking screw with an impeller washer to prevent unthreading. The locking screw (item 7SC) is installed with removable Loctite to prevent it from coming out when operating in the correct rotation. Remove this locking screw by turning it **clockwise** while holding the impeller against rotation.
6. Remove the impeller (item 200) by turning the impeller counterclockwise (when looking at the impeller from the pump end) while holding the motor shaft. It will be necessary to remove the motor shaft cover plate in the center of the rear of the motor to get access to the shaft. Using a screwdriver, wrench or vise grips as needed, hold the shaft tightly against rotation while turning the impeller. **Do apply any heat to the components**. If you are unable to hold the shaft in this manner, remove the rear motor housing and grip the motor shaft with vise grips or other similar device (do not hold shaft where bearings will mount).
7. **Model SSP Only:** There should be several spacing washers behind the impeller. These spacers locate the open impeller vanes close to the case for efficient operation. Measure the thickness of this stack of spacers for future reference. Remove them from the shaft but do not lose these washers. You will need them for reassembly.

Disassembly continued...

8. Remove the rotating element of the mechanical shaft seal (item 300). This element is held in place by the impeller only. If the rotating element does not come off easily, it is stuck to the shaft. Pry up the seal plate (Item 400) with screwdrivers or pry bars. The seal plate should compress the seal spring and force the seal off the shaft. If seal is stuck, and you must pry with force, do not pry towards your face or body. The seal and seal plate can come free unexpectedly and injure you.
9. If the seal plate (item 400) did not come off with the seal, remove it now. If you plan to replace the stationary seat, you will need to press it out from the back. Do not push with your finger, as you will probably cut it on the edges of the seal plate when the seal pushes out.
10. If you plan to replace the motor, remove the four motor adapter bolts (Item 7MB) with a 7/32" allen wrench and remove the motor adapter plate (Item 600). If you are not replacing the motor, leave the adapter plate in place.
11. If the motor comes with a deflector, the deflector should go outside of the motor adapter plate and must be removed if the adapter plate is to be removed.
12. Check the suction o-ring (item 510) in the case suction nozzle. It may be difficult to remove. Use a sharp pointed awl or similar device to pry the o-ring from the groove. Replace if damaged, swollen, fretted, or just worn out.

Assembly or Reassembly: SSP & SSPC

- ☑ See page xxx for model SSP, and page xxx for model SSPC cross sectional drawings.
- ☑ Assembly of the pump and motor is easier when the motor is standing face up so that parts do not fall off, although access to the motor shaft at the rear of the motor will require a horizontal position.
- ☑ It is considered good practice to replace the mechanical seal whenever you have to disassemble the pump.

1. If replacing the motor, remove the deflector from the motor shaft. There may not be enough room behind the motor adapter plate for the deflector to spin freely.
2. Install the motor adapter plate (Item 600) with the four motor bolts (Item 7MB) using a 7/32" allen wrench. You must use the low profile button head socket screws that came with the pump or other low profile head bolts. There is not enough room for a standard cap head screw/bolt. Tighten the bolts. Install the deflector now.
3. Install the mechanical seal stationary seat into the Seal Plate (Item 400) by putting a suitable lubricant on the cup seat and gently pressing into the seal plate bore. **Do not get any lubricant on the seal faces**. Use the foam sheet from the seal box to protect the seal face from dirt and scratches while pressing into the seal plate. Place the seal plate onto the motor adapter plate.
4. Lubricate the sealing elastomers on the rotating assembly of the mechanical seal and press gently onto the shaft. You may have to hold the seal in place until the impeller is installed.
5. **Model SSP Only:** Place the necessary number and thickness of impeller spacer/washers onto the threaded portion of the shaft. If you are not changing the impeller or the motor, use the same batch of spacer/ washers you removed. See the section on ***Setting Impeller Clearance*** for procedures if you have changed the impeller to case setting.
6. (If motor is three-phase, read section 7 below for Loctite instructions, then continue reading here) Thread the impeller onto the pump shaft. Be sure the impeller hub is tight against the spacer/washers that are tight against the shoulder of the motor shaft. If you leave the impeller loose, when the motor starts up, the impeller will tighten up on the shaft so tightly that you may not be able to remove it later. You will need to hold the motor shaft from the rear of the motor with a large screwdriver, wrench or vise grips while tightening the impeller.
7. If motor is three-phase, and wiring has been reconnected, rotation may have changed. To protect against rotation in the wrong direction at start up, reinstall the left hand threaded impeller locking screw and washer (item 7SC), or for motor horsepowers less than 1 HP, install the impeller with a locking compound such as Loctite.
8. Install the case o-ring (item 500). Replace if brittle, damaged or misshapen.
9. **Model SSPC Only:** Install the suction o-ring (item 510). Replace if brittle, damaged or misshapen.
10. **Model SSPC Only:** Join up the back pull out assembly with the case. Do not force the pump into the case. The suction O-ring (item 510) can be pinched when installing. You may have to back out the pump from the case, center up the O-ring with your finger and slip in the pump assembly again. Before installing the case bolts, check to be sure the impeller is spinning freely.
11. **Model SSP Only:** Join up the back pull out assembly with the case. Install the (8) case bolts (item 7CS), leaving the bottom two bolts loose for attaching the base (not necessary with footed motors). Slip the baseplate under the bottom two bolts. Tighten the case bolts while holding the baseplate in place.
12. **Model SSP Only:** Check the impeller to case clearance per the following instructions and adjust as needed.
13. Install and tighten the motor base hold down bolts.

Setting Impeller Clearance: Model SSP Only

- ☑ **See *SSP Performance Notes* for impeller shimming discussion.**
- ☑ **Properly setting the impeller to case clearance is the most critical factor in determining the SSP's performance.** You will get maximum performance and efficiency (and maximum amp draw) with near to zero clearance. Factory standard clearance is 8 to 12 mil. Spacer/Washers to adjust clearances are available in 10 mil and 15-mil thickness.
- ☑ You can have more or less than normal flow and head by changing the clearance. To increase clearance, remove impeller spacer/washers. To decrease clearance, add impeller spacer/washers. **Be aware that if you set the impeller at near to zero clearance, and operate near maximum flow rates, you may overload the standard motor. Also be aware that impeller clearances near zero greatly increase the risk of the impeller grinding against the casing.**
- ☑ Standard factory settings for spacers are 30 to 90 mils of spacer/washers to obtain 10-mil clearance. Since the tolerances of the motor shaft and pump parts can stack up, some pumps may need more or less than this standard. Some special OEM assemblies will not have any spacers when the customer elects to accept reduced performance in return for ease of assembly.
- ☑ American Stainless Pumps provides special feeler gauges for impeller shimming. Call and order our feeler gauge set, part number K200. Our standard shim pack set is also available. It contains ten each of the 0.010" and 0.015" shims.

Use the following impeller shimming method when building a new pump:

- ☑ American Stainless Pumps provides special feeler gauges for impeller shimming. Call and order our feeler gauge set, part number K200. Our standard shim pack set is also available. It contains ten each of the 0.010" and 0.015" shims. Use part number 200115.

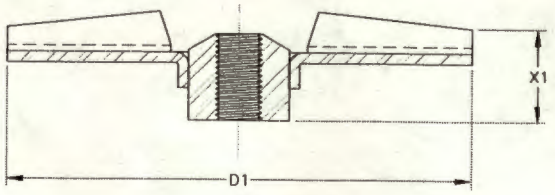
1. Place the pump (as assembled through step 4 on page 47) on the workbench, positioned vertically.
2. Place 0.050" shims onto the motor shaft (two 0.015" shims and two 0.010" shims).
3. Thread the impeller onto the shaft, compressing the seal and shims. You will need to hold the motor shaft from the rear of the motor with a large screwdriver, wrench or vise grips while tightening the impeller.
4. Place case o-ring (item 500) onto seal plate. Make sure o-ring is laying flat against the seal plate flange.
5. Place case onto pump assembly, and install case screws (item 7CS). Tighten case screws in a cross-bolting fashion.
6. Rotate the impeller from the back of the motor, or with your finger through the suction or discharge nozzles. Listen and feel for any scraping noises from the impeller hitting the casing. If a scraping noise is heard, remove the case and impeller, and then remove either one 10 or one 15 mil shim. Repeat step 5 & 6. If no noise is heard, proceed to step 7.
7. Use the pink feeler gauge (0.015"), and slide it in between the impeller and the casing through the discharge nozzle. If the pink feeler gauge does not fit, go back to step 6 and remove shims as necessary to make pink gauge slide in between impeller and casing. When done correctly, the feeler gauge will become visible through the suction nozzle. Continue pushing the feeler gauge into the casing until it is all the way in, and centered across the face of the impeller. Rotate the feeler gauge using a pair of needle nose pliers, and feel for tight spots. If gauge encounters only a slight pinching resistance, you probably have a good impeller clearance. Remove the pink feeler gauge, and check to see that the brown feeler gauge (0.010") does not bind when used in the same way. If it does not, go to step 9. If it does, remove 0.010 mils of shims from behind impeller and repeat step 7. If the pink feeler gauge is free to rotate 360 degrees across the face of the impeller without binding or resistance, go to step 8.
8. If the pink gauge is capable of rotating 360 degrees without binding, then there is a greater impeller/casing clearance than 0.015". Determine this clearance by repeating step 7 with the thicker gauges. Yellow=0.020", White=0.025", Orange=0.030". If clearance is larger than 0.030", stack the various gauge thickness and repeat procedure until clearance is known. When clearance is determined, add shims behind the impeller to close clearance as desired. Repeat step 7.
9. Proper clearance has been established. Return to step 5 on the previous page.

Model SSP Impeller Shimming Method for Replacement Impellers

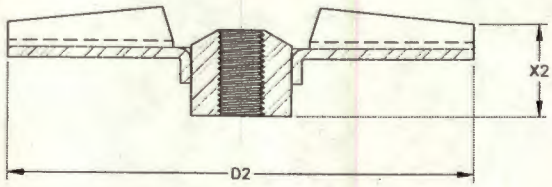
When replacing impellers in a model SSP open impeller pump, the following worksheet will provide a relatively quick method for maintaining the proper impeller/casing clearance. You may also want to read the previous page for an overview of the impeller shimming procedure.

REPLACEMENT IMPELLER SHIMMING PROCEDURE

Old Impeller



New Impeller



1. Measure D1, X1, D2, & X2. (Measure X1 & X2 as accurately as possible)

   D1=_____ X1=_____ D2=_____ X2=_____

2. Determin K1 & K2.

Impeller Diamerer D	K
3-3/4	-0.033
4-3/8	0.0
5-1/4	0.046

   K1=_____ K2=_____

3. Calculate H1 & H2
   H1=X1+(K1) H2=X2+(K2)

   H1=_____ H2=_____

4. Calculate S.
   S=H1-H2

   Round S to the nearest 0.005 increment.

   If S>0, then add shims equal to S.
   If S<0, subtract shims equal to S.

NOTES: & WHEN NOT NOTED OTHERWISE:
NO SHARP EDGES
FILLET ALL CORNERS TO 0.01
RADIAL & DIAMETRICAL DIMENSIONS ARE TO BE HELD TO A ±0.002 SYMMETRICAL TOLERANCE, AND ARE CONCENTRIC WITH PART CENTERLINES.
ALL DIMENSIONS ARE IN INCHES
PLEASE CALL (310) 630-8089 IF THERE ARE ANY QUESTIONS OR COMMENTS RELATED TO THIS DRAWING

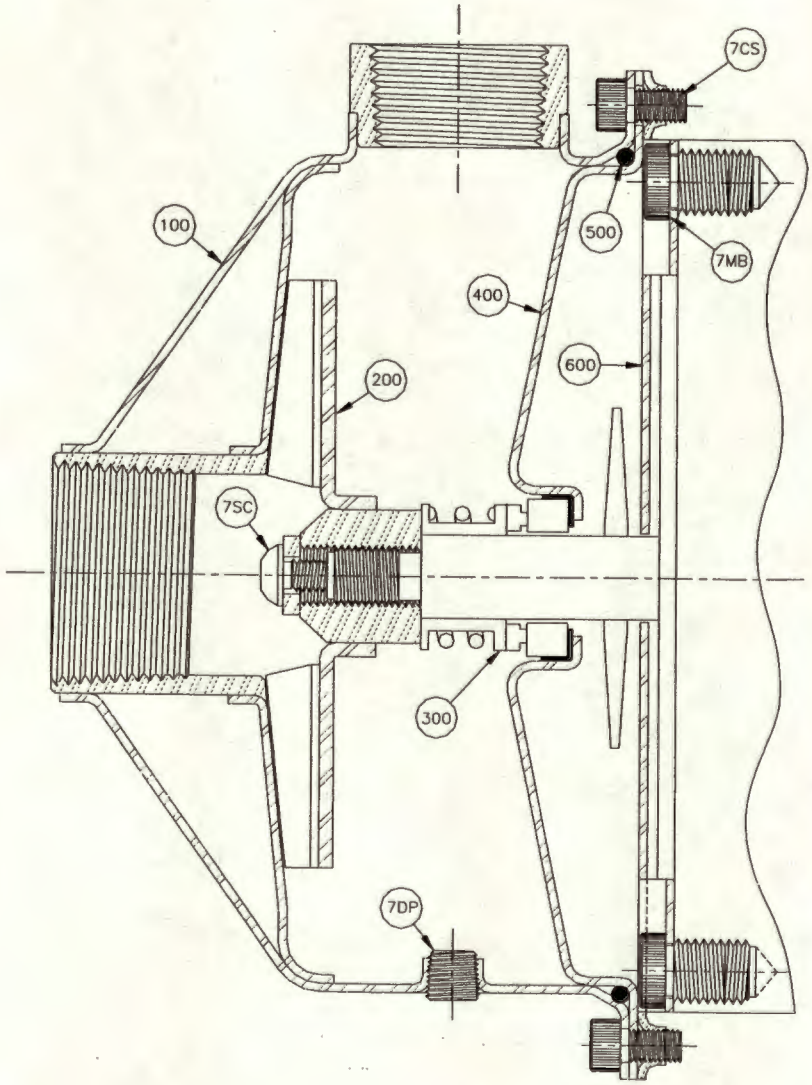
NO.	REVISION DESCRIPTION	DATE
0	ORIGINAL DRAWING	XX/XX/XX

STANDARD TOLERANCES

0.X	±0.01
0.XX	±0.005
0.XXX	±0.002
0.XXXX	±0.0005

AMERICAN STAINLESS PUMPS
SSP IMPELLER SHIM GUIDE 12/13/00
MWC
...\ASP\SSP\ XXXXXXXX.DWG 0

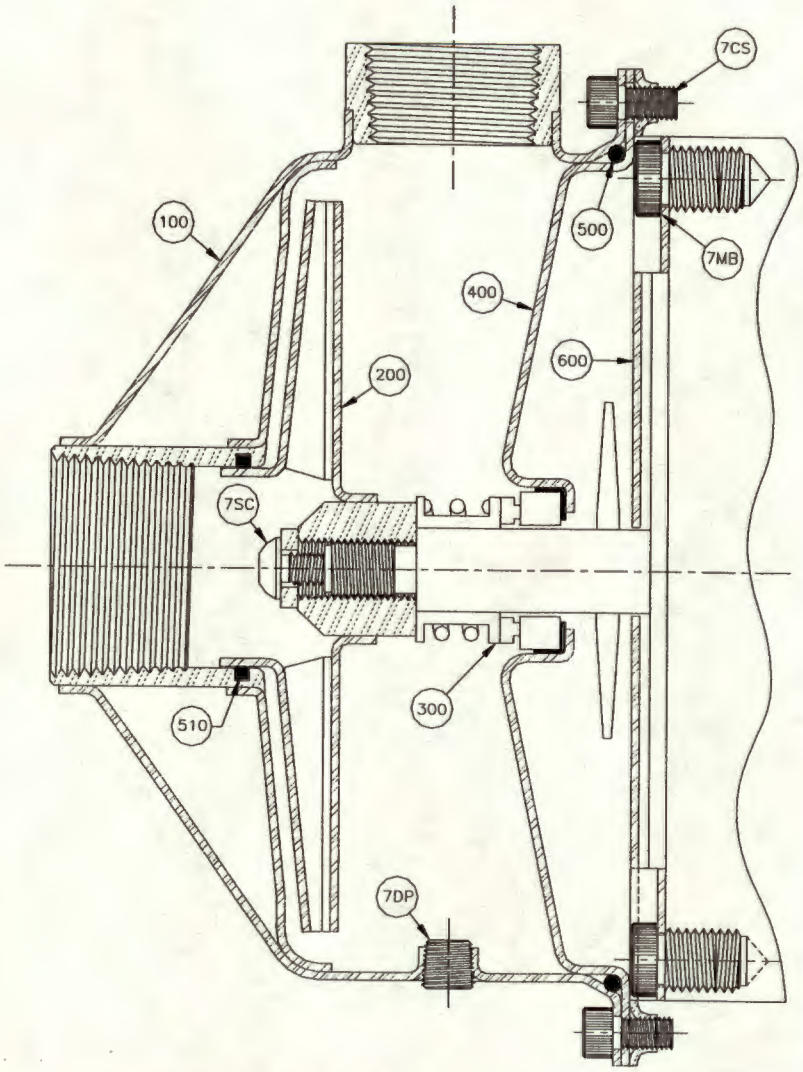
SSP (Open Impeller) Cross Sectional Drawing



Item No.	Part Description	Standard Materials
100	Casing	304 SS
200	Impeller (Open)	304 SS
300	Mechanical Seal - Type 6 (std.) (Other seal types available)	Car/Cer/Buna N/316 SS (Other materials available)
400	Seal Plate	304 SS
500	Casing O-Ring	Buna N (Other materials available)
600	Motor Adapter Plate	304 SS
7CS	Casing Screw - 1/4-20 (3/16 Allen)	Nickle Plated Steel
7DP	Drain Plug - 1/8" NPT	304 SS
7MB	Motor Bolt - 3/8-16 (7/32 Allen)	304 SS
7SC	Impeller Screw - 10-32LH (1/8 Allen) (Standard on 3-Ph motors 1-hp or larger)	304 SS
800 (not shown)	Pump Base (not supplied with footed motors)	304 SS

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

SSPC (Enclosed Impeller) Cross Sectional Drawing



Item No.	Part Description	Standard Materials
100	Casing	304 SS
200	Impeller (Enclosed)	304 SS
300	Mechanical Seal - Type 6 (std.) (Other seal types available)	Car/Cer/Buna N/316 SS (Other materials available)
400	Seal Plate	304 SS
500	Casing O-Ring	Buna N (Other materials available)
510	Impeller O-Ring	Buna N (Other materials available)
600	Motor Adapter Plate	304 SS
7CS	Casing Screw - 1/4-20 (3/16 Allen)	Nickle Plated Steel
7DP	Drain Plug - 1/8" NPT	304 SS
7MB	Motor Bolt - 3/8-16 (7/32 Allen)	304 SS
7SC	Impeller Screw - 10-32LH (1/8 Allen) (Standard on 3-Ph motors 1-hp or larger)	304 SS
800 (not shown)	Pump Base (not supplied with footed motors)	304 SS

14032 S. Avalon Blvd. Los Angeles, CA 90061
Phone: (310) 630-8089 Fax: (310) 630-8095

American Stainless Pumps

Stainless Steel Pumps for the Commercial Marketplace

P-201

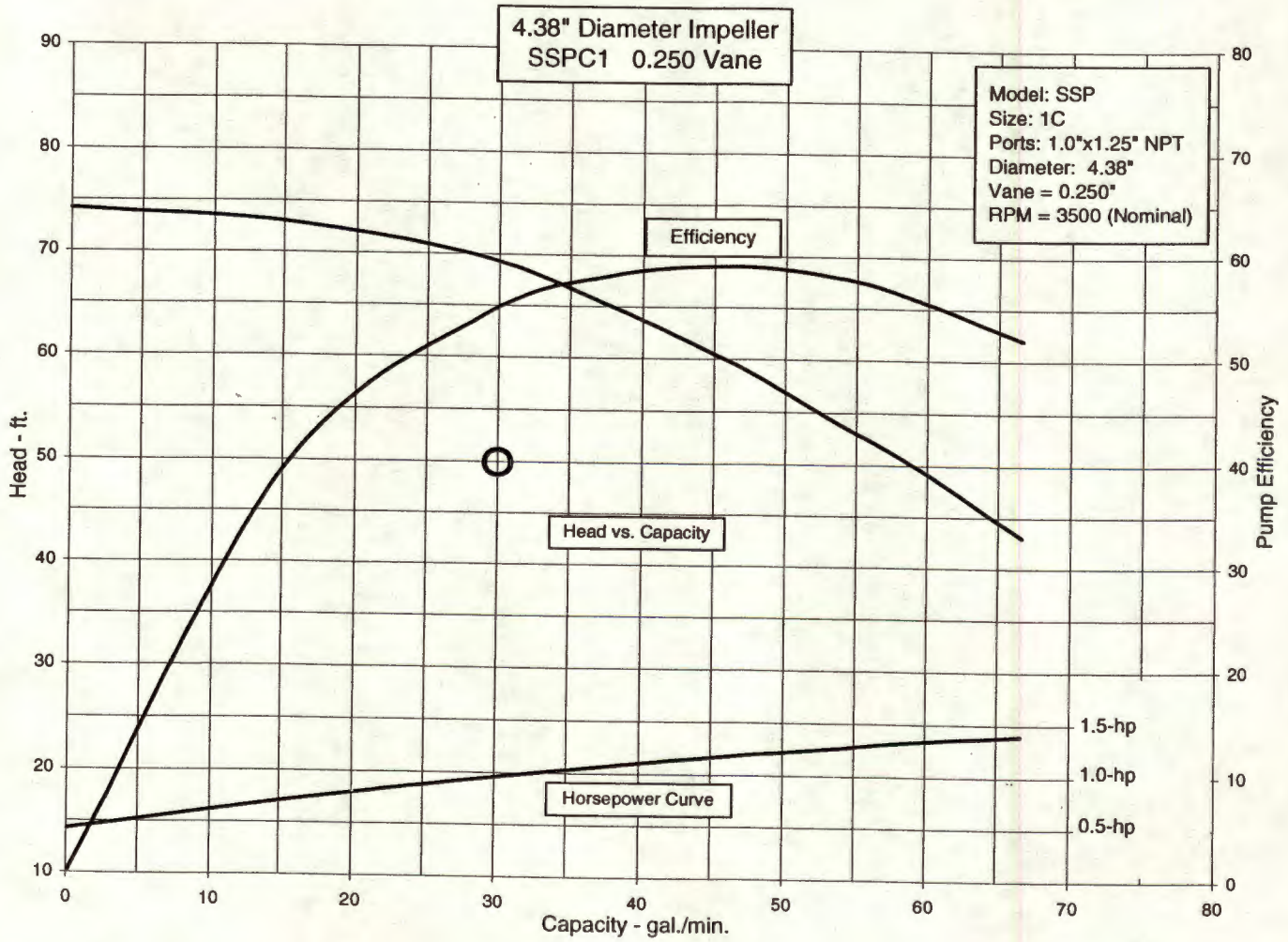
Performance Curve Data Sheet

Customer/Company Name: BENCHMARK
Contact Name: _____
Phone Number: _____
Fax Number: _____

ASP Representative: _____
Rep. Contact Name: _____
Rep. Phone: _____
Rep. Fax: _____

Application: _____
Product Being Pumped: _____
Product Specific Gravity: _____
Product Temperature: _____ deg. F/deg. C
Product Viscosity: _____ ctp./cts./SSU
Flow Rating Point: 30 gpm
Head Rating Point: 50' TDH feet/psig
Total System Pressure: 21.65 psig

Pump Catalog No: _____
Motor Horsepower: 1.5
Pump BHP @ Point: _____
Pump BHP @ Run Out: _____
Mechanical Seal: _____
Special Features: _____



Clean water based performance at 60 deg. F.

3/01/01

www.aspumps.com
14032 South Avalon Blvd. Los Angeles, CA 90061
Phone (310) 630-8089 ~ Fax (310) 630-8095

C14325-3500.pdf

American Stainless Pumps

Stainless Steel Pumps for the Commercial Marketplace

P-100

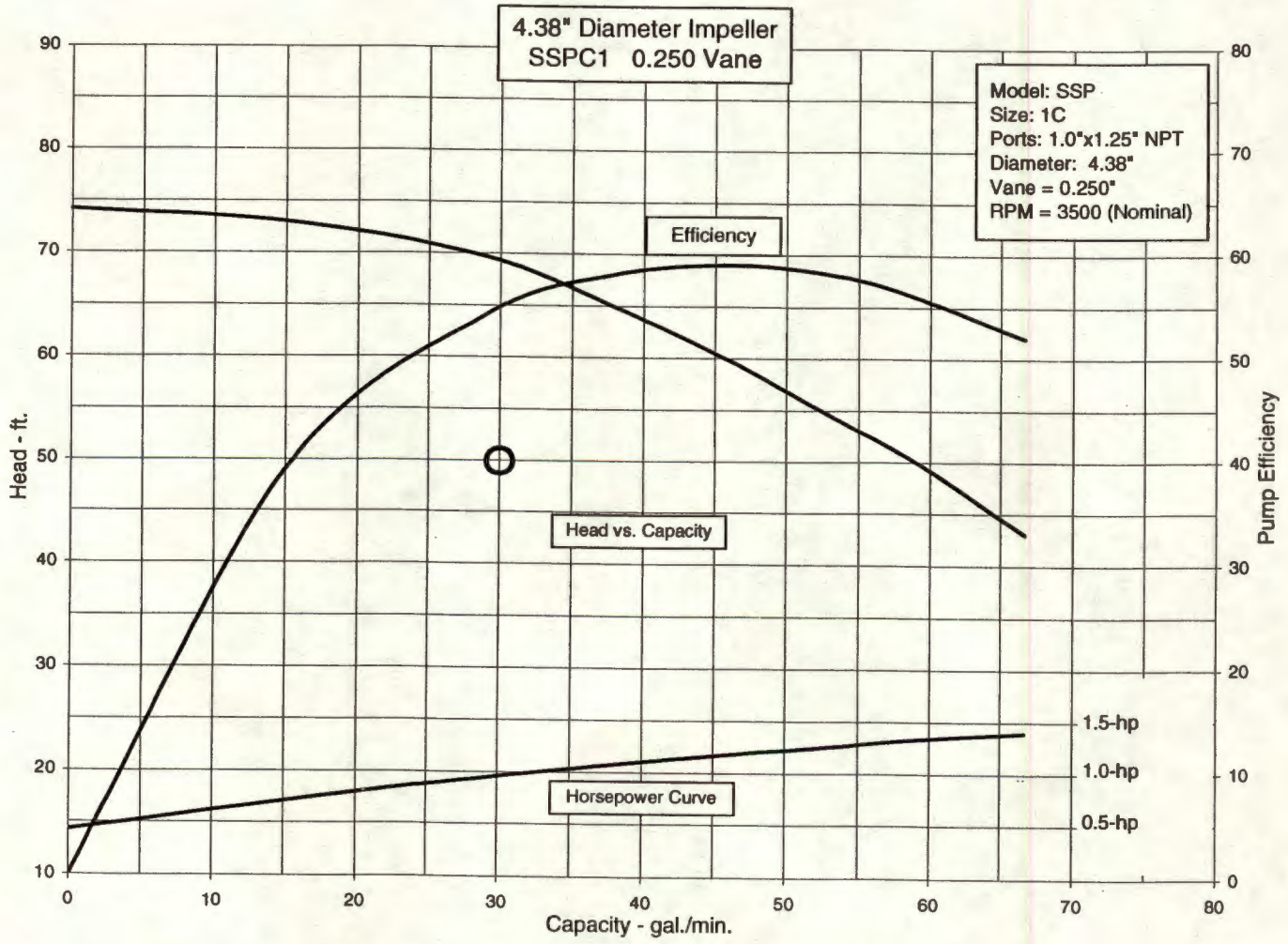
Performance Curve Data Sheet

Customer/Company Name: BENCHMARK
Contact Name: _____
Phone Number: _____
Fax Number: _____

ASP Representative: _____
Rep. Contact Name: _____
Rep. Phone: _____
Rep. Fax: _____

Application: _____
Product Being Pumped: _____
Product Specific Gravity: _____
Product Temperature: _____ deg. F/deg. C
Product Viscosity: _____ ctp./cts./SSU
Flow Rating Point: 30 gpm
Head Rating Point: 50' TDH feet/psig
Total System Pressure: 21.65 psig

Pump Catalog No: _____
Motor Horsepower: 1.5
Pump BHP @ Point: _____
Pump BHP @ Run Out: _____
Mechanical Seal: _____
Special Features: _____



Clean water based performance at 60 deg. F.

3/01/01

www.aspumps.com

14032 South Avalon Blvd. Los Angeles, CA 90061
Phone (310) 630-8089 ~ Fax (310) 630-8095

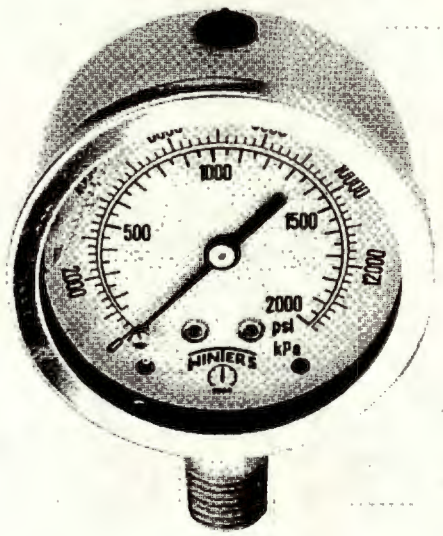
C14325-3500.pdf

WINTERS 1953

PI-206

LF SERIES QUALITY

Quality Gauge



Features:

- 1 1/2" (40mm), 2 1/2" (63mm), and 4" (100mm) dials with black and red markings
- 304 stainless steel case
- Brass internals or stainless steel internals
- Liquid filled or dry
- 1 1/2" (40mm) - 2.5% accuracy filled, ANSI/ASME Grade B
- 2 1/2" (63mm) - 1.6% accuracy filled, ANSI/ASME GRADE A. 1% dry, ANSI/ASME Grade 1A.
- 4" (100mm) - 1.6% accuracy filled, ANSI/ASME GRADE B. 1% dry, ANSI/ASME Grade 1A.
- 1/8", 1/4", 1/2" npt bottom or back connection
- Restrictor screw standard

Applications:

- Pumps, compressors, hydraulic presses & machinery, motors, winches etc. Whenever a quality liquid filled gauge is required.

How to order: Specify product code

PRODUCT CODES

Dial Size	1 1/2" (40mm)		2 1/2" (63mm)		4" (100mm)				4" (100mm)			
Connection	Bottom	Back	Bottom	Back	Bottom	Bottom	Back	Back	Bottom	Bottom	Back	Back
Tube, Socket & Movement	Brass	Brass	Brass	Brass	Brass	Brass	Brass	Brass	Stainless	Stainless	Stainless	Stainless
NPT Connection	1/8"	1/8"	1/4"	1/4"	1/4"	1/2"	1/4"	1/2"	1/4"	1/2"	1/4"	1/2"
30" Hg Vacuum/kPa	*	*	Q801	Q900	Q700	*	Q730	*	Q760	*	Q1260	*
30"-0-15 psi/kPa	*	*	Q790	Q890	Q701	*	Q731	*	Q761	*	Q1261	*
30"-0-30 psi/kPa	*	*	Q798	Q898	Q702	*	Q732	*	Q762	*	Q1262	*
30"-0-60 psi/kPa	*	*	Q799	Q899	Q703	*	Q733	*	Q763	*	Q1263	*
30"-0-100 psi/kPa	*	*	Q791	Q891	Q704	*	Q734	*	Q764	*	Q1264	*
30"-0-150 psi/kPa	*	*	Q792	Q892	Q705	*	Q735	*	Q765	*	Q1265	*
30"-0-200 psi/kPa	*	*	Q794	Q894	Q706	*	Q736	*	Q766	*	Q1266	*
30"-0-300 psi/kPa	*	*	Q795	Q895	Q707	*	Q737	*	Q767	*	Q1267	*
0-15 psi/kPa	*	*	Q800	Q901	Q708	*	Q738	*	Q768	*	Q1268	*
0-30 psi/kPa	Q1102	Q1122	Q802	Q902	Q709	*	Q739	*	Q769	*	Q1269	*
0-60 psi/kPa	Q1103	Q1123	Q803	Q903	Q710	*	Q740	*	Q770	*	Q1270	*
0-100 psi/kPa	Q1104	Q1124	Q804	Q904	Q711	*	Q741	*	Q771	*	Q1271	*
0-160 psi/kPa	Q1105	Q1125	Q805	Q905	Q712	*	Q742	*	Q772	*	Q1272	*
0-200 psi/kPa	Q1106	Q1126	Q806	Q906	Q713	*	Q743	*	Q773	*	Q1273	*
0-300 psi/kPa	Q1107	Q1127	Q807	Q907	Q714	*	Q744	*	Q774	*	Q1274	*
0-400 psi/kPa	*	*	Q817	Q917	Q715	*	Q745	*	Q775	*	Q1275	*
0-600 psi/kPa	Q1108	Q1128	Q808	Q908	Q716	*	Q746	*	Q776	*	Q1276	*
0-1000 psi/kPa	Q1109	Q1129	Q809	Q909	*	Q717	*	Q747	*	Q777	*	Q1277
0-1500 psi/kPa	Q1110	Q1130	Q816	Q914	*	Q718	*	Q748	*	Q778	*	Q1278
0-2000 psi/kPa	Q1111	Q1131	Q810	Q910	*	Q719	*	Q749	*	Q779	*	Q1279
0-3000 psi/kPa	Q1112	Q1132	Q811	Q911	*	Q720	*	Q750	*	Q780	*	Q1280
0-5000 psi/kPa	Q1113	Q1133	Q812	Q912	*	Q721	*	Q751	*	Q781	*	Q1281
0-10000 psi/kPa	*	*	Q813	Q913	*	Q722	*	Q752	*	Q782	*	Q1282
0-15000 psi/kPa	*	*	*	*	*	Q723	*	Q753	*	Q783	*	Q1283
0-20000 psi/kPa	*	*	*	*	*	*	*	*	*	*	*	*

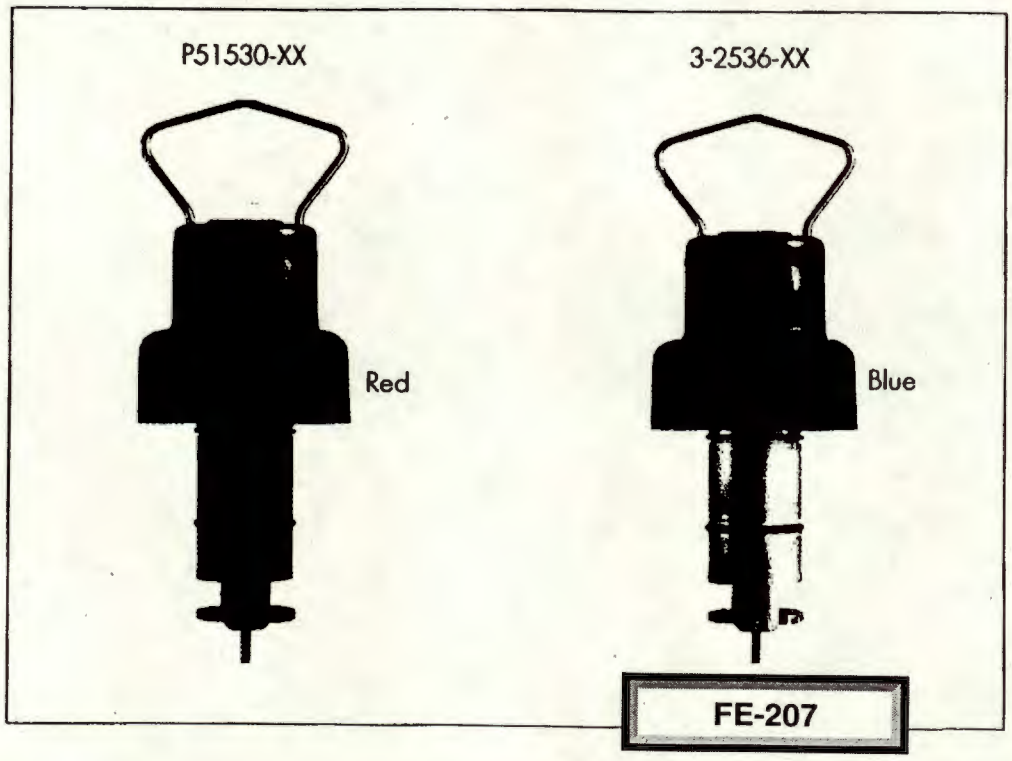
Options:

Dry = supply above gauge less liquid fill
25UC = 2.5" (63mm) U-Clamp
25BF = 2.5" (63mm) Back Flange
25FF = 2.5" (63mm) Front Flange
4UC = 4" (100mm) U-Clamp
4BF = 4" (100mm) Back Flange
4FF = 4" (100mm) Front Flange

Other ranges available upon request.

* Available upon request.

+GF+ SIGNET 515/2536 Rotor-X Flow Sensors



Features

- **PVDF or Polypropylene molded sensor body**
- **Simple Insertion Design**
- **Wide Turndown Ratio of 66:1**
- **For DN15 to DN1000 (0.5 to 36 in.) pipes**
- **Self-powered Flow Rate (P51530-XX)**
- **Process Ready Signal (3-2536-XX)**
- **Extended length for wet-tap installations available**

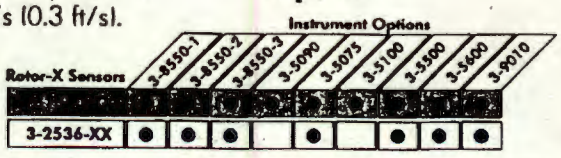
Application

- **Pure Water Production**
- **Filtration systems**
- **Chemical Production**
- **Liquid Delivery Systems**
- **Pump Protection**
- **Scrubbers**

Description

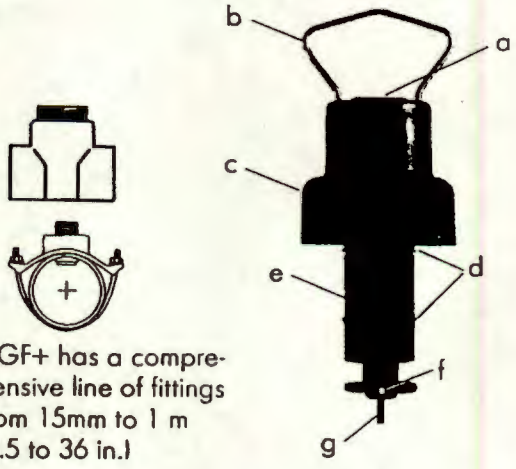
Invented over 25 years ago by +GF+ SIGNET, the Rotor-X paddle-wheel insertion-flow sensor is a proven flow sensor. These highly repeatable, rugged sensors offer exceptional value with little or no maintenance required. Installation is simple with +GF+ SIGNET's comprehensive line of fittings for all pipe materials in sizes from DN15 to DN1000 (0.5 to 36 in.). Output signal of the 515 is a sinusoidal frequency capable of driving a self-powered flowmeter (3-5090). The 3-2536 has a process-ready open-collector signal and can operate to flows as low as 0.1 m/s (0.3 ft/s).

Options



Technical Features

a) 1/2 in. NPT Conduit Connection
b) Large bail simplifies insertion/removal
c) High-strength ring nut with provision for lead seal installation
d) Dual O-ring seal (Viton® standard, EPR optional)
e) Molded one-piece black glass-filled Polypropylene or natural PVDF body
f) Multiple pin materials
g) Open-cell rotor with material options

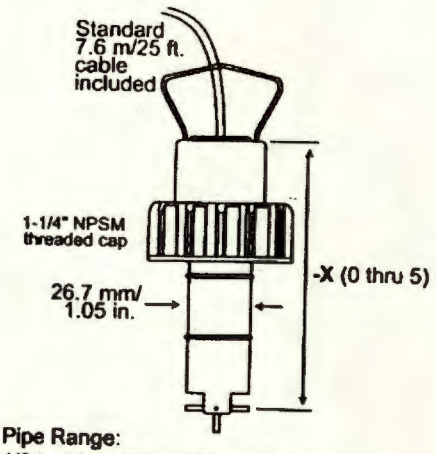


+GF+ has a comprehensive line of fittings from 15mm to 1 m (0.5 to 36 in.)

+GF+ SIGNET's unique "open-cell" rotor design eliminates cavitation at higher flow rates.

Dimensions

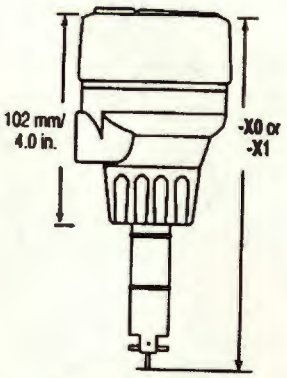
515/2536 Sensor



Pipe Range:

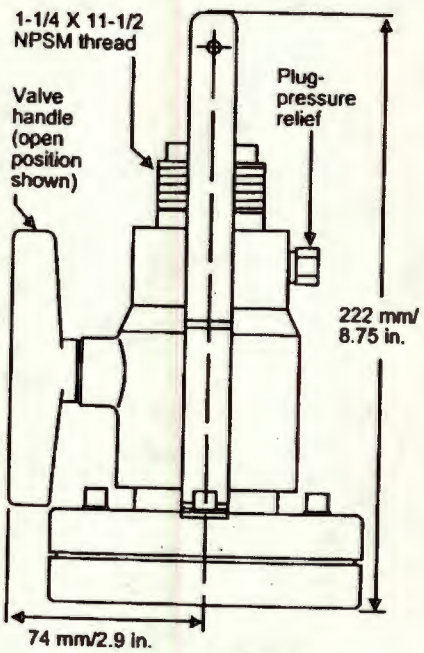
1/2 to 4 in.	-X0 = 104 mm/4.1 in.	
5 to 8 in.	-X1 = 137 mm/5.4 in.	
10" and up	-X2 = 213 mm/8.4 in.	
1/2 to 4 in.	-X3 = 219 mm/8.6 in.	Wet-tap Lengths
5 to 8 in.	-X4 = 254 mm/10 in.	
10" and up	-X5 = 331 mm/13 in.	

8510 / 8512 Integral Sensor with Transmitter (sold separately)



-X0 = 152 mm/6.0 in.
-X1 = 185 mm/7.3 in.

319 Wet Tap Assembly



- Adapts to SIGNET flow fittings
- Extended 515 sensor included (not shown)
- 7 bar/100 psi max. @ 20°C/68°F
- Max. installation/removal pressure: 1.7 bar/25 psi @ 22°C/72°F

Fitting Types

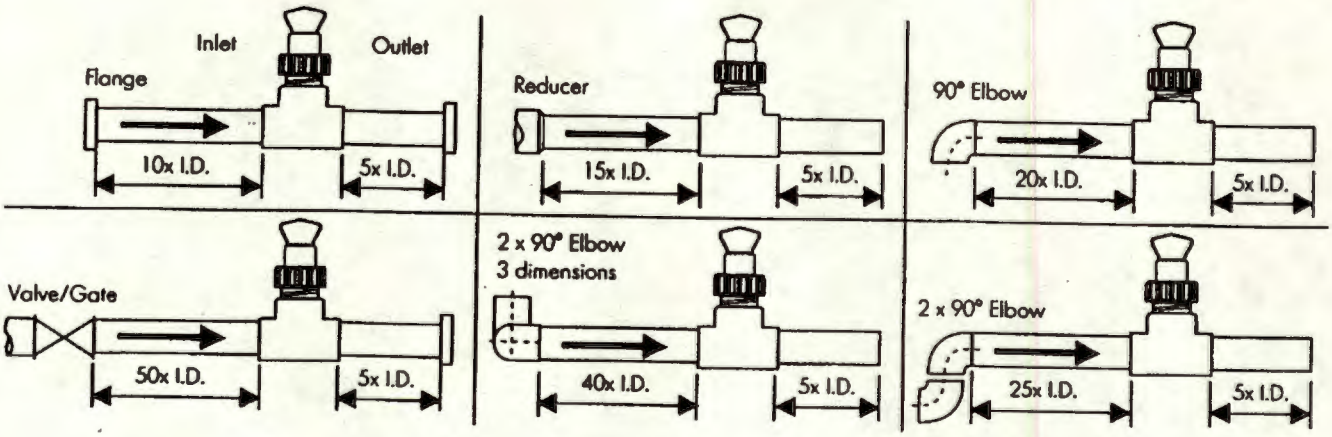
Refer to Fitting Specification Sheets for detailed part numbers

Type	Description
Plastic tees: PV8T CPV8T PV8Txxx F CPV8TxxxF	• 0.5 to 4 in. versions • PVC or CPVC • Mounts via glue-on fittings
Plastic Saddles: PV8S (PVC) CPV8S (CPVC)	• 2 to 4 in., cut 1-7/16 in. hole in pipe • 6 to 8 in., cut 2-1/4 in. hole in pipe • Pipes over 8 in., use iron or fiberglass saddle
Iron strap-on saddles: IR8S	• 2 to 4 in., cut 1-7/16 in. hole in pipe • Over 4 in., cut 2-1/4 in. hole in pipe • Special order over 12 in.
Weldolets: Copper/Bronze (BR4B) Carbon Steel (CS4W) 316SS (CR4W)	• 2 to 4 in., cut 1-7/16 in. hole in pipe • Over 4 in., cut 2-1/4 in. hole in pipe • Remove insert before welding • Installed by certified welder only • Special order over 12 in.

Type	Description
Threaded tees: •Iron (IR4T) •Carbon Steel (CS4T) •316 SS (CR4T)	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Fiberglass tees & saddles: FPT FPS	• 1.5 in. to 8 in. PVDF insert • > 8 in. PVC insert • Special order over 12 in.
Polypropylene (PPMT) PVDF (SFMT)	Metric wafer fitting • For pipes DN 65 to 200 mm • PP or PVDF
Polypropylene (PPMT) PVDF (SFMT)	Metric union fitting • For pipes from DN 15 to 50 mm • PP or PVDF

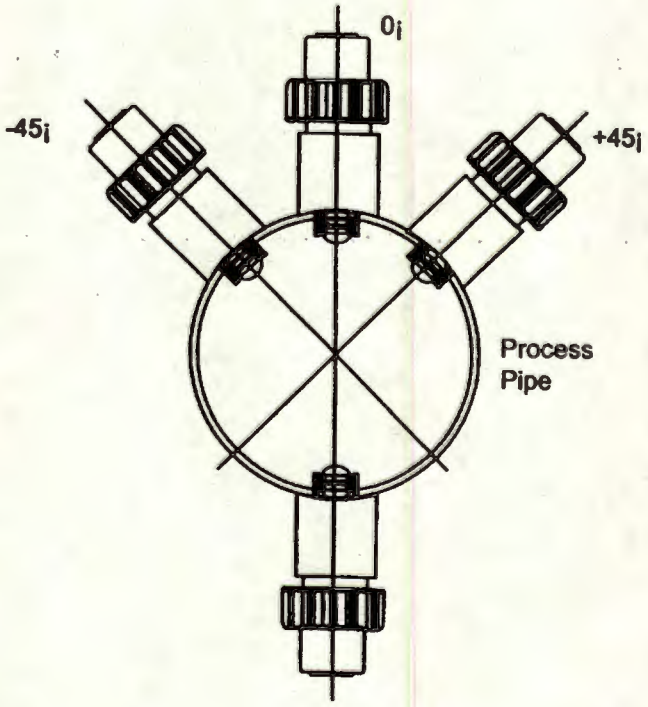
Installation

- Six common installation configurations are shown here as guidelines to help you select the best location in your piping system for a paddlewheel flow sensor.
- Always maximize distance between sensors and pump sources.



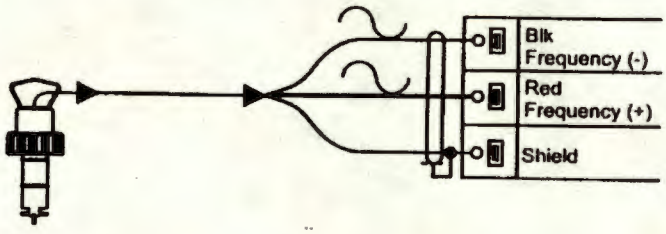
Sensor Mounting Position

- Horizontal pipe runs: Mount sensor in the upright (0°) position for best overall performance. Mount at a maximum of 45° when air bubbles are present. Do not mount on the bottom of the pipe when sediments are present.
- Vertical pipe runs: Sensor must be mounted in lines with UPWARD flow only.

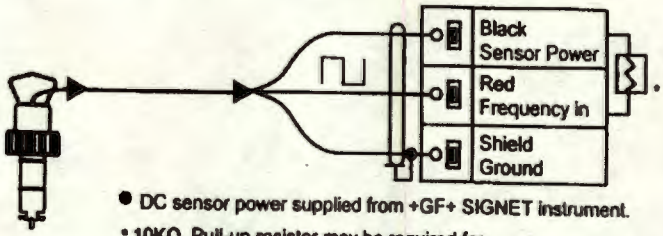


Wiring

515 Sensor Connection to +GF+ SIGNET Instruments



2536 Sensor Connection to +GF+ SIGNET Instruments



- DC sensor power supplied from +GF+ SIGNET instrument.
- 10KΩ Pull-up resistor may be required for non-SIGNET brand instrument

Technical Data

General (for both 515 & 2536)

Pipe Size Range: 15 to 1000 mm (0.5 to 36 in.)
Linearity: ±1% of full range
Repeatability: ±0.5% of full range
Minimum Reynolds Number Required: 4500
Wetted Materials:

Sensor Body:	Glass-filled Polypropylene (black) or PVDF (natural)
O-rings:	FPM-Viton (std) or EPDM or FPM-Kalrez
Pin:	Titanium or Hastelloy-C or PVDF; other materials options available
Rotor:	Black PVDF or Natural PVDF; optional Tefzel with or w/o Fluoralloy B sleeve

Cable Type: 2-conductor twisted pair with shield (22 AWG)
Weight:

-X0	454 grams
-X1	476 grams
-X2	680 grams
-X3	794 grams
-X4	850 grams
-X5	1 kg
P31940	1.2 kg

Standards and Approvals (for both 515 & 2536):

- Manufactured under ISO 9001
- CE

General (515 Only)

Flow Rate Range: 0.3 to 6 m/s (1 to 20 ft./s)
Pipe Size Range: DN15 to DN1000 (0.5 to 36 in.)
Cable Length: 7.6 m (25 ft.)/60 m (200 ft.) maximum
Signal:
Frequency: 19.7 Hz per m/s nominal (6 Hz per ft/s)
Amplitude: 3.3 V p/p per m/s nominal (1 V p/p per ft/s)
Source Impedance: 8 KΩ

Standards and Approvals (515 only):

- FM Class I, II, III/Div./groups A-G

General (2536 Only)

Flow Rate Range: 0.1 to 6 m/s (0.3 to 20 ft./s)
Pipe Size Range: DN15 to DN1000 (0.5 to 36 in.)
Cable Length: 7.6 m (25 ft.)/300 m (1,000 ft.) maximum
Signal:
Frequency: 49Hz per m/s nominal (15 Hz per ft/s nominal)
Supply voltage: 3.5 to 24 VDC regulated
Supply current: <1.5 mA @ 3.3 to 6 VDC
<20 mA @ 6 to 24 VDC
Output Type: Open collector transistor, sinking
Output Current: 10 mA max.

Fluid Conditions

Sensor Pressure / Temperature Ratings:

Glass-filled Polypropylene Body:

12.5 bar (180 psi) max. @ 20°C (68°F)

1.7 bar (25 psi) max. @ 90°C (194°F)

PVDF Body:

14 bar (200 psi) max. @ 20°C (68°F)

1.7 bar (25 psi) max. @ 100°C (212°F)

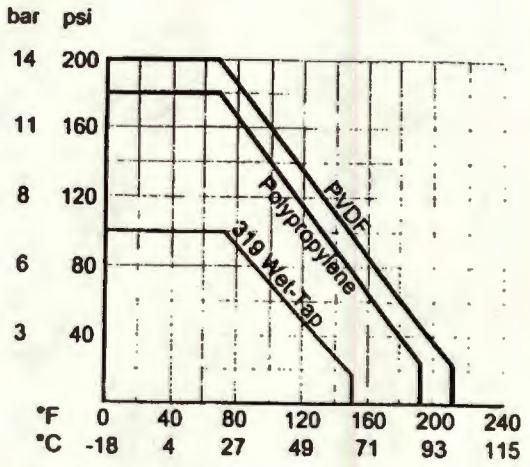
319 Wet-Tap Assembly:

7 bar (100psi) max. @ 20°C (68°F)

1.7 bar (25 psi) max. @ 66°C (150°F)

Note: Wet-tap max. installation/removal pressure:

25 psi @ 22°C (72°F).



Ordering Information

515/8510-XX (Sinusoidal)

Mfr. Part No.	Code	Pipe Sizes	Body	Rotor/Pin	Installation
P51530-H0	198 801 659	0.5 to 4 in.	Polypro	Blk PVDF/Hastelloy-C	Remote
P51530-P0	198 801 620	0.5 to 4 in.	Polypro	Blk PVDF/Titanium	Remote
P51530-P1	198 801 621	5 to 8 in.	Polypro	Blk PVDF/Titanium	Remote
P51530-P2	198 801 622	10 to 36 in.	Polypro	Blk PVDF/Titanium	Remote
P51530-P3	198 840 310	0.5 to 4 in.	Polypro	Blk PVDF/Titanium	Remote Wet-Tap
P51530-P4	198 840 311	5 to 8 in.	Polypro	Blk PVDF/Titanium	Remote Wet-Tap
P51530-P5	198 840 312	10 to 36 in.	Polypro	Blk PVDF/Titanium	Remote Wet-Tap
P51530-S0	198 801 661	0.5 to 4 in.	Polypro	Blk PVDF/Natural PVDF	Remote
P51530-T0	198 801 663	0.5 to 4 in.	Natural PVDF	Natural PVDF	Remote
P51530-T1	198 801 664	5 to 8 in.	Natural PVDF	Natural PVDF	Remote
P51530-V0	198 801 623	0.5 to 4 in.	Natural PVDF	Nat. PVDF/Hastelloy-C	Remote
P51530-V1	198 801 624	5 to 8 in.	Natural PVDF	Nat. PVDF/Hastelloy-C	Remote
P51530-V2	198 801 625	10 to 36 in.	Natural PVDF	Nat. PVDF/Hastelloy-C	Remote
3-8510-P0	198 864 504	0.5 to 4 in.	Polypro	Blk PVDF/Titanium	Integral
3-8510-P1	198 864 505	5 to 8 in.	Polypro	Blk PVDF/Titanium	Integral
3-8510-T0	159 000 622	0.5 to 4 in.	Natural PVDF	Natural PVDF	Integral
3-8510-V0	198 864 506	0.5 to 4 in.	Natural PVDF	Nat. PVDF/Hastelloy-C	Integral
2536/8512-XX (Open-Collector)					
3-2536-P0	198 840 143	0.5 to 4 in.	Polypro	Blk PVDF/Titanium	Remote
3-2536-P1	198 840 144	5 to 8 in.	Polypro	Blk PVDF/Titanium	Remote
3-2536-P2	198 840 145	10 to 36 in.	Polypro	Blk PVDF/Titanium	Remote
3-2536-T0	198 840 149	0.5 to 4 in.	Polypro	Natural PVDF	Remote
3-2536-V0	198 840 146	0.5 to 4 in.	Natural PVDF	Nat. PVDF/Hastelloy-C	Remote
3-2536-V1	198 840 147	5 to 8 in.	Natural PVDF	Nat. PVDF/Hastelloy-C	Remote
3-8512-P0	198 864 513	0.5 to 4 in.	Polypro	Blk PVDF/Titanium	Integral
3-8512-P1	198 864 514	5 to 8 in.	Polypro	Blk PVDF/Titanium	Integral
3-8512-T0	198 864 518	0.5 to 4 in.	Natural PVDF	Natural PVDF	Integral
3-8512-V0	198 864 516	0.5 to 4 in.	Natural PVDF	Nat. PVDF/Hastelloy-C	Integral
Wet-Tap Sensor and Valve Assembly (Fitting Separate)					
MK319/515-P3	198 840 119	0.5 to 4 in.	Polypro	Blk PVDF/Titanium	Remote Wet-Tap
MK319/515-P4	198 840 120	5 to 8 in.	Polypro	Blk PVDF/Titanium	Remote Wet-Tap
MK319/515-P5	198 840 121	10 to 36 in.	Polypro	Blk PVDF/Titanium	Remote Wet-Tap

Accessories

Rotors 515/8510-XX

Mfr. Part. No.	Code	Description
M1538-2	198 801 181	Rotor, PVDF Black
P51547-3	159 000 474	Rotor, PVDF Natural
M1538-4	198 820 018	Rotor, Tefzel
P51550-3	198 820 043	Rotor and Pin, PVDF Natural
3-0515.322-1	198 820 059	Sleeved Rotor, PVDF Black
3-0515.322-2	198 820 060	Sleeved Rotor, PVDF Natural
3-0515.322-3	198 820 017	Sleeved Rotor, Tefzel

Accessories (continued)

Rotors 2536/8512-XX

Mfr. Part No.	Code	Description
3-2536.320-1	198 820 052	Rotor, PVDF Black
3-2536.320-2	159 000 272	Rotor, PVDF Natural
3-2536.320-3	159 000 273	Rotor, Tefzel
3-2536.321	198 820 054	Rotor and Pin, PVDF Natural
3-2536.322-1	198 820 056	Sleeved Rotor, PVDF Black
3-2536.322-2	198 820 057	Sleeved Rotor, PVDF Natural
3-2536.322-3	198 820 058	Sleeved Rotor, Tefzel
Rotor Pins		
M1546-1	198 801 182	Pin, Titanium
M1546-2	198 801 183	Pin, Hastelloy-C
M1546-3	198 820 014	Pin, Tantalum
M1546-4	198 820 015	Pin, Stainless Steel
P51545	198 820 016	Pin, Ceramic
O-Rings		
1220-0021	198 801 186	O-Ring, FPM-Viton
1224-0021	198 820 006	O-Ring, EPDM
1228-0021	198 820 007	O-Ring, FPM-Kalrez
Miscellaneous		
P31536	198 840 201	Sensor Plug, Polypro
P31536-1	198 840 202	Sensor Plug, PVDF Metric
P31536-2	159 000 649	Sensor Plug, PVDF
P31542	198 801 630	Sensor Cap, Red (for use w/515)
P31542-3	159 000 464	Sensor Cap, Blue (for use w/2536)
P31934	159 000 466	Conduit Cap
P51589	159 000 476	Conduit Adapter Kit
5523-0222	159 000 392	Cable, (per foot)
3-8051	159 000 187	Transmitter Integral Adapter

Engineering Specifications for both 515 and 2536 Flow Sensors

- The flow sensor shall use a four-blade, open-cell rotor design using insertion paddlewheel technology.
- Linearity of the output signal with respect to flow rate shall be ± 1 % of full range.
- Measurement repeatability of the output signal with respect to flow rate shall be ±0.5 % of full range.
- The sensor body shall be made of injection-molded polypropylene (PP) that shall accommodate up to 12.5 bar @ 20°C (180 psi @ 68°F) and 1.7 bar @ 90°C (25 psi @ 194°F). As an alternative, the sensor shall be made of injection-molded polyvinylidene fluoride (PVDF) that shall accommodate up to 14 bar @ 20°C (200 psi @ 68°F) and 1.7 bar @ 100°C (25 psi @ 212°F).
- The sensor shall attach to a pipe via a variety of insertion-style installation fittings supplied by the flow sensor manufacturer. Attachment shall use a 1-1/4 X 11-1/2 NPSM threaded cap. Sealing shall be accomplished with a double O-ring seal. O-rings shall be made of FPM-Viton, FPM-Kalrez or EPDM.
- The sensor shall be equipped with 0.5 in. female conduit connection.

Engineering Specifications for +GF+ SIGNET 515 Rotor-X Flow Sensor

- The sensor shall require no electrical power.
- The sensor shall provide an output signal of 3.3 V p-p per m/s nominal (1 V p-p per ft/s) at a frequency of 19.7 Hz per m/s nominal (6 Hz per ft/s) from 0.3 to 6 m/s (1 to 20 ft/s).
- Output shall be via a twisted pair, foil-shielded cable with drain wire. Supplied cable shall be at least 7.6 m (25 ft) long, with a maximum allowable length of 60 m (200 ft).
- The operating range of the sensor shall accommodate nominal flow rates from 0.3 to 6 m/s (1 to 20 ft/s).
- The sensor shall meet appropriate CE standards and FM standards for Classes I, II and III, Division 1/Groups A-G.

Engineering Specifications for +GF+ SIGNET 2536 Low Flow Sensor

- The sensor shall operate with a power input of 3.3 to 6VDC @ <1.5 mA or from 6 to 24 VDC @ <20 mA.
- The sensor output shall provide an open-collector pulse at a frequency of 49.2 Hz per m/s nominal (15 Hz per ft/s).
- Output shall be via a twisted pair, foil-shielded cable with drain wire. Supplied cable shall be at least 7.6 m (25 ft) long, with a maximum allowable length of 300 m (1000 ft).
- The operating range of the sensor shall accommodate nominal flow rates from 0.1 to 6 m/s (0.3 to 20 ft/s).
- The sensor shall meet appropriate CE standards.

+GF+ SIGNET 515/2536 Rotor-X Flow Sensors

ENGLISH

Instructions for all versions of: 515/8510-XX and 2536/8512-XX

3-0515.090

D (2/03) English

WARNING!

SAFETY INSTRUCTIONS

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

1. Specifications

General Data

Flow Rate Range:	515: 0.3 to 6 m/s (1 to 20 ft/s)
	2536: 0.1 to 6 m/s (0.3 to 20 ft/s)
Pipe Size Range:	DN15 to DN1000 (0.5 to 36 in.)
Linearity:	±1% of full range
Repeatability:	±0.5% full range
Cable Length:	7.6 m (25 ft) standard
	515: 60 m (200 ft) maximum
	2536: 305m (1000 ft) maximum
Cable Type:	2-conductor twisted pair w/shield (22 AWG)
Minimum Reynolds Number Required:	4500
Cap Material:	Glass Filled Polypropylene
	515: Red
	2536: Blue

Wetted Materials:

• Sensor Body:	Glass filled Polypropylene (black) or PVDF (natural)
• O-Rings:	FPM-Viton® (Std) or EPDM or FFKM-Kalrez®
• Pin:	Titanium or Hastelloy-C or PVDF; other material options available
• Rotor:	Black PVDF or natural PVDF; optional Tefzel® with or w/o Fluoraloy B® sleeve

Shipping Weight:	-X0	0.454 kg (1 lb)
	-X1	0.476 kg (1.04 lbs)
	-X2	0.680 kg (1.50 lbs)
	-X3	0.794 kg (1.75 lbs)
	-X4	0.850 kg (1.87 lbs)
	-X5	1.0 kg (2.20 lbs)
	3519	1.3 kg (2.86 lbs)

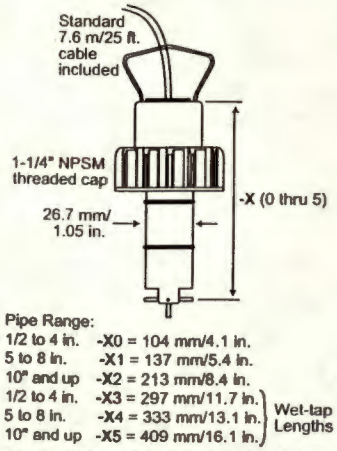
515 Sensor

Signal:

Frequency:	19.7 Hz per m/s nominal (6 Hz per ft/s)
Amplitude:	3.3 V p/p per m/s nominal (1 V p/p per ft/s)
Source Impedance:	8 kΩ

Dimensions

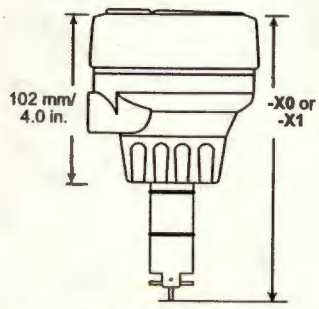
515/2536 Sensor



Pipe Range:

1/2 to 4 in.	-X0 = 104 mm/4.1 in.	Wet-tap Lengths
5 to 8 in.	-X1 = 137 mm/5.4 in.	
10" and up	-X2 = 213 mm/8.4 in.	
1/2 to 4 in.	-X3 = 297 mm/11.7 in.	
5 to 8 in.	-X4 = 333 mm/13.1 in.	
10" and up	-X5 = 409 mm/16.1 in.	

8510-XX/8512-XX Integral Sensor shown with Transmitter and Integral Adapter Kit (sold separately)



-X0 = 152 mm/6.0 in.
-X1 = 185 mm/7.3 in.

2536 Sensor

Signal:

Frequency:	49 Hz per m/s nominal (15 Hz per ft/s nominal)
Supply voltage:	3.5 to 24 VDC regulated
Supply current:	<1.5 mA @ 3.3 to 6 VDC
	<20 mA @ 6 to 24 VDC
Output Type:	Open collector transistor, sinking
Output current:	10 mA max.

Fluid Conditions

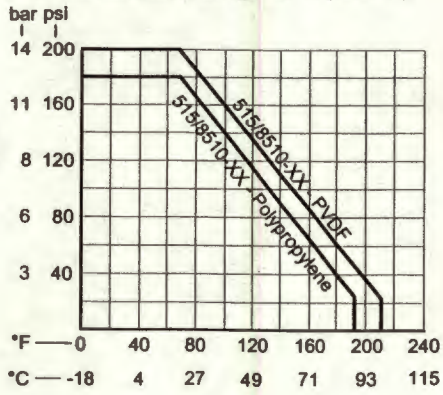
Rotor-X Sensor Pressure/Temperature Ratings:

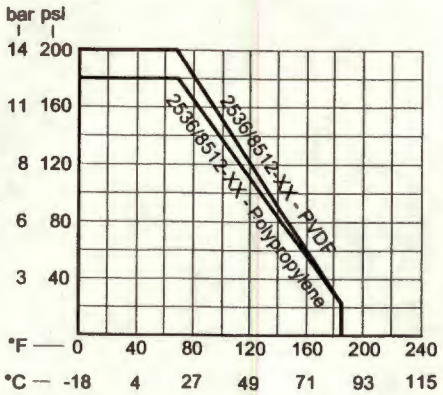
Polypropylene Body:

- 12.5 bar (180 psi) max. @ 20 °C (68 °F)
- 515: 1.7 bar (25 psi) max. @ 90 °C (194 °F)
- 2536: 1.7 bar (25 psi) max. @ 85 °C (185 °F)

PVDF Body:

- 14 bar (200 psi) max @ 20 °C (68 °F)
- 515: 1.7 bar (25 psi) max @ 100 °C (212 °F)
- 2536: 1.7 bar (25 psi) max @ 85 °C (185 °F)



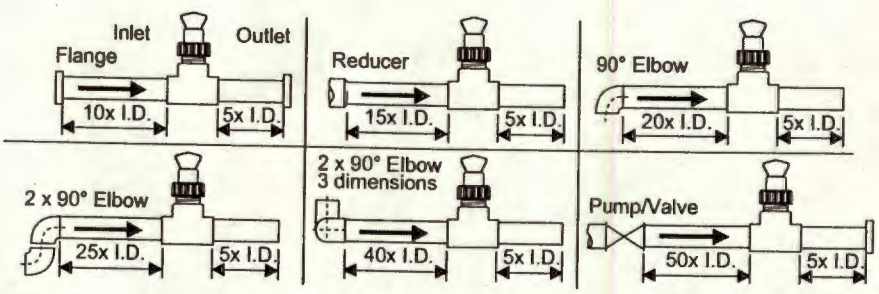


Standards & Approvals

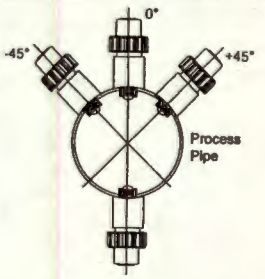
- Manufactured under ISO 9001 and ISO 14001
- CE
- 515 Only: FM Class I, II, III/Div. I/Groups A-G

2. Location of Fitting

Recommended sensor upstream/downstream mounting requirements



3. Sensor Mounting Position



- Horizontal pipe runs: Mount sensor in the upright (0°) position for best performance. Mount at a maximum of 45° when air bubbles are present (pipe must be full). Do not mount on the bottom of the pipe when sediments are present.
- Vertical pipe runs: Mount sensor in any orientation. Upward flow is preferred to ensure full pipe.

4. Standard Sensor Installation

1. Lubricate the sensor O-rings with a silicone lubricant (e.g. GE silicone compound #G632 or equivalent). Do not use any petroleum based lubricant that will attack the O-rings.

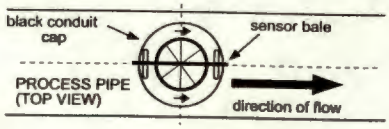


Figure A

2. Using an alternating/twisting motion, lower the sensor into the fitting, making sure the installation arrows on the black cap are pointing in the direction of flow, see Figure A.
3. Engage one thread of the sensor cap then turn the sensor until the alignment tab is seated in the fitting notch. Hand tighten the sensor cap. DO NOT use any tools on the sensor cap or the cap threads and/or fitting flange threads will be damaged, see Figure B.

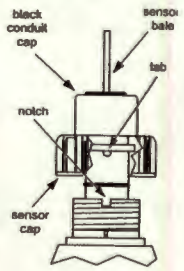


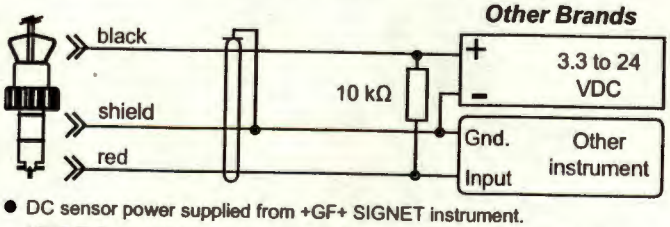
Figure B

5. Sensor Wiring

Technical Notes

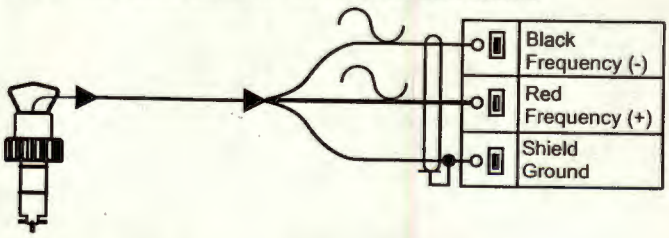
- Use 2-conductor shielded cable for cable extensions.
- Cable shield must be maintained through cable splice.
- Refer to your instrument manual for specific wiring details.

2536 Sensor Connections to Other Brand Instruments

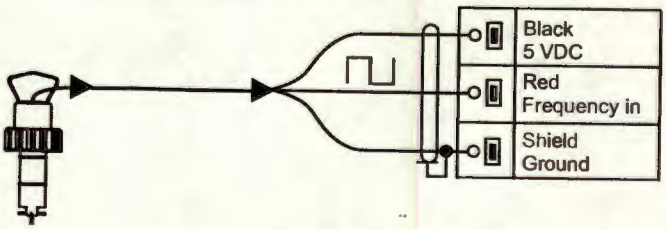


- DC sensor power supplied from +GF+ SIGNET instrument. 10KΩ Pull-up resistor may be required for non +GF+ SIGNET brand instrument.

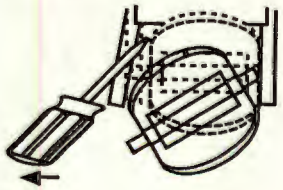
515 Sensor Connections to +GF+ SIGNET Instruments



2536 Sensor Connections to +GF+ SIGNET Instruments



6. Rotor Replacement Procedure



1. To remove the rotor, insert a small screwdriver between the rotor and the ear of the sensor.
2. Twist the screwdriver blade to flex the ear outward enough to remove one end of the rotor and pin. DO NOT flex the ear any more than necessary! If it breaks, the sensor cannot be repaired.
3. Install the new rotor by inserting one tip of the pin into the hole, then flex the opposite ear back enough to slip rotor into place.

7. K-Factors

A **K-Factor** is the number of pulses a sensor will generate for each engineering unit of fluid which passes the sensor. K-factors for water are listed below in U.S. gallons and liters. For example, in a 1-inch PVC pipe, the 515 paddlewheel generates 174.67 pulses per gallon of water passing the rotor. K-factors are listed for pipes up to 12 inches. For pipes over 12 inches, consult your +GF+ SIGNET distributor.

PIPE SIZE (IN.)	FITTING TYPE	515/8510-XX		2536/8512-XX	
		U.S. GAL	LITERS	U.S. GAL	LITERS
SCH 80 PVC TEES FOR SCH 80 PVC PIPE					
1/2	PV8T005	480.19	126.87	991.71	262.01
3/4	PV8T007	257.72	68.090	545.14	144.03
1	PV8T010	174.67	46.148	352.44	93.114
1-1/4	PV8T012	83.390	22.032	177.18	46.812
1-1/2	PV8T015	58.580	15.477	117.85	31.137
2	PV8T020	32.480	8.5812	66.739	17.633
2-1/2	PV8T025	21.833	5.7683	42.994	11.359
3	PV8T030	13.541	3.5775	26.652	7.0414
4	PV8T040	7.6258	2.0147	15.006	3.9645
SCH 80 CPVC TEES FOR SCH 80 CPVC PIPE					
1/2	CPV8T005	480.19	126.87	991.71	262.01
3/4	CPV8T007	257.72	68.090	545.14	144.03
1	CPV8T010	174.67	46.148	352.44	93.114
1-1/4	CPV8T012	83.390	22.032	177.18	46.812
1-1/2	CPV8T015	58.580	15.477	117.85	31.137
SCH 80 PVC SADDLES FOR SCH 80 PVC PIPE					
2	PV8S020	32.480	8.5812	66.739	17.633
2-1/2	PV8S025	21.833	5.7683	42.994	11.359
3	PV8S030	13.541	3.5775	26.652	7.0414
4	PV8S040	7.6258	2.0147	15.006	3.9645
6	PV8S060	4.1623	1.0997	8.3246	2.1994
8	PV8S080	2.3705	0.6263	5.0164	1.3253
10	PV8S100	1.5300	0.4042	3.0600	0.808
12	PV8S120	1.0600	0.2801	2.1600	0.571
SCH 80 PVC SADDLE ON SCH 40 PVC PIPE					
2	PV8S020	27.350	7.2259	54.700	14.452
2-1/2	PV8S025	18.874	4.9866	37.159	9.8175
3	PV8S030	12.638	3.3389	23.697	6.2608
4	PV8S040	6.7282	1.7776	13.456	3.5552
6	PV8S060	3.7297	0.9854	7.4594	1.9708
8	PV8S080	2.1527	0.5688	4.5292	1.1966
10	PV8S100	1.3500	0.3567	2.8000	0.740
12	PV8S120	0.9600	0.2536	1.9800	0.523
PP CLAMP-ON SADDLE ON SCH 80 PP PIPE					
10	PPS100	1.5300	0.4042	3.0600	0.808
12	PPS120	1.0600	0.2801	2.1600	0.571
PP CLAMP-ON SADDLE ON SCH 40 PP PIPE					
10	PPS100	1.3500	0.3567	2.8000	0.740
12	PPS120	0.9600	0.2536	1.9800	0.523

PIPE SIZE (IN.)	FITTING TYPE	515/8510-XX		2536/8512-XX	
		U.S. GAL	LITERS	U.S. GAL	LITERS
CARBON STEEL TEES ON SCH 40 PIPE					
1/2	CS4T005	370.20	97.808	756.00	199.74
3/4	CS4T007	212.06	56.027	438.69	115.90
1	CS4T010	141.14	37.289	286.78	75.768
1-1/4	CS4T012	60.655	16.025	121.22	32.026
1-1/2	CS4T015	45.350	11.982	91.139	24.079
2	CS4T020	26.767	7.0717	54.468	14.391
STAINLESS STEEL TEES ON SCH 40 PIPE					
1/2	CR4T005	358.96	94.838	734.20	193.98
3/4	CR4T007	202.61	53.530	412.10	108.88
1	CR4T010	127.14	33.590	252.70	66.764
1-1/4	CR4T012	61.910	16.357	128.12	33.849
1-1/2	CR4T015	40.410	10.676	77.320	20.428
2	CR4T020	22.300	5.8917	45.780	12.095
GALVANIZED IRON TEES ON SCH 40 PIPE					
1	IR4T010	104.54	27.619	213.01	56.277
1-1/4	IR4T012	62.979	16.639	127.75	33.751
1 1/2	IR4T015	46.688	12.335	94.401	24.941
2	IR4T020	29.459	7.7832	59.420	15.699
BRONZE TEES ON SCH 40 PIPE					
1	BR4T010	104.54	27.619	213.01	56.277
1-1/4	BR4T012	62.979	16.639	127.75	33.751
1-1/2	BR4T015	46.688	12.335	94.401	24.941
2	BR4T020	29.459	7.7832	59.420	15.699
COPPER TEE FITTINGS ON COPPER PIPE SCH K					
1/2	CUKT005	443.21	117.10	917.84	242.50
3/4	CUKT007	212.16	56.052	428.27	113.15
1	CUKT010	127.18	33.600	256.43	67.749
1-1/4	CUKT012	88.218	23.307	176.44	46.615
1-1/2	CUKT015	56.962	15.049	115.69	30.565
2	CUKT020	29.370	7.7595	63.385	16.746
COPPER TEE FITTINGS ON COPPER PIPE SCH L					
1/2	CUKT005	414.41	109.49	858.22	226.74
3/4	CUKT007	191.09	50.485	385.74	101.91
1	CUKT010	119.84	31.662	241.64	63.841
1-1/4	CUKT012	85.451	22.576	170.90	45.152
1-1/2	CUKT015	55.160	14.573	112.03	29.598
2	CUKT020	28.605	7.5575	61.74	16.310

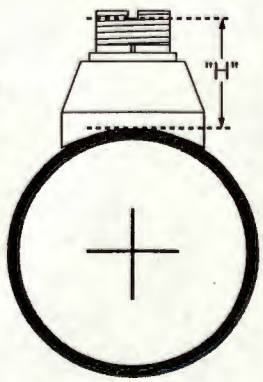
PIPE SIZE (IN.)	FITTING TYPE	515/8510-XX		2536/8512-XX	
		U.S. GAL	LITERS	U.S. GAL	LITERS
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE					
2-1/2	CR4W025	18.800	4.9670	37.600	9.9339
3	CR4W030	12.170	3.2153	24.340	6.4306
4	CR4W040	6.9600	1.8388	13.920	3.6777
5	CR4W050	5.2600	1.3897	10.860	2.8692
6	CR4W060	3.6900	0.9749	7.5200	1.9868
8	CR4W080	2.1300	0.5627	4.3400	1.1466
10	CR4W100	1.3500	0.3567	2.7600	0.7292
12	CR4W120	0.9600	0.2536	1.9400	0.5125
CARBON STEEL WELDOLETS ON SCH 40 PIPE					
2-1/2	CS4W025	18.800	4.9670	37.600	9.9339
3	CS4W030	12.170	3.2153	24.340	6.4306
4	CS4W040	6.9600	1.8388	13.920	3.6777
5	CS4W050	5.2600	1.3897	10.860	2.8692
6	CS4W060	3.6900	0.9749	7.5200	1.9868
8	CS4W080	2.1300	0.5627	4.3400	1.1466
10	CS4W100	1.3500	0.3567	2.7600	0.7292
12	CS4W120	0.9600	0.2536	1.9400	0.5125
COPPER/BRONZE BRAZOLETS ON SCH 40 PIPE					
2-1/2	BR4B025	18.800	4.9670	37.600	9.934
3	BR4B030	12.170	3.2153	24.340	6.431
4	BR4B040	6.9600	1.8388	13.920	3.678
5	BR4B050	5.2600	1.3897	10.860	2.869
6	BR4B060	3.6900	0.9749	7.5200	1.987
8	BR4B080	2.1300	0.5627	4.3400	1.147
10	BR4B100	1.3500	0.3567	2.7600	0.729
12	BR4B120	0.9600	0.2536	1.9400	0.513
SCH 80 IRON SADDLES ON SCH 80 PIPE					
2	IR8S020	32.360	8.5495	64.720	17.099
2-1/2	IR8S025	22.220	5.8705	42.480	11.223
3	IR8S030	13.420	3.5456	26.420	6.980
4	IR8S040	7.6600	2.0238	14.700	3.884
5	IR8S050	5.8600	1.5482	12.180	3.218
6	IR8S060	4.0900	1.0806	8.4400	2.230
8	IR8S080	2.3300	0.6156	4.9000	1.295
10	IR8S100	1.5300	0.4042	3.0600	0.808
12	IR8S120	1.0600	0.2801	2.1600	0.571
SCH 80 IRON SADDLE ON SCH 40 PIPE					
2	IR8S020	26.820	7.0859	53.640	14.172
2-1/2	IR8S025	18.800	4.9670	37.600	9.934
3	IR8S030	11.990	3.1678	23.220	6.135
4	IR8S040	6.8500	1.8098	13.260	3.503
5	IR8S050	5.3300	1.4082	11.040	2.917
6	IR8S060	3.7600	0.9934	7.2400	1.913
8	IR8S080	2.1300	0.5627	4.4000	1.162
10	IR8S100	1.3500	0.3567	2.8000	0.740
12	IR8S120	0.9600	0.2536	1.9800	0.523

K-Factors DIN Pipes

PIPE SIZE	FITTING TYPE	515/8510-XX		2536/8512-XX		CODE
		U.S. GAL	LITERS	U.S. GAL	LITERS	
POLYPROPYLENE FITTINGS (DIN/ISO AND BS AND ANSI)						
DN 15	PPMT005	481.55	127.23	952.87	251.75	198.150.522
DN 20	PPMT007	277.09	73.207	563.10	148.77	198.150.523
DN 25	PPMT010	141.18	37.300	291.60	77.042	198.150.524
DN 32	PPMT012	83.540	22.071	169.22	44.709	198.150.525
DN 40	PPMT015	51.265	13.544	103.90	27.450	198.150.526
DN 50	PPMT020	29.596	7.8193	60.789	16.060	198.150.527
DN 65	PPMT025	20.658	5.4579	41.498	10.964	198.150.560
DN 80	PPMT030	13.330	3.5218	26.786	7.0769	198.150.561
DN 100	PPMT040	8.7077	2.3006	17.415	4.6011	198.150.562
DN 125	PPMT050	5.0667	1.3386	10.168	2.6864	198.150.563
DN 150	PPMT060	3.6892	0.9747	7.3119	1.9318	198.150.564
DN 200	PPMT080	2.0398	0.5389	3.9946	1.0554	198.150.565
PVDF FITTINGS (DIN/ISO AND BS AND ANSI)						
DN 15	SFMT005	420.87	111.19	827.26	218.56	198.150.529
DN 20	SFMT007	228.15	60.277	489.87	129.42	198.150.530
DN 25	SFMT010	136.70	36.116	283.55	74.915	198.150.531
DN 32	SFMT012	79.294	20.950	158.59	41.899	198.150.532
DN 40	SFMT015	43.490	11.490	86.980	22.980	198.150.533
DN 50	SFMT020	25.908	6.8450	50.385	13.312	198.150.534
DN 65	SFMT025	18.067	4.7732	36.133	9.5465	198.150.571
DN 80	SFMT030	12.357	3.2648	24.715	6.5297	198.150.572
DN 100	SFMT040	8.0599	2.1294	16.120	4.2589	198.150.573
DN 125	SFMT050	4.4312	1.1707	8.8624	2.3415	198.150.574
DN 150	SFMT060	3.2271	0.8526	6.4543	1.7052	198.150.575
DN 200	SFMT080	2.0360	0.5379	4.0720	1.0758	198.150.576
PVC FITTINGS (DIN/ISO) - EUROPE ONLY						
DN 15	PVMT005	486.18	128.45	972.37	256.90	198.150.480
DN 20	PVMT007	242.85	64.160	485.69	128.32	198.150.481
DN 25	PVMT010	148.64	39.270	297.274	78.540	198.150.482
DN 32	PVMT012	85.125	22.490	170.249	44.980	198.150.483
DN 40	PVMT015	51.855	13.700	103.709	27.400	198.150.484
DN 50	PVMT020	29.750	7.8600	59.500	15.720	198.150.485
DN 65	PVMT025	17.487	4.6200	34.9734	9.2400	198.150.538
DN 80	PVMT030	12.491	3.3000	24.9810	6.6000	198.150.539
DN 100	PVMT040	8.1377	2.1500	16.2754	4.3000	198.150.540
DN 150	PVMT060	4.0878	1.0800	8.1756	2.1600	198.150.543
DN 200	PVMT080	2.0439	0.5400	4.0878	1.0800	198.150.545

8. H-Dimensions

The plastic sensor insert in the Weldolet fitting MUST be removed during the welding process. When reinstalled, it is important that the insert be threaded to the proper height ("H" dimension).



Weldolet part number	"H" dimension inches	mm
CS4W020	2.38	60.45
CS4W025	2.33	59.18
CS4W030	2.32	58.92
CS4W040	2.30	58.42
CS4W050	3.09	78.48
CS4W060	2.96	75.18
CS4W080	2.73	69.34
CS4W100	5.48	139.19
CS4W120	5.25	133.35
CS4W140	5.10	129.54
CS4W160	4.85	123.19
CS4W180	4.60	116.84
CS4W200	4.38	111.25

Weldolet part number	"H" dimension inches	mm
CS4W240	4.16	105.66
CS4W360	4.10	104.14
CR4W020	2.38	60.45
CR4W025	2.33	59.18
CR4W030	2.32	58.92
CR4W040	2.30	58.42
CR4W050	3.09	78.48
CR4W060	2.96	75.18
CR4W080	2.73	69.34
CR4W100	5.48	139.19
CR4W120	5.25	133.35

9. +GF+ SIGNET Fittings

Type	Description
Plastic tees 	• 0.5 to 4 inch versions • PVC or CPVC
PVC Glue-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/2 inch hole in pipe • Weld in place using solvent cement
PVC Saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • 6 to 8 inch, cut 2-1/4 inch hole in pipe
PP Clamp-on Saddles 	• Available in 10 and 12 inch sizes only • Cut 2-1/4 inch hole in pipe
Iron Strap-on saddles 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/4 inch hole in pipe • Special order 12 in. to 36 in.

Type	Description
Iron, Carbon Steel, 316 SS Threaded tees 	• 0.5 to 2 in. versions • Mounts on threaded pipe ends
Carbon steel & stainless steel Weld-on Weldolets 	• 2 to 4 inch, cut 1-7/16 inch hole in pipe • Over 4 inch, cut 2-1/4 inch hole in pipe
Fiberglass tees & saddles:  FPT FPS	• 1.5 in. to 8 in. PVDF insert • > 8 in. PVC insert • Special order 12 in. to 36 in.
Metric Wafer Fitting 	• For pipes DN 65 to 200 mm • PP or PVDF
Metric Union Fitting 	• For pipes from DN 15 to 50 mm • PP or PVDF

515/8510-XX Ordering Information		2536/8512-XX Ordering Information		Product Description
Part No.	**Code**	**Part No.**	**Code**	
P51530-P0	198 801 620	3-2536-P0	198 840 143	Sensor, Polypropylene, Titanium Rotor Pin, PVDF Rotor (black), ½ to 4 Inch Pipe
P51530-P1	198 801 621	3-2536-P1	198 840 144	Sensor, Polypropylene, Titanium Rotor Pin, PVDF Rotor (black) 5 to 8 Inch Pipe
P51530-P2	198 801 622	3-2536-P2	198 840 145	Sensor, Polypropylene, Titanium Rotor Pin, PVDF Rotor (black) 10 to 36 Inch Pipe
P51530-P3	198 840 310	3-2536-P3	159 000 758	Sensor, Wet-Tap, Polypropylene, Titanium Rotor Pin, PVDF Rotor (black), ½ to 4 Inch Pipe
P51530-P4	198 840 311	3-2536-P4	159 000 759	Sensor, Wet-Tap, Polypropylene, Titanium Rotor Pin, PVDF Rotor (black) 5 to 8 Inch Pipe
P51530-P5	198 840 312	3-2536-P5	159 000 760	Sensor, Wet-Tap, Polypropylene, Titanium Rotor Pin, PVDF Rotor (black) 10 to 36 Inch Pipe
P51530-V0	198 801 623	3-2536-V0	198 840 146	Sensor, PVDF (natural), Hastelloy Rotor Pin, PVDF Rotor (natural), ½ to 4 Inch Pipe
P51530-V1	198 801 624	3-2536-V1	198 840 147	Sensor, PVDF (natural), Hastelloy Rotor Pin, PVDF Rotor (natural), 5 to 8 Inch Pipe
P51530-V2	198 801 625	N/A	N/A	Sensor, PVDF (natural), Hastelloy Rotor Pin, PVDF Rotor (natural), 10 to 36 Inch Pipe
P51530-T0	198 801 663	3-2536-T0	198 840 149	Sensor, PVDF (natural), PVDF (nat.) Rotor Pin, PVDF Rotor (nat.), ½ to 4 Inch Pipe
P51530-T1	198 801 664	N/A	N/A	Sensor, PVDF (natural), PVDF (nat.) Rotor Pin, PVDF Rotor (nat.), 5 to 8 Inch Pipe
8510-P0	198 864 504	3-8512-P0	198 864 513	Sensor, Integral, PP, Titanium Rotor Pin, PVDF Rotor (black), ½ to 4 Inch Pipe
3-8510-P1	198 864 505	3-8512-P1	198 864 514	Sensor, Integral, PP, Titanium Rotor Pin, PVDF Rotor (black) 5 to 8 Inch Pipe
3-8510-T0	159 000 622	3-8512-T0	198 864 518	Sensor, Integral, PVDF (nat.), Hastelloy Rotor Pin, PVDF Rotor (nat.), ½ to 4 In. Pipe
3-8510-V0	198 864 506	3-8512-V0	198 864 516	Sensor, Integral, PVDF (nat.), PVDF (nat.) Rotor Pin, PVDF Rotor (nat.), ½ to 4 In. Pipe
3519/515-P3	159 000 819	3519/2536-P3	159 000 822	Sensor & Wet-Tap Assy., PP, Titanium Rotor Pin, PVDF Rotor (black), ½ to 4 In. Pipe
3519/515-P4	159 000 820	3519/2536-P4	159 000 823	Sensor & Wet-Tap Assy., PP, Titanium Rotor Pin, PVDF Rotor (black), 5 to 8 In. Pipe
3519/515-P5	159 000 821	3519/2536-P5	159 000 824	Sensor & Wet-Tap Assy., PP, Titanium Rotor Pin, PVDF Rotor (black), 10 to 36 In. Pipe
Accessories				
M1538-2	198 801 181	3-2536.320-1	198 820 052	Rotor, PVDF Black
P51547-3	159 000 474	3-2536.320-2	159 000 272	Rotor, PVDF Natural
M1538-4	198 820 018	3-2536.320-3	159 000 273	Rotor, Tefzel®
P51550-3	198 820 043	3-2536.321	198 820 054	Rotor and Pin, PVDF Natural
3-0515.322-1	198 820 059	3-2536.322-1	198 820 056	Sleeved Rotor, PVDF Black
3-0515.322-2	198 820 060	3-2536.322-2	198 820 057	Sleeved Rotor, PVDF Natural
3-0515.322-3	198 820 017	3-2536.322-3	198 820 058	Sleeved Rotor, Tefzel®
M1546-1	198 801 182	M1546-1	198 801 182	Rotor Pin, Titanium
M1546-2	198 801 183	M1546-2	198 801 183	Rotor Pin, Hastelloy-C
M1546-3	198 820 014	M1546-3	198 820 014	Rotor Pin, Tantalum
M1546-4	198 820 015	M1546-4	198 820 015	Rotor Pin, Stainless Steel
P51545	198 820 016	P51545	198 820 016	Rotor Pin, Ceramic
1220-0021	198 801 186	1220-0021	198 801 186	O-Ring, FPM-Viton®
1224-0021	198 820 006	1224-0021	198 820 006	O-Ring, EPDM
1228-0021	198 820 007	1228-0021	198 820 007	O-Ring, FFKM-Kalrez®
P31536	198 840 201	P31536	198 840 201	Sensor Plug, Polypro
P31536-1	198 840 202	P31536-1	198 840 202	Sensor Plug, PVDF Metric
P31536-2	159 000 649	P31536-2	159 000 649	Sensor Plug, PVDF
P31542	198 801 630	P31542	198 801 630	Sensor Cap, Red (for use w/515)
---	---	P31542-3	159 000 464	Sensor Cap, Blue (for use w/2536)
P31934	159 000 466	P31934	159 000 466	Conduit Cap
P51589	159 000 476	P51589	159 000 476	Conduit Adapter Kit
5523-0222	159 000 392	5523-0222	159 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG

+GF+ SIGNET

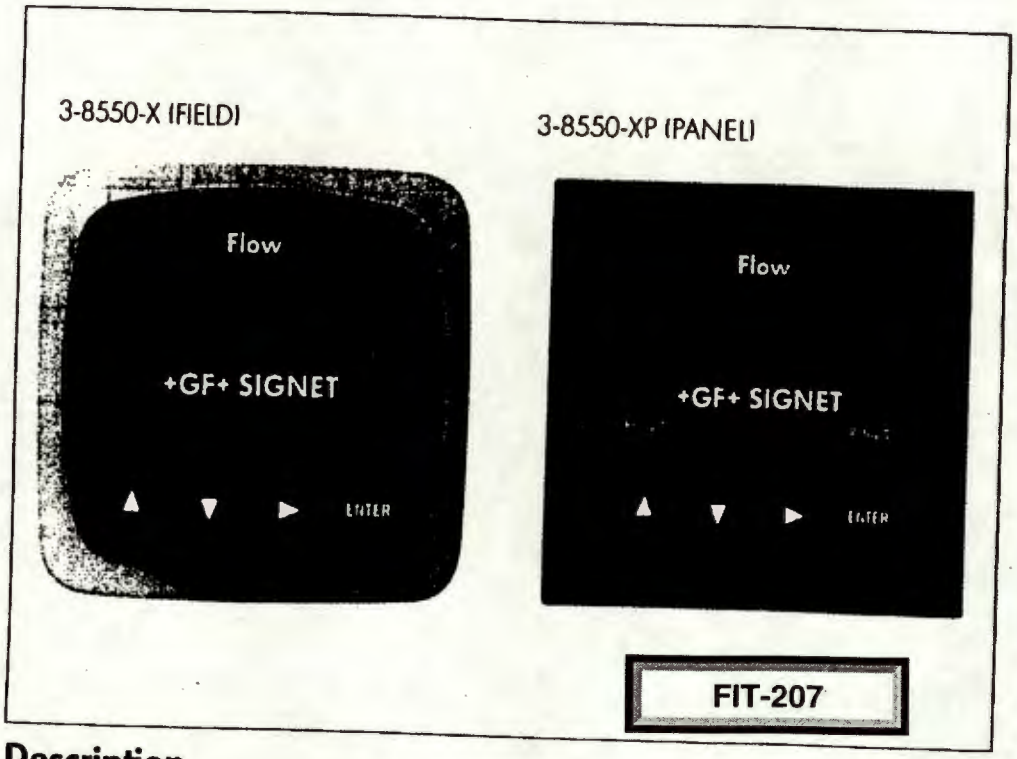
Signet Scientific Company, 3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090

GEORGE FISCHER +GF+ Piping Systems

3-0515.090 (D-2/03) English

Printed in U.S.A. on recycled paper

+GF+ SIGNET 8550 ProcessPro™ Flow Transmitter



Features

- **Permanent & resettable totalizers**
- **Scaleable outputs**
- **Relay options**
- **Mounting versatility**
- **Simulate function**
- **2 x 16 character dot matrix LCD**
- **Chemical resistant enclosure and self-healing window**
- **Large pushbuttons**
- **Clearly marked terminal labels**

Application

- **Flow control and monitoring**
- **Filtration or softener regeneration**
- **Effluent totalization**
- **Pump protection**
- **Feed pump pulsing**
- **Ratio control**
- **Water distribution**
- **Leak detection**

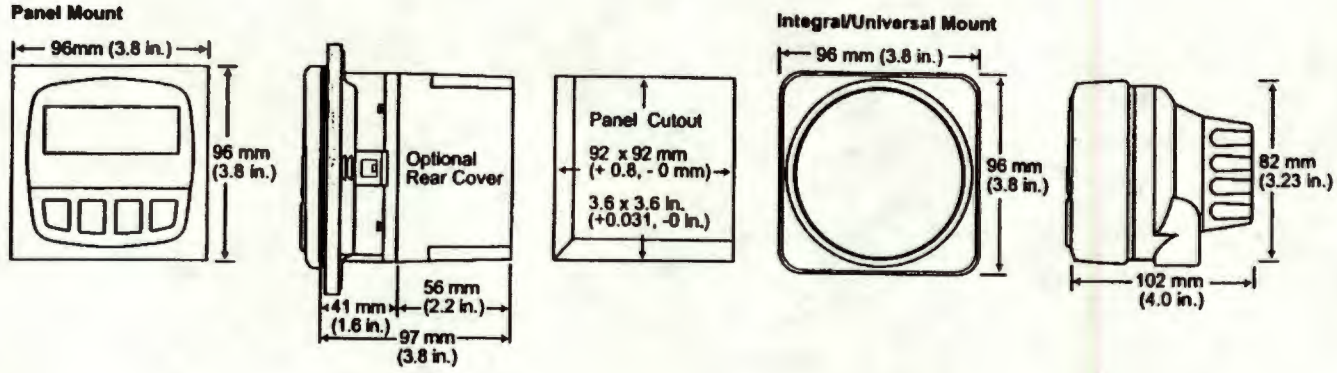
Description

The +GF+ SIGNET 8550 Flow Transmitter is an advanced solution that converts the signal from all +GF+ SIGNET flow sensors into a 4 to 20 mA signal for long distance transmission, and offers the unique feature of dual input and output capability. Configuration flexibility is maximized with two optional relays for process control, two packaging options for integral/pipe mount or panel installation, and scalability for virtually any flow range or engineering unit. State-of-the-art electronic design ensures long-term reliability, signal stability, and simple user setup and operation.

Technical Features

Mounting Version	Part No.	Wire Power	Sensor Input	4 to 20 mA Output	Open Collector/ Relay
Field 	3-8550-1	2/4 non-powered and powered sensors	1	1	1 O.C. Hi, Lo, Pulse Freq or Off
	3-8550-2	4 non-powered and powered sensors	1	1	2 Relays Hi, Lo, Pulse or Off
	3-8550-3	2/4 non-powered and powered sensors	2	2 Sensor 1, Sensor 2 or delta Flow	2 O.C.'s Hi, Lo, Pulse Freq or Off
Panel 	3-8550-1P	2/4 non-powered and powered sensors	1	1	1 O.C. Hi, Lo, Pulse Freq or Off
	3-8550-2P	4 non-powered and powered sensors	1	1	2 Relays Hi, Lo, Pulse or Off
	3-8550-3P	2/4 non-powered and powered sensors	2	2 Sensor 1, Sensor 2 or delta Flow	2 O.C.'s Hi, Lo, Pulse Freq or Off

Dimensions



Installation

The transmitter is available in a panel mount or a field version. The field version is mounted to the sensor using the integral mount kit (3-8051) or you may select the universal mount kit (3-8050) to mount the transmitter on a surface near the sensor.

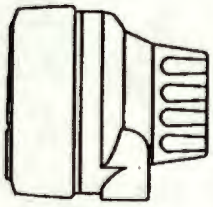
1. Panel Mount

3-8550-XP

All panel mount transmitters (3-8550-XP) include a mounting bracket and gasket for a NEMA 4X watertight panel installation. Panel mount transmitters fit into a standard 1/4 DIN panel cutout.

2. Integral Mount

3-8051 Kit

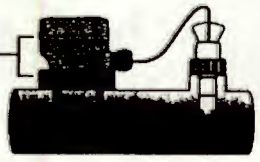


The Integral Mount Kit (3-8051) can be ordered separately and includes a conduit base, locking ring, and integral adapter for mounting the transmitter and sensor directly in a pipe.

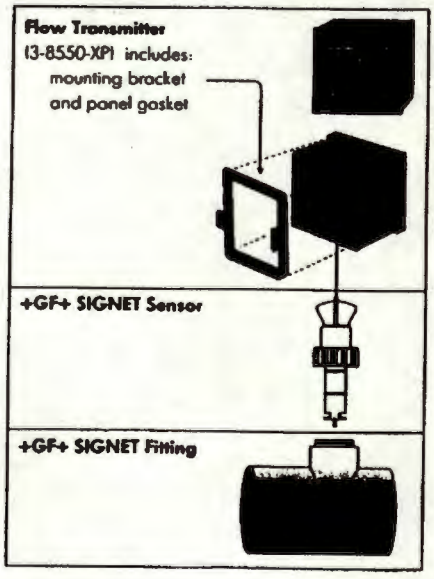
3. Universal Mount

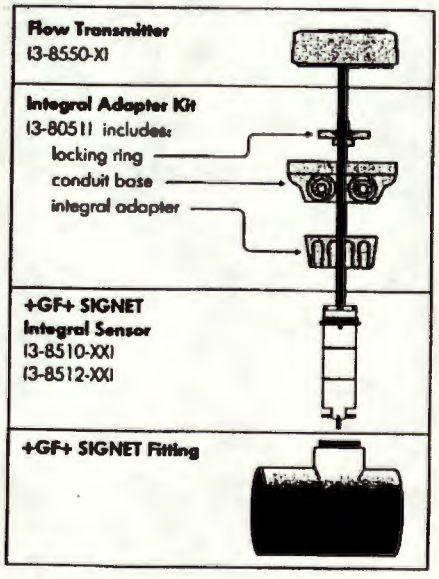
3-8550-X Transmitter

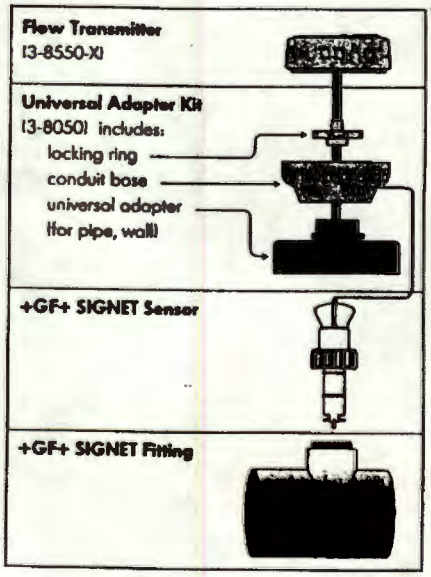
3-8050 Kit



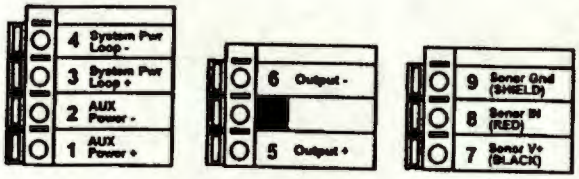
The Universal Mount Kit (3-8050) can be ordered separately and includes a conduit base, locking ring, and universal adapter for mounting the transmitter on a pipe, wall, or other stationary surface.



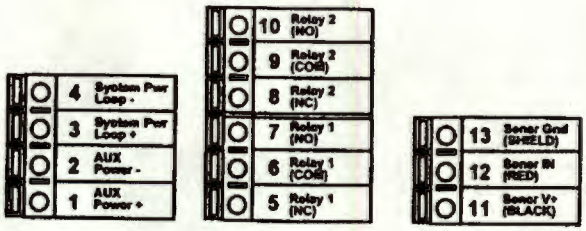




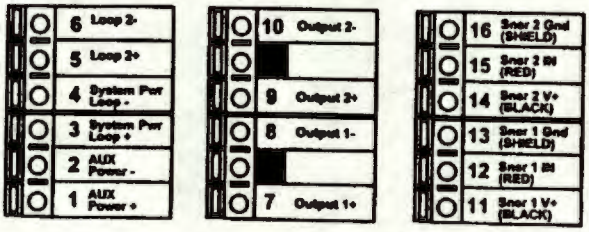
Rear Terminal View



3. terminal 8550-1



3. terminal 8550-1



3. terminal 8550-1

Technical Data

General

Compatibility:
+GF+ SIGNET Flow Sensors with frequency outputs

Accuracy: ±0.5 Hz

Enclosure:
- Rating: NEMA 4X/IP65 front
- Case: PBT
- Panel Case Gasket: Neoprene
- Window: Polyurethane coated polycarbonate
- Keypad:
  Sealed 4-key silicone rubber
- Weight: Approx. 325g (12 oz.)

Display:
- Alphanumeric 2 x 16 LCD
- Update rate: 1 second
- Contrast: User selected, 5 levels

Environmental

Operating temperature:
-10 to 70°C (14 to 158°F)

Storage temperature:
-15 to 80°C (5 to 176°F)

Relative humidity:
0 to 95%, non-condensing

Standards and Approvals

- CSA, CE, UL listed
- Manufactured under ISO 9001

Electrical

Power:
- 12 to 24 VDC ±10%, regulated
  (-11 61 mA max.; (-21 200 mA max.; (-31 122 mA max.

Sensor Input:
- Range: 0.5 to 1500 Hz
- Sensor power:
  2-wire: 1.5 mA @ 5 VDC ± 1%
  3 or 4 wire: 20 mA @ 5 VDC ± 1%
- Optically isolated from current loop
- Short circuit protected

Current output:
- 4 to 20 mA, isolated, fully adjustable and reversible
- Max loop impedance:
  50Ω max. @ 12 V,
  325Ω max. @ 18 V,
  600Ω max. @ 24 V
- Update rate: 100 ms
- Accuracy: ±0.03 mA

Relay output:
- Mechanical SPDT contacts: Hi, Lo, Pulse, Off
- Maximum voltage rating: 5 A @ 30 VDC, 5 A @ 250 VAC resistive load
- Hysteresis: User adjustable
- Max 300 pulses/min.

Open-collector output: Hi, Lo, Pulse, Off
- Open-collector, optically isolated, 50 mA max. sink, 30 VDC max. pull-up voltage.
- Max 300 pulses/min.

Ordering Information

Mfr. Part No.	Code	Description
3-8550-1	159 000 210	Flow transmitter, Field mount
3-8550-1P	159 000 211	Flow transmitter, Panel mount
3-8550-2	159 000 212	Flow transmitter, Field mount with relays
3-8550-2P	159 000 213	Flow transmitter, Panel mount with relays
3-8550-3	159 000 214	Flow transmitter, Field mount with dual input/output
3-8550-3P	159 000 215	Flow transmitter, Panel mount with dual input/output

Accessories

Mfr. Part No	Code	Description
3-8050	159 000 184	Universal mounting kit
3-8050.395	159 000 186	Transmitter NEMA 4X cover
3-8051	159 000 187	Flow Integral Mnt NPT
3-8050.396	159 000 617	RC Filter kit (for relay use)
3-8050.392	159 000 640	Model 200 retro-fit adapter
3-0000.596	159 000 641	Heavy duty wall mount bracket

Engineering Specifications

- The transmitter shall meet appropriate CE, CSA & UL standards.
- The transmitter shall be manufactured under ISO 9001 certified processes.
- The transmitter shall be field or panel mountable.
- The transmitter shall have flow rate and dual totalization capability.
- The display units shall be fully scaleable.
- The device shall meet NEMA 4X and IP65 standards.
- The operating voltage shall be 12 to 24 VDC.
- The transmitter shall have a 4 to 20 mA output with an open collector output, 5 to 30 VDC or a 4 to 20 mA output with 2 relays, or dual 4 to 20 mA output with dual open collector with delta capability.
- The transmitter shall have simulate capability.
- The transmitter shall be +GF+SIGNET, Model 8550 Flow Transmitter.

+GF+ SIGNET
8550-1 Flow Transmitter

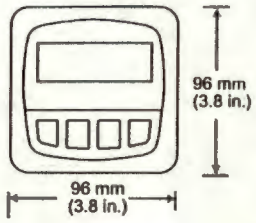
3-8550.090-1 G-4/03 English

WARNING!
- Remove power to unit before wiring input and output connections.
- Follow instructions carefully to avoid personal injury.

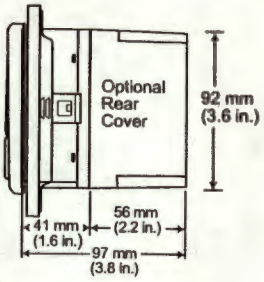
Contents

1. Specifications

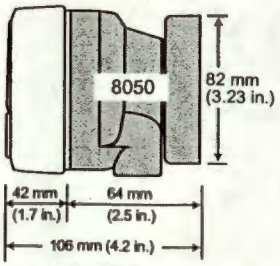
Dimensions



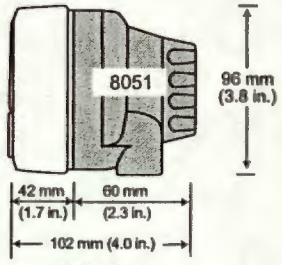
FRONT VIEW
Field Mount & Panel Mount



SIDE VIEW
Panel Mount



SIDE VIEW
Field Mount w/ 8050 Universal base



SIDE VIEW
Field Mount w/ 8051 Integral kit

General

Compatibility: +GF+ SIGNET Flow Sensors (w/freq out)

Enclosure:
- Rating: NEMA 4X/IP65 front
- Case: PBT
- Panel case gasket: Neoprene
- Window: Polyurethane coated polycarbonate
- Keypad: Sealed 4-key silicone rubber
- Weight: Approx. 325g (12 oz.)

Display:
- Alphanumeric 2 x 16 LCD
- Update rate: 1 second
- Contrast: User selected, 5 levels
- Display accuracy: ±0.5% of reading @ 25°C
- Thermal sensitivity shift: ±0.005% of reading per °C

Electrical
- Power: 12 to 24 VDC ±10%, regulated, 61 mA max current

Sensor Input:
- Range: 0.5 to 1500 Hz
- Sensor power: 2-wire: 1.5 mA @ 5 VDC ± 1%
  3 or 4 wire: 20 mA @ 5 VDC ± 1%
- Optically isolated from current loop
- Short circuit protected

Current output:
- 4 to 20 mA, isolated, fully adjustable and reversible
- Max loop impedance: 50 Ω max. @ 12 V
  325 Ω max. @ 18 V
  600 Ω max. @ 24V
- Update rate: 100 ms
- Accuracy: ±0.03 mA

Open-collector output, optically isolated:
- 50 mA max. sink, 30 VDC maximum pull-up voltage.
- Programmable for:
  - High or Low setpoint with adjustable hysteresis
  - Pulse operation (max rate: 300 pulses/min).

Environmental
- Operating temperature: -10 to 70°C (14 to 158°F)
- Storage temperature: -15 to 80°C (5 to 176°F)
- Relative humidity: 0 to 95%, non-condensing
- Maximum altitude: 2000 m (6562 ft)
- Insulation category: II
- Pollution degree: 2

Standards and Approvals
- CSA, CE, UL listed
- Immunity: EN50082-2
- Emissions: EN55011 Class B
- Manufactured under ISO 9001 and ISO 14001

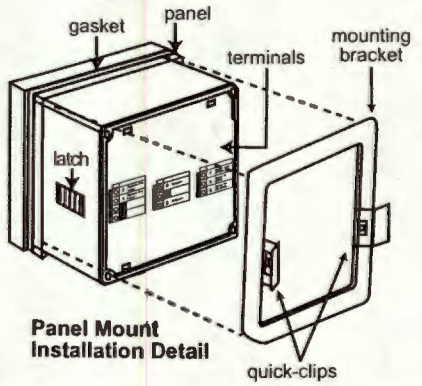
2. Installation

ProcessPro transmitters are available in two styles: panel mount and field mount. The panel mount is supplied with the necessary hardware to install the transmitter. This manual includes complete panel mounting instructions.
Field mounting requires one of two separate mounting kits. The 3-8051 integral kit joins the sensor and instrument together into a single package. The 3-8050 Universal kit enables the transmitter to be installed virtually anywhere.
Detailed instructions for integral mounting or other field installation options are included with the 3-8051 Integral kit or the 3-8050 Universal kit.

2.1 Panel Installation

1. The panel mount transmitter is designed for installation using a 1/4 DIN Punch. For manual panel cutout, an adhesive template is provided as an installation guide. Recommended clearance on all sides between instruments is 1 inch.
2. Place gasket on instrument, and install in panel.
3. Slide mounting bracket over back of instrument until quick-clips snap into latches on side of instrument.
4. To remove, secure instrument temporarily with tape from front or grip from rear of instrument. DO NOT RELEASE.

Press quick-clips outward and remove.



Panel Mount Installation Detail

3. Electrical Connections

Caution: Failure to fully open terminal jaws before removing wire may permanently damage instrument.

Wiring Procedure

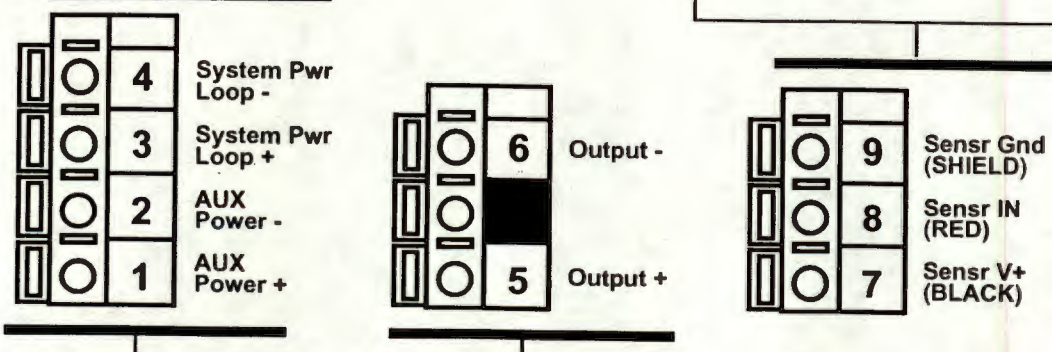
1. Remove 0.5 - 0.625 in. (13-16 mm) of insulation from wire end.
2. Press the orange terminal lever downward with a small screwdriver to open terminal jaws.
3. Insert exposed (non-insulated) wire end in terminal hole until it bottoms out.
4. Release orange terminal lever to secure wire in place. Gently pull on each wire to ensure a good connection.

Wiring Removal Procedure

1. Press the orange terminal lever downward with a small screwdriver to open terminal jaws.
2. When fully open, remove wire from terminal.

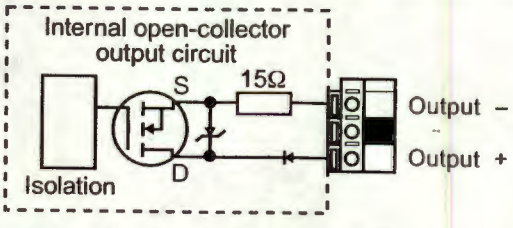
Terminals 3 and 4: Loop Power
12-24 VDC ±10% system power and current loop output.
Max. loop impedance:
50 Ω max. @ 12 V
325 Ω max. @ 18 V
600 Ω max. @ 24 V

Terminals 7-9: Flow sensor input



Terminals 1 and 2: AUXILIARY power
Used only if the flow sensor requires more than 1.5 mA current. For Signet sensors this is limited to the following products:

- 2000
- 2507
- 2530
- 2535
- 2540 if mfg. prior to Jan 1999
- 7002 Vortex sensor

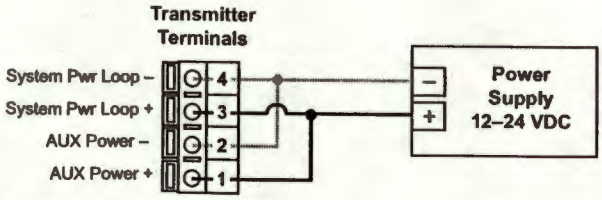


Terminals 5 and 6: Open-collector Output
A transistor output, programmable (see CALIBRATE menu) as:

- High or Low setpoint with adjustable hysteresis
- Volumetric pulse
- Frequency based on flow rate
- May be disabled (Off) if not used.

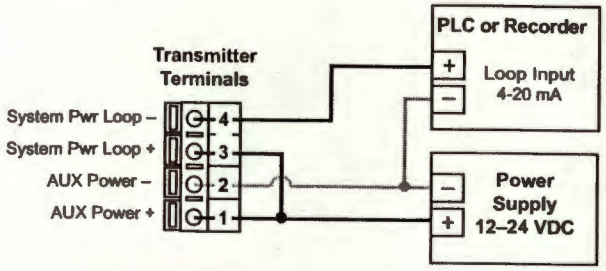
3.1 System Power/Loop Connections

Stand-alone application, no current loop used



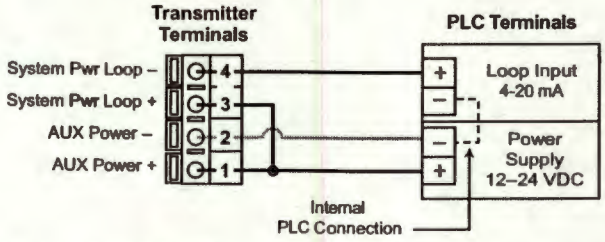
* See AUX POWER Note

Connection to a PLC/Recorder, separate supply



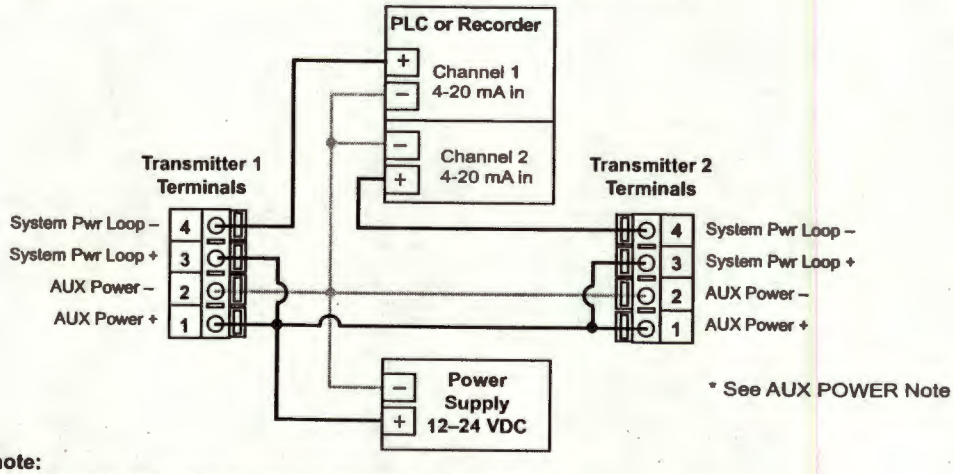
* See AUX POWER Note

Connection to a PLC with built-in power supply



* See AUX POWER Note

Example: Two transmitters connected to PLC/Recorder with separate power supply



* See AUX POWER Note

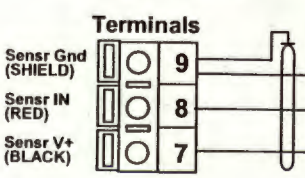
Auxiliary Power note:
AUXILIARY power is used only if the flow sensor requires more than 1.5 mA current.
For Signet sensors this is limited to the following products:

- 2000, 2507, 2530, 2535, 2540 if mfg. prior to Jan 1999, 7002 Vortex sensor

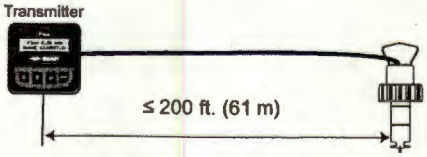
3.2 Sensor Input Connections

Wiring Tips:

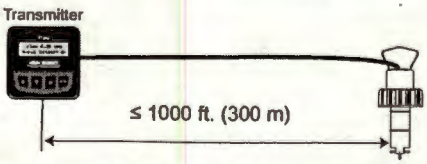
- Do not route sensor cable in conduit containing AC power wiring. Electrical noise may interfere with sensor signal.
- Routing sensor cable in grounded metal conduit will help prevent electrical noise and mechanical damage.
- Seal cable entry points to prevent moisture damage.
- Only one wire should be inserted into a terminal. Splice double wires outside the terminal.



No Aux Power	Aux Power
515/3-8510-XX	**2000**
525	**2507**
2100	**2530**
2517	**2535**
2536/3-8512-XX	**2540 (mfg prior to Jan 1999)**
2540/2541	**7002 Vortex**
7000 Vortex	



Maximum cable length is 200 ft. for 515/8510-XX, 525 , 2517 and any sinusoidal flow signal.



Maximum cable length is 1000 ft. for 2536/ 8512-XX, 2540/2541, vortex, and any open collector flow signal.

3.3 Open Collector Output

The Open collector output can be used as a switch that responds when the flow rate moves above or below a setpoint, or it can be used to generate a pulse that is relative to the flow volume or to the flow rate.

- **Low**

Output triggers when the flow rate is less than the setpoint. The output will relax when the flow rate moves above the setpoint plus the hysteresis value.

- **High**

Output triggers when the flow rate is greater than the setpoint. The output will relax when the flow rate drops below the setpoint plus the hysteresis value.

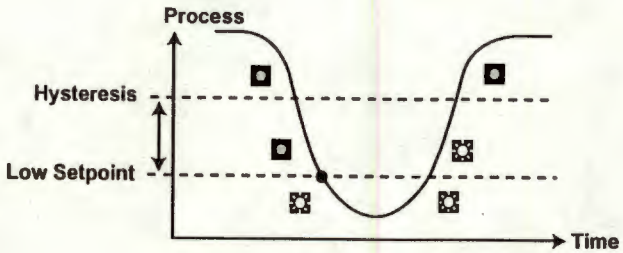
- **Frequency**

Output is a pulse stream that is based on the input flow sensor signal. Set for 1 (input frequency = output frequency). Set for even numbers (2, 4, 6, 8 . . . . 254 maximum) to scale output frequency.

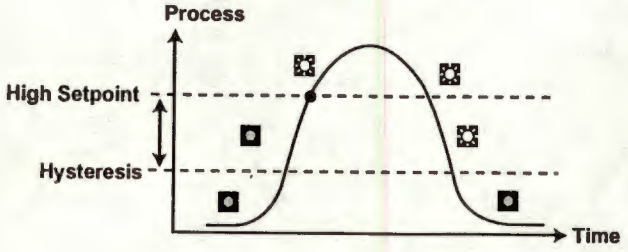
- **Pulse**

Output is a pulse based on the volume of fluid that passes the sensor. Set any value from 0.0001 to 99999.

The output may be disabled (Off) if not used.

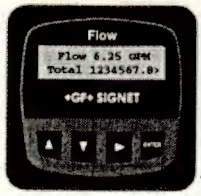


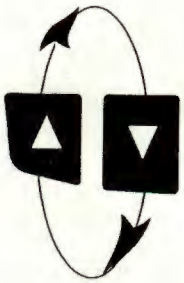
Relay energized
Relay relaxed



VIEW menu

- During normal operation, the ProcessPro displays the VIEW menu.
- When using the CALIBRATE or OPTIONS menus, the ProcessPro will return to the VIEW menu if no activity occurs for 10 minutes.
- To select the item you want displayed, press the UP or DOWN arrow keys. The items will scroll in a continuous loop. Changing the display selection does not interrupt system operations.
- No key code is necessary to change display selection.
- Output settings cannot be edited from the VIEW menu.





View Menu

Display	Description
0.0 GPM Total: 12345678 >	Monitor the flow rate and the resettable totalizer. Press the RIGHT ARROW key to reset the totalizer. If the Reset is locked, you will need to enter the Key Code first. Lock or Unlock the totalizer in the OPTIONS menu. This is the permanent View display.

All of the displays below are temporary. After ten minutes the display will return to the permanent display.

Perm: 12345678 Gallons	Monitor the Permanent Totalizer value.
Loop Output: 12.00 mA	Monitor the 4-20 mA Loop output.
Last CAL: 06-30-01	Monitor date for scheduled maintenance or date of last calibration. (See description in Calibrate Menu.)

ProcessPro Editing Procedure:

Step 1. Press and hold ENTER key:

- 2 seconds to select the CALIBRATE menu
- 5 seconds to select the OPTIONS menu.

Step 2. The Key Code is UP-UP-UP-DOWN keys in sequence.

- After entering the Key Code, the display will show the first item in the selected menu.

Step 3. Scroll menu with UP or DOWN arrow keys.

Step 4. Press RIGHT ARROW key to select menu item to be edited.

- The first display element will begin flashing.

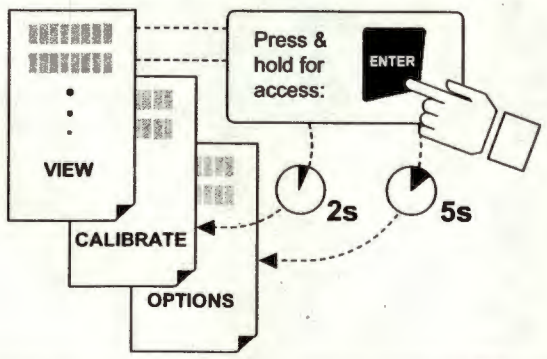
Step 5. Press UP or DOWN keys to edit the flashing element.

- RIGHT ARROW key advances the flashing element.

Step 6. Press ENTER key to save the new setting and return to Step 3.

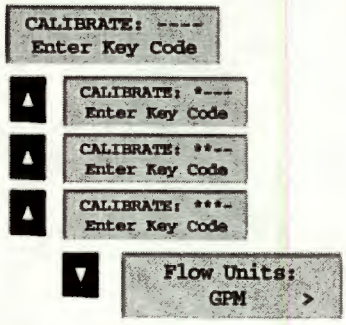
Notes on Step 1:

- The View Menu is normally displayed.
- The CALIBRATE and OPTIONS menus require a KEY CODE.



Notes on Step 2:

If no key is pressed for 5 minutes while display is showing "Enter Key Code", the display will return to the VIEW menu.



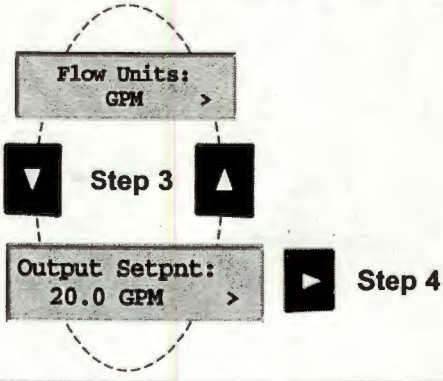
First item in CALIBRATE menu

Notes on Steps 3 and 4:

- Refer to pages 6 and 7 for complete listing of menu items and their use.
- From the Step 3 display, pressing the UP and DOWN keys simultaneously will return the display to the VIEW menu.
- If no key is pressed for 10 minutes, display will also return to the VIEW menu.

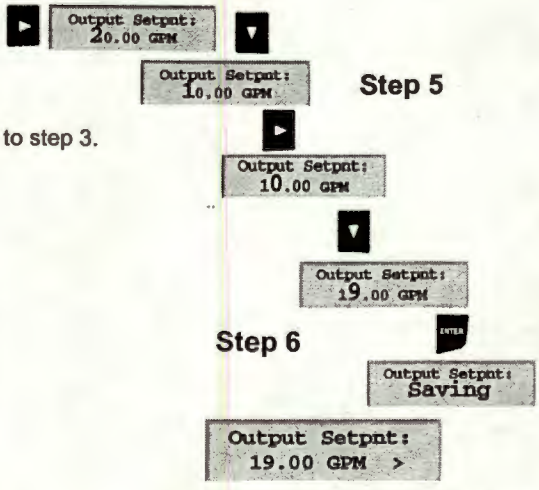
Step 3: Finished Editing?

Press the UP and DOWN keys simultaneously after saving the last setting to return to normal operation.



Notes on Steps 5 and 6:

- All output functions remain active during editing.
- Only the flashing element can be edited.
- RIGHT ARROW key advances the flashing element in a continuous loop.
- Edited value is effective immediately after pressing ENTER key.
- If no key is pressed for 10 minutes unit will restore the last saved value and return to step 3.
- Step 6 (pressing ENTER key) always returns you to Step 3.
- Repeat steps 3-6 until all editing is completed.



Step 5: Made an Error?

Press the UP and DOWN keys simultaneously while any element is flashing. This will recall the last saved value of the item being edited and return you to Step 3.

Calibrate Menu

Display (Factory settings shown)	Description
Flow Units: GPM >	The first three characters set the Flow Rate units of measure. They have no effect on calculations. They may be any alpha or numeric character, upper or lower case. The last character sets the Flow rate Timebase. Select S (seconds), M (minutes), H (hours) or D (days).
Flow K-Factor: 60 >	This setting tells the transmitter how to convert the input frequency from the flow sensor into a flow rate. The K-factor is unique to the sensor model and to the pipe size and schedule. Refer to data in the sensor manual for the correct value. Limits: 0.0001 to 99999. (The K-factor cannot be set to 0)
Total Units: Gallons >	This setting identifies the Totalizer units. It has no effect on any calculation. It serves as a label only. Each character can be any alpha or numeric selection, upper or lower case.
Total K-Factor 60 >	This setting tells the transmitter how to convert the input frequency from the flow sensor into a volumetric total. It also is used as the basis for the Open Collector pulse mode. The setting is usually the same as the Flow K-factor, or different by x10 or x100. Limits: 0.0001 to 99999. (The K-factor cannot be set to 0)
Loop Range: GPM 000.00 → 100.00 >	Select the minimum and maximum values for the 4-20 mA Current loop output. The 8550 will allow any values from 0.0000 to 99999.
Output Mode: Low >	Select the desired mode of operation for the Open Collector output. Options available are High, Low, volumetric Pulse, or Frequency. The signal may be disabled (Off) if not used.
Output Setpnt: 10.0 GPM >	In Low or High Mode, the Open Collector output will be activated when the Flow rate reaches this value. Be sure to modify this setting if you change the Flow Units.
Output Hys: 5.0 GPM >	The Open Collector output will be deactivated at Setpoint ± Hysteresis, depending on High or Low Setpoint selection. (See details on page 4.)
Output Volume: 100.00 Gallons >	In Pulse mode, the Open collector output will generate one pulse when this volume of flow passes the sensor. The measurement is based on the Total K-factor. The 8550 will allow any value from 0.0001 to 99999.
Output PlsWdth: 0.1 Seconds >	In Pulse mode, this setting defines the duration of the Open Collector output pulse. The 8550 allows any value from 0.1 seconds to 999.9 seconds.
Output Freq.: Divide by 1 >	In Frequency mode, the Open Collector output will simulate the sensor frequency, divided by this setting. Set for 1 (input frequency = output frequency). Set for even numbers (2, 4, 6, 8 . . . 254 maximum) to scale output frequency.
Last CAL: 6-30-01	Use this "note pad" to record important dates, such as annual recertification or scheduled maintenance.

Options Menu

Display (Factory settings shown)	Description
Contrast: 3 >	Adjust the LCD contrast for best viewing. A setting of 1 is lower contrast, 5 is higher. Select lower contrast if the display is in warmer ambient surroundings.
Flow Decimal *****. >	Set the decimal to the best resolution for your application. The display will automatically scale up to this restriction. Select *****., ****.*, ***.**, **.*** or *.****
Total Decimal ******.** >	Set the totalizer decimal to the best resolution for your application. Select ********., *******.*, or ******.**
Averaging: Off >	OFF provides the quickest output response to changes in flow. LOW averaging = 4 seconds, HIGH averaging = 8 seconds of input signal. Longer averaging produces more stable display and output response.
Total Reset: Lock Off >	Lock Off : No key code required to reset the resettable totalizer. Lock On : The Key Code must be entered to reset the resettable totalizer.
Loop Adjust: 4.00 mA > Loop Adjust: 20.00 mA >	Adjust the minimum and maximum current output. The display value represents the precise current output. Adjustment limits: • 3.80 mA < 4.00 mA > 5.00 mA • 19.00 mA < 20.00 mA > 21.00 mA Use this setting to match the system output to any external device.
Output Active: Low >	Active HIGH: This setting is used to turn a device (pump, valve) ON at the setpoint. Active LOW: This setting is used to turn a device OFF at the setpoint.
Test Loop: >	Press UP or DOWN keys to manually order any output current value from 3.6 mA to 21.00 mA to test current loop output.
Test Output: >	Press UP or DOWN keys to manually toggle the state of open collector output.

Troubleshooting

Display Condition	Possible Causes	Suggested Solutions
"- - - - -"	Flow rate exceeds display capability	• Increase Flow units time base • Move flow decimal one place to the right
"Pulse Overrun"	• Open Collector pulse rate exceeds maximum of 300 pulses per minute. • Pulse width set too wide.	• Increase Pulse volume setting • Decrease pulse width setting. • Reduce system flow rate
"Value must be more than 0"	K-factors cannot be set to 0.	Enter K-factor from 0.0001 to 99999
Open Collector is always activated	• Hysteresis value too large • Defective transmitter	• Change the hysteresis value • Replace transmitter

Ordering Information

Mfr. Part No.	Code	Description
3-8550-1	159 000 047	Flow transmitter, Field mount
3-8550-1P	159 000 048	Flow transmitter, Panel mount
3-8550-2	159 000 049	Flow transmitter, Field mount with relays
3-8550-2P	159 000 050	Flow transmitter, Panel mount with relays
3-8550-3	159 000 051	Flow transmitter, Field mount with dual input/output
3-8550-3P	159 000 052	Flow transmitter, Panel mount with dual input/output

Accessories

Mfr. Part No.	Code	Description
3-8050	159 000 184	Universal mounting kit
3-8051	159 000 187	Flow Integral Mnt NPT
3-8050.395	159 000 186	Splashproof rear cover
3-8050.396	159 000 617	RC Filter kit (for relay use)
3-0000.596	159 000 641	Heavy duty wall mount bracket
3-5000.598	198 840 225	Surface Mount Bracket
3-5000.399	198 840 224	5 x 5 inch adapter plate for +GF+ SIGNET retrofit
3-9000.392	159 000 368	Liquid tight connector kit for rear cover (includes 3 connectors)
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 piece)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG13.5 (1 piece)
7300-7524	159 000 687	24 VDC Power Supply 7.5 W, 300mA
7300-1524	159 000 688	24 VDC Power Supply 15 W, 600mA
7300-3024	159 000 689	24 VDC Power Supply 30 W, 1.3 A
7300-5024	159 000 690	24 VDC Power Supply 50 W, 2.1 A
7300-1024	159 000 691	24 VDC Power Supply 100 W, 4.2 A

+GF+ SIGNET

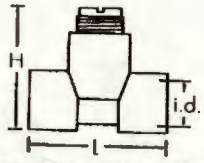
Signet Scientific Company, 3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: www.gfsignet.com • Or call (in the U.S.): (800) 854-4090

GEORGE FISCHER +GF+ Piping Systems
3-8550.090-1 (G-4/03) English

Printed in U.S.A. on Recycled Paper

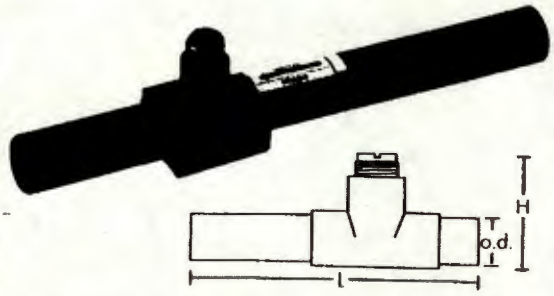
+GF+ SIGNET Plastic Installation Fittings

PVC TEES SCH 80 - Fitting only



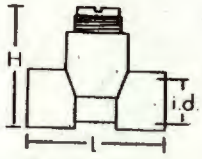
Part no.	Code	Size	L	H	i.d.
PV8T005F	159 000 527	0.50 in.	3.75	3.6	.85
PV8T007F	159 000 529	0.75 in.	3.75	3.8	1.06
PV8T010F	159 000 531	1.00 in.	4.26	4.0	1.33
PV8T012F	159 000 533	1.25 in.	4.36	4.4	1.67
PV8T015F	159 000 535	1.50 in.	4.90	4.6	1.91

PVC TEES SCH 80 - With Pipe



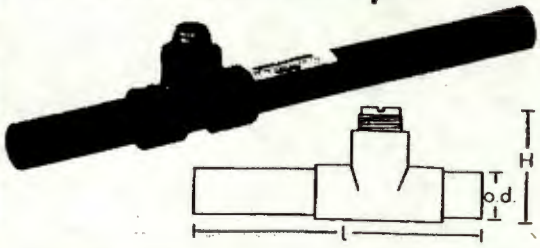
Part no.	Code	Size	L	H	o.d.
PV8T005	159 000 526	0.50 in.	14	3.6	0.840
PV8T007	159 000 528	0.75 in.	14	3.8	1.050
PV8T010	159 000 530	1.00 in.	17	4.0	1.315
PV8T012	159 000 532	1.25 in.	20	4.4	1.660
PV8T015	159 000 534	1.50 in.	24	4.6	1.900
PV8T020	198 801 415	2.00 in.	24	5.0	2.375
PV8T025	198 801 573	2.50 in.	24	5.4	2.875
PV8T030	198 801 416	3.00 in.	24	6.0	3.500
PV8T040	198 801 436	4.00 in.	24	7.0	4.500

CPVC Tees SCH 80 - Fitting only



Part no.	Code	Size	L	H	i.d.
CPV8T005F	159 000 409	0.50 in.	3.75	3.6	.85
CPV8T007F	159 000 411	0.75 in.	3.75	3.8	1.06
CPV8T010F	159 000 413	1.00 in.	4.26	4.0	1.33
CPV8T012F	159 000 415	1.25 in.	4.36	4.4	1.67
CPV8T015F	159 000 417	1.50 in.	4.90	4.6	1.91

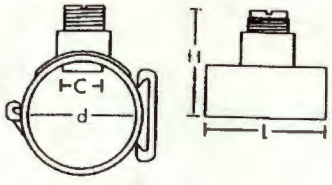
CPVC Tees SCH 80 - With Pipe



Part no.	Code	Size	L	H	o.d.
CPV8T005	159 000 408	0.50 in.	14	3.6	0.840
CPV8T007	159 000 410	0.75 in.	14	3.8	1.050
CPV8T010	159 000 412	1.00 in.	17	4.0	1.315
CPV8T012	159 000 414	1.25 in.	20	4.4	1.660
CPV8T015	159 000 416	1.50 in.	24	4.6	1.900

- Mounts on SCH 80 CPVC pipe

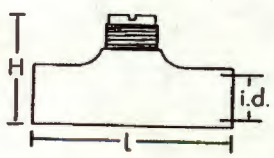
PVC Glue-on Saddles



Part no.	Code	Size	L	H	d	C
PV8S020	159 000 637	2.00 in.	4.00	5.0	2.375	1.43
PV8S025	159 000 638	2.50 in.	4.75	5.4	2.875	1.43
PV8S030	198 150 577	3.00 in.	5.00	6.0	3.500	1.43
PV8S040	198 150 578	4.00 in.	5.00	7.0	4.500	1.43
PV8S060	198 150 579	6.00 in.	5.00	10.0	6.625	2.25
PV8S080	159 000 639	8.00 in.	5.00	11.5	8.625	2.25

- Mounts on SCH 80 PVC pipe
- C - Clearance dimension

Fiberglass Glue-on Tees



Part no.	Code	Size	L	H	i.d.
FPT015	159 000 446	1.50 in.	5.5	4.7	1.92
FPT020	159 000 447	2.00 in.	7.7	8.0	2.375

- PVDF insert - all sizes
- Mounts on fiberglass pipe

+GF+ SIGNET PVC/CPVC TEE Fitting Instructions

ENGLISH

PV8T090-1
A-4/96

CAUTION!

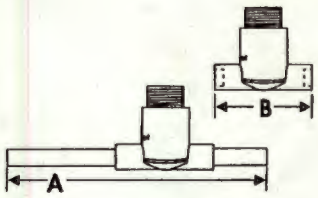
- Improper pipe fitting installation may result in pressure failure, personal injury, and/or property damage.
- Always match fitting and pipeline materials.
- Always use piping cement designed for your specific fitting and pipeline material.

1. +GF+ SIGNET PVC/CPVC Tee Fittings

PVC TEE Fittings, 0.5 - 1.5 in.

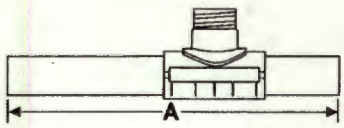
Fitting Number	Fitting Size	Fitting Type	Fitting Material	Male fitting Dimension "A"	Female fitting Dimension "B"
PV8T005	0.5 in.	Male pipe ends	PVC, SCH 80	356 mm (14 in.)	95 mm (3.75 in.)
PV8T007	0.75 in.	Male pipe ends	PVC, SCH 80	356 mm (14 in.)	95 mm (3.75 in.)
PV8T010	1.0 in.	Male pipe ends	PVC, SCH 80	432 mm (17 in.)	109 mm (4.3 in.)
PV8T012	1.25 in.	Male pipe ends	PVC, SCH 80	508 mm (20 in.)	108 mm (4.25 in.)
PV8T015	1.5 in.	Male pipe ends	PVC, SCH 80	610 mm (24 in.)	119 mm (4.7 in.)

Add "F" for Female socket type fitting (illustration B)



PVC TEE Fittings, 2 - 4 in.

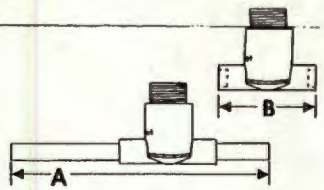
Fitting Number	Fitting Size	Fitting Type	Fitting Material	Male fitting Dimension "A"
PV8T020	2.0 in.	Male pipe ends	PVC, SCH 80	610 mm (24 in.)
PV8T025	2.5 in.	Male pipe ends	PVC, SCH 80	610 mm (24 in.)
PV8T030	3.0 in.	Male pipe ends	PVC, SCH 80	610 mm (24 in.)
PV8T040	4.0 in.	Male pipe ends	PVC, SCH 80	610 mm (24 in.)



CPVC TEE Fittings, 0.5 - 1.5 in.

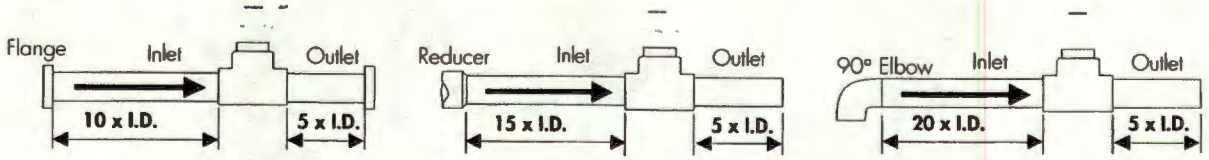
Fitting Number	Fitting Size	Fitting Type	Fitting Material	Male fitting Dimension "A"	Female fitting Dimension "B"
CPV8T005	0.5 in.	Male pipe ends	CPVC, SCH 80	356 mm (14 in.)	95 mm (3.75 in.)
CPV8T007	0.75 in.	Male pipe ends	CPVC, SCH 80	356 mm (14 in.)	95 mm (3.75 in.)
CPV8T010	1.0 in.	Male pipe ends	CPVC, SCH 80	432 mm (17 in.)	109 mm (4.3 in.)
CPV8T012	1.25 in.	Male pipe ends	CPVC, SCH 80	508 mm (20 in.)	108 mm (4.25 in.)
CPV8T015	1.5 in.	Male pipe ends	CPVC, SCH 80	610 mm (24 in.)	119 mm (4.7 in.)

Add "F" for Female socket type fitting (illustration B)



2. Recommended Fitting Location

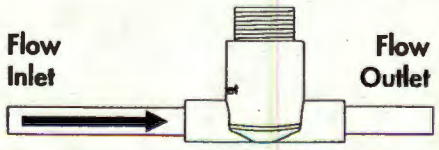
Always locate the fitting in a spot where you have the longest upstream straight run. This allows the flow profile plenty of time to settle into the fully developed, turbulent range. Industry standards usually require a minimum of 10 pipe diameters upstream and 5 pipe diameters downstream. Major obstructions that interrupt the flow such as pumps, valves, etc. require considerably longer straight runs for the flow profile to recover. Careful selection of this location will pay off in optimum system performance.



3. Fitting Direction

Observe markings on fitting for proper inlet orientation (some models):

- Male Tee fittings (All): Always install longer pipe end pointing upstream.
- Female Tee fittings: Always place end marked "Inlet" upstream. Unmarked Tee fittings are bidirectional and can be installed in either direction.

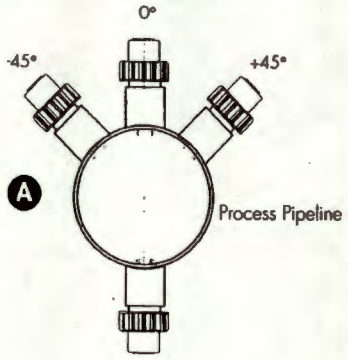


4. Recommended Fitting Angles

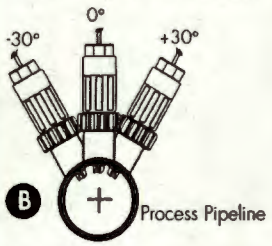
A) +GF+ SIGNET Flow Sensor Installations
Vertical fitting mounting is recommended for best sensor performance. Mount fitting at a maximum angle of 45° when air bubbles are present. DO NOT mount fitting on bottom of the pipe when sediments are present (see illustration A).

B) +GF+ SIGNET pH/ORP Sensor Installations
Vertical fitting mounting is recommended for best sensor performance. Mount fitting at a maximum angle of 30°. DO NOT mount fitting in excess of 30° (see illustration B).

+GF+ SIGNET Flow Sensors



+GF+ SIGNET pH/ORP Sensors



5. Fitting Installation

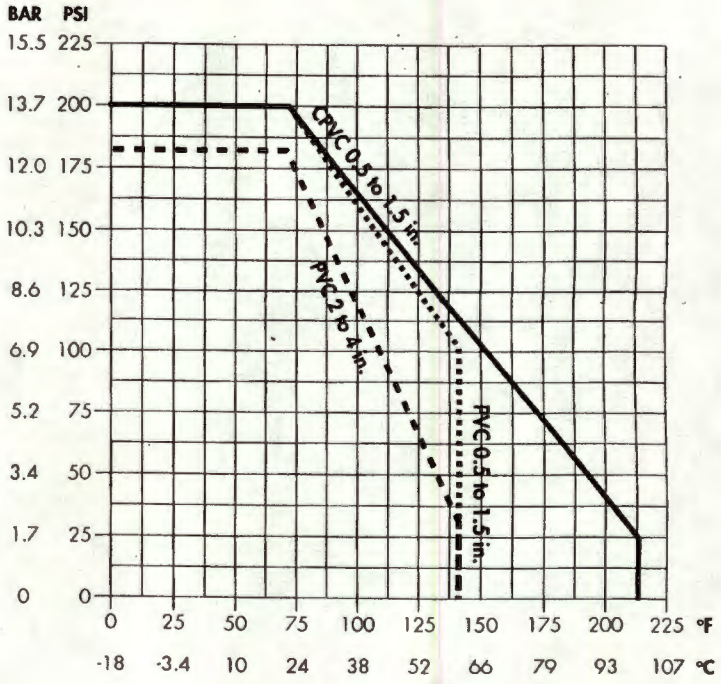
Follow plastic piping cement manufacturer's recommended preparation and gluing instructions. Avoid excess cement in fitting joints to prevent any port obstruction.

6. Fitting Specifications

FOR YOUR SAFETY: Always confirm the chemical compatibility and the maximum pressure/temperature specifications for your fitting and sensor selection prior to installation. Failure to do so may result in system damage and/or serious personal injury. Refer to maximum fitting pressure/temperature graph (right).

Verify both fitting and sensor specifications (see sensor manual). Some fittings have much lower pressure/temperature specifications than the flow sensors. Remember the overall system specifications and limitations of your flow system depend on the lowest maximum rating of all components associated with the system. Never use a fitting and/or sensor in an application which exceeds +GF+ SIGNET's published pressure/temperature specifications.

+GF+ SIGNET PVC/CPVC Tee Fitting Maximum Pressure/Temperature Chart



+GF+ SIGNET

Sales Offices:

USA	George Fischer, Inc., 2882 Dow Avenue, Tustin, CA 92780/USA, Tel. (714) 731-8800, Fax (714) 731-6201
Switzerland	Georg Fischer Rohrleitungssysteme AG, P.O. Box 671, CH-8201 Schaffhausen/Switzerland, Tel. 052/631 1111, Fax 052/631 2830
Singapore	George Fischer Pte. Ltd., 15 Kaki Bukit Road 2, KB Warehouse Complex, Singapore 1441, Tel. 65/747 0611, Fax 65/747 0577
Japan	Kubota George Fischer, 2-47 Shikitsuhigashi, 1-Chome, Naniwa-Ku, Osaka, 556-91 Japan, Tel. 816/648 2545, Fax 816/648 2565
China	Georg Fischer Ltd., Rm 1503, Business Residence Bldg. of Asia Plaza, 2-3 Bldg. No. 5th Qu Anzhenxili, Chaoyang Qu, Beijing 100029, P.R. China, Tel. 86/10 6443 0577, Fax 86/10 6443 0578
Australia	George Fischer Pty. Ltd., Suite 3, 41 Stamford Road, Oakleigh, Victoria 3166, Australia, Tel. 61/3 9568 0966, Fax 61/3 9568 0988

Signet Scientific Company, 3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A., Tel. (626) 571-2770, Fax (626) 573-2057

GEORGE FISCHER +GF+ Piping Systems

PV8T090-1/(A-4/96), English

PRINTED ON RECYCLED PAPER
Printed in U.S.A.

CP-300

Data Sheet

Series A
Electronic Metering Pumps

Configuration Data

Model A94 1 - 351SI

Control & Output Mode

Manual Control
Speed (stroking frequency) and stroke length manually adjustable.

A14 --------- 0.58 GPH (2.2 l/h) --- 250 psi(17.3 Bar)
A15 --------- 1.00 GPH (3.8 l/h) --- 110 psi (7.6 Bar)
A16 --------- 2.00 GPH (7.6 l/h) --- 50 psi (3.5 Bar)
A17 --------- 0.42 GPH (1.6 l/h) --- 140 psi (9.7 Bar)
A18 --------- 0.75 GPH (2.8 l/h) --- 80 psi (5.5 Bar)

Manual Control / Extended Low Range
Speed (stroking frequency) and stroke length manually adjustable. Minimum stroke rate less than 2 per minute for very low outputs.

A34 --------- 0.58 GPH (2.2 l/h) --- 250 psi(17.3 Bar)
A37 --------- 0.42 GPH (1.6 l/h) --- 140 psi (9.7 Bar)

Instrument Responsive / Manual Control
Manual adjustment features of Series A1 plus switch conversion to external control for automatic systems.

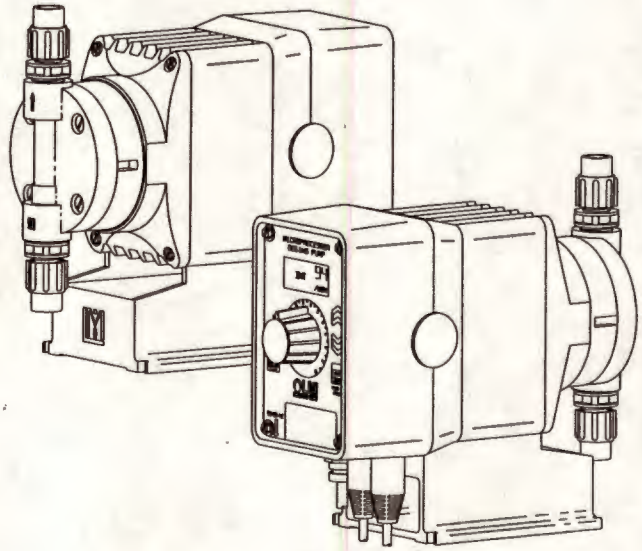
A74, A94 -- 0.58 GPH (2.2 l/h) -- 250 psi(17.3 Bar)
A75, A95 -- 1.00 GPH (3.8 l/h) -- 110 psi (7.6 Bar)
A76, A96 -- 2.00 GPH (7.6 l/h) -- 50 psi (3.5 Bar)
A77, A97 -- 0.42 GPH (1.6 l/h) -- 140 psi (9.7 Bar)
A78 --------- 0.75 GPH (2.8 l/h) -- 80 psi (5.5 Bar)

Voltage Code

1 ------- 120 VAC, US Plug
2 ------- 240 VAC, US Plug
3 ------- 220-240 VAC, DIN Plug
5 ------- 240-250 VAC, UK Plug
6 ------- 240-250 VAC, Aust./NZ Plug
7 ------- 220-240 VAC, Swiss Plug

Liquid End

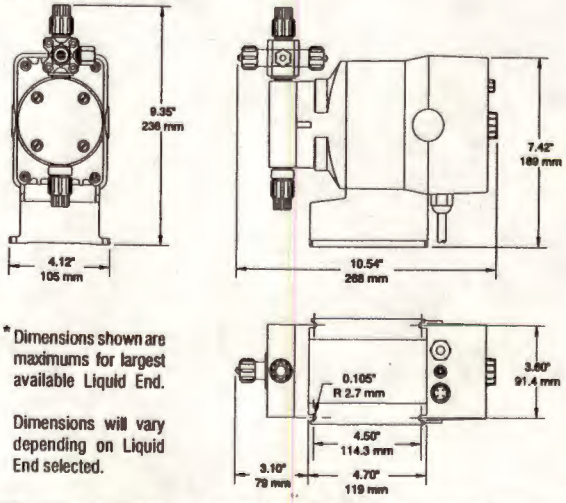
See next page for complete liquid end specifications and selection.



Specifications

Series	Strokes Per Minute (Adjustable) Min	Max	Stroke Length (Adjustable) Recommended Minimum	Average Input Power @ Max Speed	Shipping Weight
A14, A74* A15, A75* A16, A76*	1	100	20%	22 watts	10 lbs (4.55 kg)
A17, A77* A18, A78*	1	100	30%		
A34	1	100	20%		
A37	1	100	30%		

Dimensions



* Dimensions shown are maximums for largest available Liquid End.

Dimensions will vary depending on Liquid End selected.

LMI
LIQUID METRONICS DIVISION
MILTON ROY
A unit of Sundstrand Corporation

8 Post Office Square
Acton, MA 01720 USA
TEL: (978) 263-9800
FAX: (978) 264-9172
http://www.lmipumps.com

ISO9001

Replaces same of Rev. E 6/96
1386.F 10/97

CP-300

Configuration Data & Materials of Construction

Drive Assembly	Liquid End No.	Size Code	Materials of Construction				Accessory	Tubing & Connections	
			Head & Fittings	Balls	Liquifram™	Check Valve		Discharge	Suction
	350SI†	0.5	Acrylic/PGC™	Ceramic	Fluorofilm™	PGC™/Polyprel®	4FV	PE .250" O.D.	
A74 ☐ -	351SI†	0.5	PGC™/PGC™	Ceramic	Fluorofilm™	PGC™/Polyprel®	4FV	PE .250" O.D.	
A77 ☐ -	352SI†	0.5	PVDF/PVDF	Ceramic	Fluorofilm™	PVDF/Polyprel®	4FV	PE .250" O.D.	
A34 ☐ -	353SI†	0.5	PVDF/PVDF	Ceramic	Fluorofilm™	PVDF/PTFE	4FV	PE .250" O.D.	
A37 ☐ -	150FS	0.5	Acrylic/PVDF	PTFE	Fluorofilm™	Hypalon®	4FV	PE .250" O.D.	
A14 ☐ -	155HV	0.5	Polypropylene	316 S.S.	Fluorofilm™	PTFE		PE .5" O.D.	Vinyl .938" O.D.
A17 ☐ -	155S**	0.5	Polypropylene	Ceramic	Fluorofilm™	PTFE	4FV	PE .250" O.D.	
	156	0.5	Acrylic/PP	316 S.S.	Fluorofilm™	Hypalon®		PE .5" O.D.	Vinyl .938" O.D.
	257	0.5	316 S.S.	316 S.S.	Fluorofilm™	316 S.S.		Pipe 1/4" NPT M	
	390SI†	0.9	Acrylic/PGC™	Ceramic	Fluorofilm™	PGC™/Polyprel®	4FV	PE .375" O.D.	
A75 ☐ -	391SI†	0.9	PGC™/PGC™	Ceramic	Fluorofilm™	PGC™/Polyprel®	4FV	PE .375" O.D.	
A78 ☐ -	392SI†	0.9	PVDF/PVDF	Ceramic	Fluorofilm™	PVDF/Polyprel®	4FV	PE .375" O.D.	
A15 ☐ -	393SI†	0.9	PVDF/PVDF	Ceramic	Fluorofilm™	PVDF/PTFE	4FV	PE .375" O.D.	
A18 ☐ -	297	0.9	316 S.S.	316 S.S.	Fluorofilm™	316 S.S.		Pipe 1/4" NPT M	
	85HV	0.9	Polypropylene	316 S.S.	Fluorofilm™	PTFE		PE .5" O.D.	Vinyl .938" O.D.
	86	0.9	Acrylic/PP	316 S.S.	Fluorofilm™	Hypalon®		PE .5" O.D.	Vinyl .938" O.D.
	89	0.9	UHMW PE	Ceramic	Hypalon®	Hypalon®		PE .5" O.D.	Vinyl .5" O.D.
	91FS	0.9	Acrylic/PVDF	PTFE	Hypalon®	Hypalon®		PE .375" O.D.	Vinyl .375" O.D.
	92S**	0.9	PVC	Ceramic	Fluorofilm™	PTFE	4FV	PE .375" O.D.	
	94S**	0.9	PVC	Ceramic	Fluorofilm™	PTFE	4FV	Pipe 1/4" NPT M	
	95S**	0.9	Polypropylene	Ceramic	Fluorofilm™	PTFE	4FV	PE .375" O.D.	
	360SI†	1.8	Acrylic/PGC™	Ceramic	Fluorofilm™	PGC™/Polyprel®	4FV	PE .375" O.D.	
A76 ☐ -	361SI†	1.8	PGC™/PGC™	Ceramic	Fluorofilm™	PGC™/Polyprel®	4FV	PE .375" O.D.	
A16 ☐ -	362SI†	1.8	PVDF/PVDF	Ceramic	Fluorofilm™	PVDF/Polyprel®	4FV	PE .375" O.D.	
	363SI†	1.8	PVDF/PVDF	Ceramic	Fluorofilm™	PVDF/PTFE	4FV	PE .375" O.D.	
	277	1.8	316 S.S.	316 S.S.	Fluorofilm™	316 S.S.		Pipe 1/4" NPT M	
	62S**	1.8	PVC/PVDF	Ceramic	Fluorofilm™	Polyprel®	4FV	PE .375" O.D.	
	65S**	1.8	Polypropylene	Ceramic	Fluorofilm™	PTFE	4FV	PE .375" O.D.	
	74S**	1.8	PVC	Ceramic	Fluorofilm™	PTFE	4FV	Pipe 1/4" NPT M	
	75HV	1.8	Polypropylene	316 S.S.	Fluorofilm™	PTFE		PE .5" O.D.	Vinyl .938" O.D.
	76	1.8	Acrylic/PP	316 S.S.	Fluorofilm™	Hypalon®		PE .5" O.D.	Vinyl .938" O.D.
	79	1.8	UHMW PE	Ceramic	Hypalon®	Hypalon®		PE .5" O.D.	Vinyl .5" O.D.

☐ See front page for voltage code specifications.

** These Liquid Ends are available without a 4-FV.

† To specify ¼" NPT male, change 'I' to 'P'. To specify black, UV resistant tubing, change 'I' to 'U'. To specify Bleed 4FV, change 'S' to 'B'. To specify 3FV, change 'S' to'T'.

3FV indicates that the pump is equipped with an LMI Three Function Valve (pressure relief, priming aid, line drain).

4FV indicates that the pump is equipped with an LMI Four Function Valve. This diaphragm type, anti- syhon/pressure relief valve is installed on the pump head. It provides anti-syphon protection and aids in priming, even under pressure.

Fluorofilm™ is a copolymer of PTFE and PFA.
Polyprel® is an elastomeric PTFE copolymer.

Polyprel is a registered trademark of Liquid Metronics, Inc.
Fluorofilm, Liquifram, PGC are trademarks of Liquid Metronics, Inc.
Hypalon is a registered trademark of E. I. du Pont de Nemours & Co., Inc.

Output Information

Series	Gallons per Hour Min	Gallons per Hour Max	Liters per Hour Min	Liters per Hour Max	mL/cc per Minute Min	mL/cc per Minute Max	mL/cc per Stroke Min	mL/cc per Stroke Max	Maximum Injection Pressure
A14, A34, A74*, A94*	0.001	0.58	0.004	2.2	0.07	37	0.07	0.37	250 psi (17.3 Bar)
A15, A75*, A95*	0.002	1.00	0.008	3.8	0.13	63	0.13	0.63	110 psi (7.6 Bar)
A16, A76*, A96*	0.004	2.00	0.015	7.6	0.25	126	0.25	1.26	50 psi (3.5 Bar)
A17, A37, A77*, A97*	0.001	0.42	0.005	1.6	0.08	26	0.08	0.26	140 psi (9.7 Bar)
A18, A78*	0.002	0.75	0.009	2.8	0.14	47	0.14	0.47	80 psi (5.5 Bar)

* Minimum output is based on one stroke per minute. Minimum output can be reduced further in external mode. Series A9 pumps may be programmed for strokes per hour for lower outputs.

Specification **Sheet**

Series A

GENERAL

Chemical metering pumps shall be positive displacement, Liquifram™ type pumps that are UL and CUL approved. Output volume shall be adjustable while pumps are in operation from zero to maximum capacity of:

A17, A77, A97 - 0.42 GPH (1.6 liters per hour)
A14, A74, A94 - 0.58 GPH (2.2 liters per hour)
A18, A78 - 0.75 GPH (2.8 liters per hour)
A15, A75, A95 - 1.0 GPH (3.8 liters per hour)
A16, A76, A96 - 2.0 GPH (7.6 liters per hour)

Chemical metering pumps shall be capable, without a hydraulically backed diaphragm, of injecting solutions against pressures up to:

A14, A74, A94 - 250 psig (17.3 bar)
A17, A77, A97 - 140 psig (9.7 bar)
A15, A75, A95 - 110 psig (7.6 bar)
A18, A78 - 80 psig (5.5 bar)
A16, A76, A96 - 50 psig (3.5 bar)

SERIES A1

Adjustment shall be by means of readily accessible dial knobs, one for changing stroke length and the other for changing stroke frequency. Both knobs are to be located opposite the liquid handling end. On-off switch shall be integral with frequency control, "off" position to be below lowest frequency setting.

SERIES A7

Control of Series A7 metering pumps shall be selectable between internal and external pulsing by means of a switch integral with frequency control knob. "External" position to be below lowest internally paced frequency setting. Stroke length shall be adjustable by means of readily accessible dial knob. When in external pulsed mode, Series A7 units shall accept signals without the use of electrical timer or internal timer.

SERIES A9

Series A9 metering pumps shall have a clear liquid crystal display. Control shall be selectable between internal and external pulsing by means of a tactile keypad. Internal stroke frequency shall be adjustable from 1 stroke per hour to 100 strokes per minute. Pressure capacity shall be keypad adjustable to reduce noise, vibration and wear. Metering pump shall be capable of dividing or multiplying pulse inputs from 1 to 999 or responding directly or inversely to a 4-20mA input signal.

DRIVE

The pump drive shall be totally enclosed with no exposed moving parts. Solid state electronic pulser shall be fully encapsulated and supplied with quick connect terminals at least 3/16" (4.75 mm) wide. Electronics shall be housed in chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage. Electrical power consumption shall not exceed 22 watts per hour under full speed and maximum pressure conditions. Pump weight shall not exceed 14 lbs (6.5 kg).

AUTOMATIC PRESSURE RELIEF

To eliminate need for pressure relief valve, Liquifram™ shall automatically stop pulsating when discharge pressure exceeds pump pressure rating by not more than 35%.

MATERIAL

Chemical metering pump housing shall be of chemically resistant glass fiber reinforced thermoplastic. All exposed fasteners shall be stainless steel. Chemical metering pump valves shall be ball type, with ceramic balls[1]. Valve seat and seal ring shall be renewable by replacing the combination seat-seal ring[2] or cartridge valve assembly. Pump head shall be of transparent acrylic[3] material capable of resisting the pumped chemical. Fittings and connections at pump head shall be PVC[4].

CHECK VALVES AND TUBING

A total of 16 ft (4.8 m) of polyethylene tubing[5] shall be provided per pump complete with compression connections. A foot valve with integral one piece strainer shall be provided for the suction line, and an injection check/back pressure[6] valve with ½" NPT male connection for the injection point. The injection check valve shall incorporate a dilating orifice which prohibits scale formation and accumulation of crystalline deposits.

Notes:

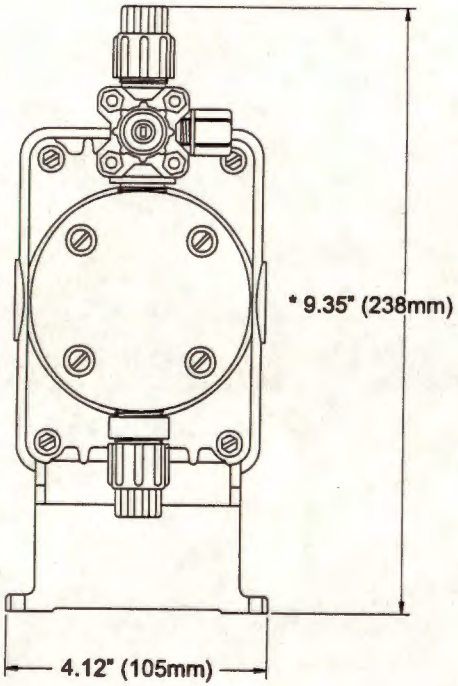
1. Type 316 stainless steel or PTFE may be specified.
2. Hypalon®, PTFE or Polyprel® may be specified.
3. PVDF, PVC, Polypropylene, or Type 316 stainless steel may be specified.
4. PVDF, Polypropylene, or Type 316 stainless steel may be specified.
5. 6 ft. (1.8 m) of vinyl suction tubing may be specified in place of polyethylene for the suction side only. 1/4" pipe thread may be specified.

LMI
MILTON ROY

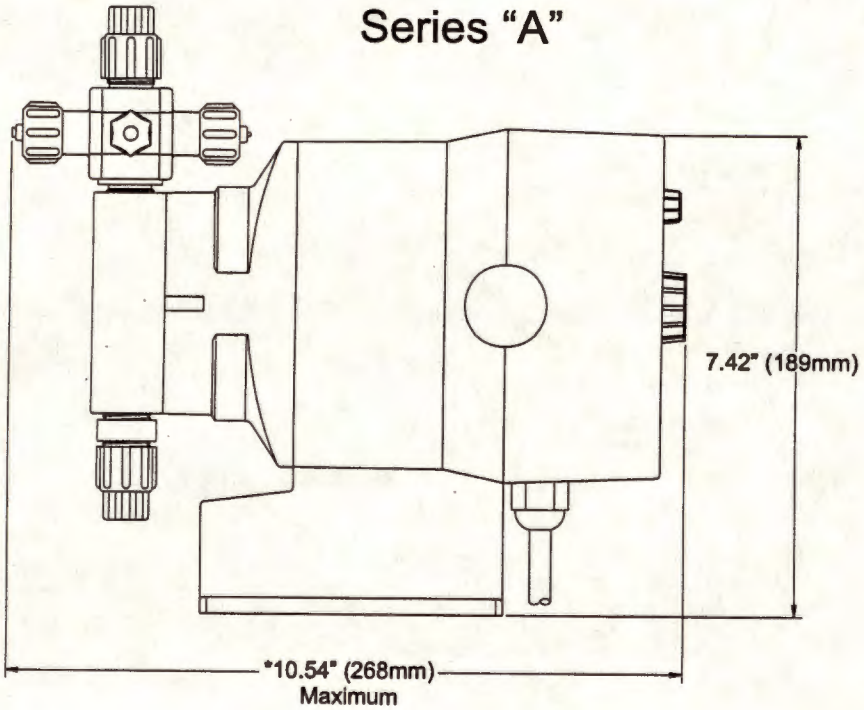
8 Post Office Square
Acton, MA 01720 USA
TEL: (978) 263-9800
FAX: (978) 264-9172
http://www.lmipumps.com

ISO9001

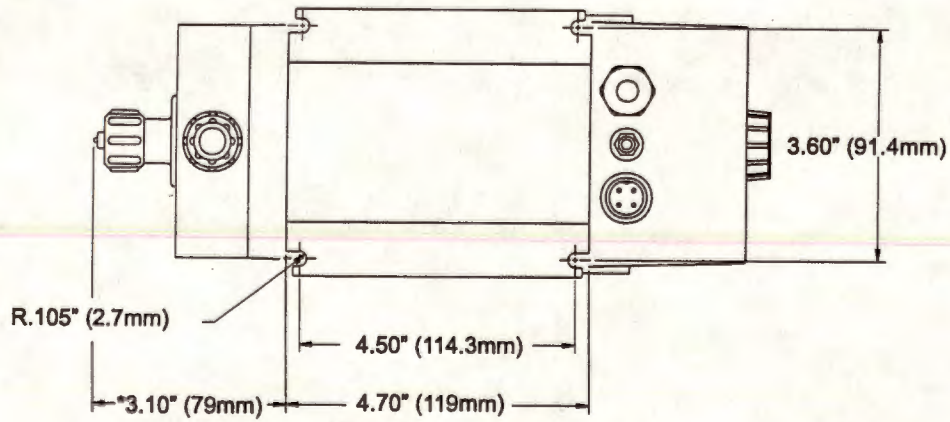
Replaces same of Rev. F 6/94
1143. G 12/99



Series "A"



* Dimensions shown are maximum for largest liquid end available. These dimensions vary depending on the Liquid End selected.



Instruction **Manual**

Electronic Metering Pumps

Carefully read and understand all precautions before installing or servicing any metering

For file reference, please record the following data:

Model No: _____

Serial No: _____

Installation Date: _____

Installation Location: _____

When ordering replacement parts for your LMI Metering Pump or Accessory, please include complete Model Number and Serial Number of your unit.

LMI
MILTON ROY

8 Post Office Square
Acton, MA 01720 USA
TEL: (978) 263-9800
FAX: (978) 264-9172
www.lmipumps.com

Replaces same of Rev. M 8/00
1615.N 6/01

Contents

1.0 Introduction

LMI is the world's most versatile manufacturer of economical and efficient metering pumps. This manual addresses the installation, maintenance and troubleshooting procedures for manually and externally controlled pumps. LMI has a worldwide network of stocking representatives and authorized repair centers to give you prompt and efficient service.

Please review this manual carefully. Pay particular attention to warnings and precautions. Always follow good safety procedures, including the use of proper clothing, eye and face protection.

This manual is for Series A, B, C, E, J5, and P pumps.

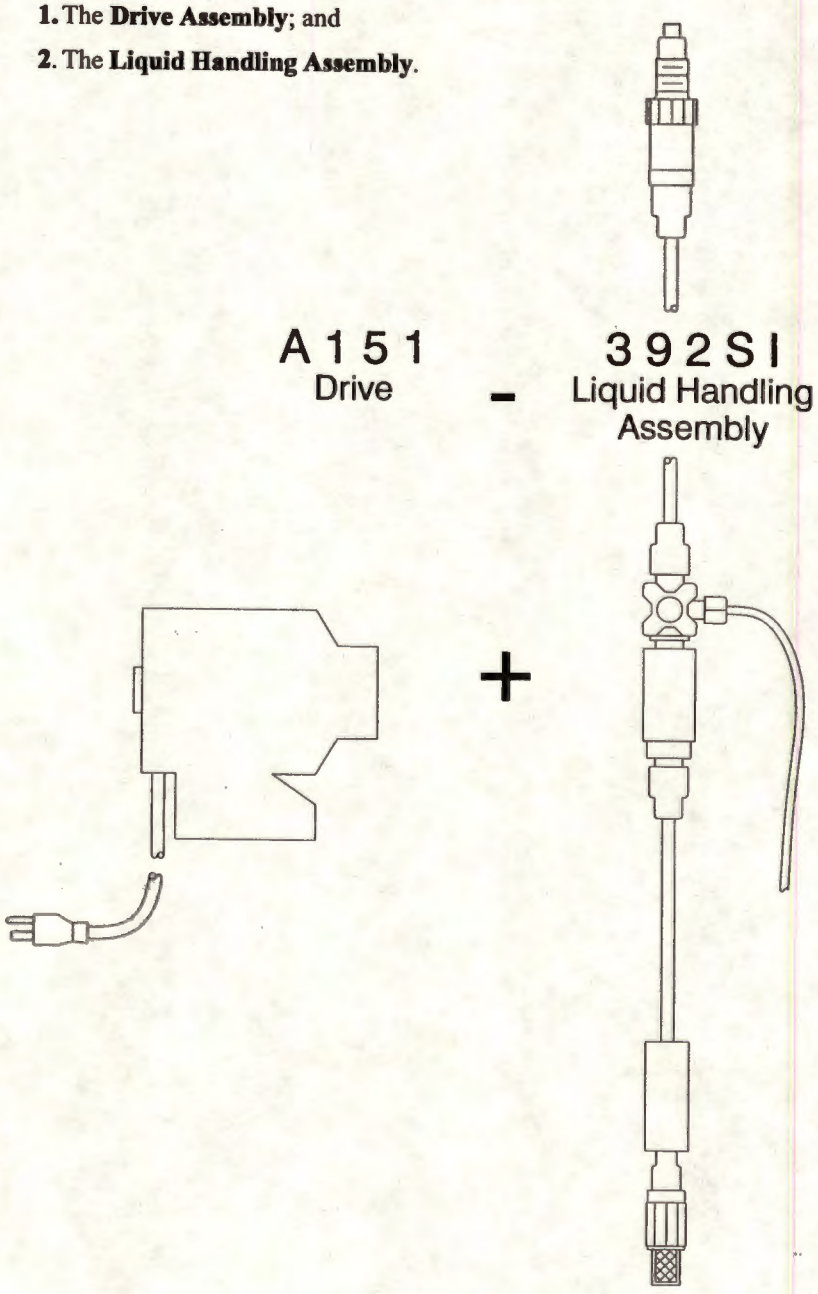
1.1 Spare Parts

LMI recommends replacing the elastomeric components of the pump on an annual basis. RPM Pro Pacs™ and spare part kits are available from your local LMI Master Stocking Distributor.

Example:

Your pump consists of two main components:

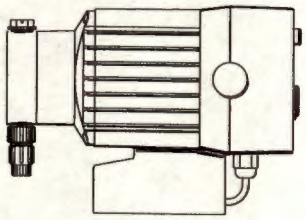
1. The **Drive Assembly**; and
2. The **Liquid Handling Assembly**.



2.0 Unpacking Check List

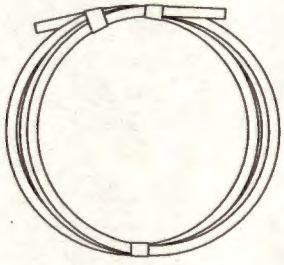
Your carton will contain many or all of the following items. Please notify the carrier immediately if there are any signs of damage to the pump or its parts.

Please refer to the enclosed Instruction Supplement for an illustration and electrical diagram of your complete pump.



Metering Pump

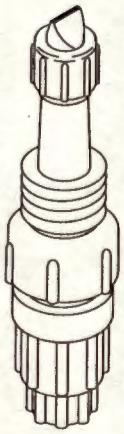
Foot Valve



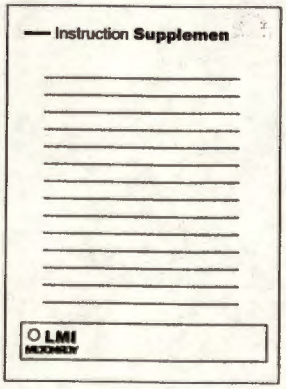
Tubing

Depending on the model, your carton may contain 0, 1, 2 or 3 rolls of tubing. Your carton may contain a roll of clear vinyl tubing; this is for connection to the SUCTION SIDE OF THE PUMP HEAD ONLY.

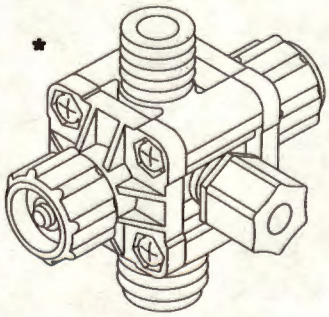
Ceramic Foot Valve Weight



Injection Check Valve



Instruction Supplement



MULTI-FUNCTION Valve and Tubing

* Your carton may or may not contain a 3-FV, 4-FV, or bleed 4-FV accessory.

3.0 Pre-Installation Instructions

The following precautions should be taken when working with LMI metering pumps. Please read this section carefully prior to installation.

Precautions

Protective Clothing

ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or near your metering pump. Additional precautions should be taken depending on the solution being pumped. Refer to MSDS precautions from your solution supplier.

Water Pre-Prime

All LMI pumps are pre-primed with water when shipped from the factory. If your solution is not compatible with water, disassemble the Pump Head Assembly. Thoroughly dry the pump head, valves, seal rings, balls and Liquifram™(diaphragm). Reassemble head assembly tightening screws in a crisscross pattern. Refill the pump head with the solution to be pumped before priming the pump. (This will aid in priming.)

Solution Compatibility

Determine if the materials of construction included in the liquid handling portion of your pump are adequate for the solution (chemical) to be pumped. LMI pumps are tested by NSF for use on muriatic acid and sodium hypochlorite. Always refer to the solution supplier and the **LMI Chemical Resistance Chart** for compatibility of your specific LMI metering pump. Contact your local LMI distributor for further information.

Tubing Connections

Inlet and outlet tubing or pipe sizes must not be reduced. Make certain that all tubing is SECURELY ATTACHED to fittings prior to start-up (see Section 4.3, Tubing Connections). ALWAYS use LMI supplied tubing with your pump, as the tubing is specifically designed for use with the pump fittings. It is recommended that all tubing be shielded to prevent possible injury in case of rupture or accidental damage. If tubing is exposed to sunlight, black UV resistant tubing should be installed. Check tubing frequently for cracks and replace as necessary.

Fittings And Machine Threads

All fittings should be hand-tightened. An additional 1/8 - 1/4 turn after the fitting contacts the seal ring may be necessary to provide a leak-proof seal. Excessive overtightening or use of a pipe wrench can cause damage to the fittings, seals, or pump head.

All LMI pumps have straight screw machine threads on the head and fittings and are sealed by the seal rings or O-rings. **DO NOT use Teflon® tape or pipe dope to seal threads. Teflon® Tape may only be used on the 1/2" NPT thread side of the Injection Check Valve as well as stainless steel liquid end connections.**

Plumbing

Always adhere to your local plumbing codes and requirements. Be sure installation does not constitute a cross connection. Check local plumbing codes for guidelines. LMI is not responsible for improper installations.

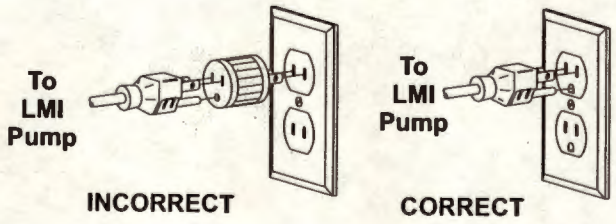
Back Pressure/Anti-Syphon Valve

If you are pumping downhill or into low or no system pressure, a back pressure/anti-syphon device such as LMI's Four Function Valve should be installed to prevent overpumping or syphoning. Contact your LMI distributor for furthur information.

Electrical Connections

CAUTION

To reduce the risk of electrical shock, the metering pump must be plugged into a grounded outlet with ratings conforming to the data on the pump control panel. The pump must be connected to a good ground. **DO NOT USE ADAPTERS!** All wiring must conform to local electrical codes.



4.0 Installation

4.1 Pump Location and Installation

Locate pump in an area convenient to solution tank and electrical supply.

The pump should be accessible for routine maintenance, and should not be subjected to ambient temperatures above 122°F (50°C). If the pump will be exposed to direct sunlight, LMI black, UV resistant tubing should be installed.

4.2 Pump Mounting

The pump can be mounted in one of two ways:

A. FLOODED SUCTION (ideal installation); or

B. SUCTION LIFT - when suction lift is less than 5 feet (1.5 m) for solutions having a specific gravity of water. For denser solutions, consult distributor.

Your LMI metering pump must be mounted so that the suction and discharge valves are vertical. **NEVER position pump head and fittings horizontally.**

4.2.1 Flooded Suction

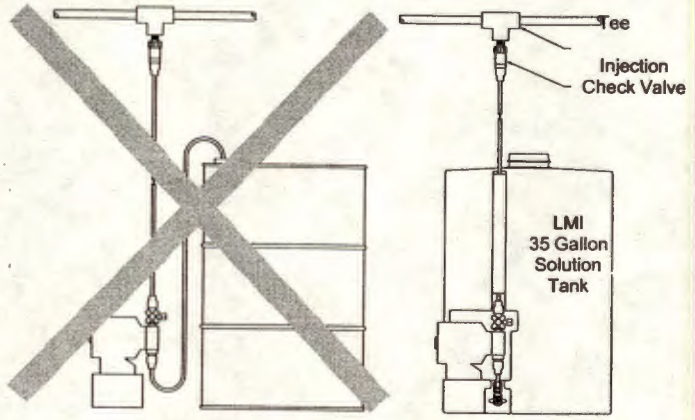
The pump is mounted at the base of the storage tank. This installation is the most trouble-free , and is recommended for very low outputs, solutions that gasify, and high-viscosity solutions. Since the suction tubing is filled with solution, priming is accomplished quickly and the chance of losing prime is reduced.

CAUTION

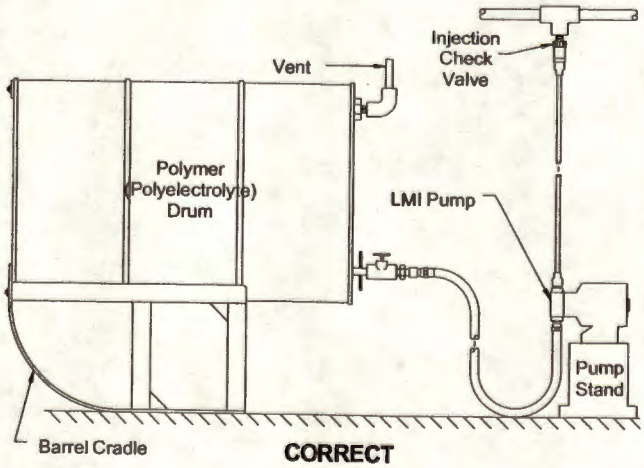
When pumping downhill or into low or no pressure system, a back pressure/anti-syphon device should be installed to prevent overpumping or syphoning.

Note

Although popular for all solutions, LMI recommends flooded suction installations for all high-viscosity fluid applications.

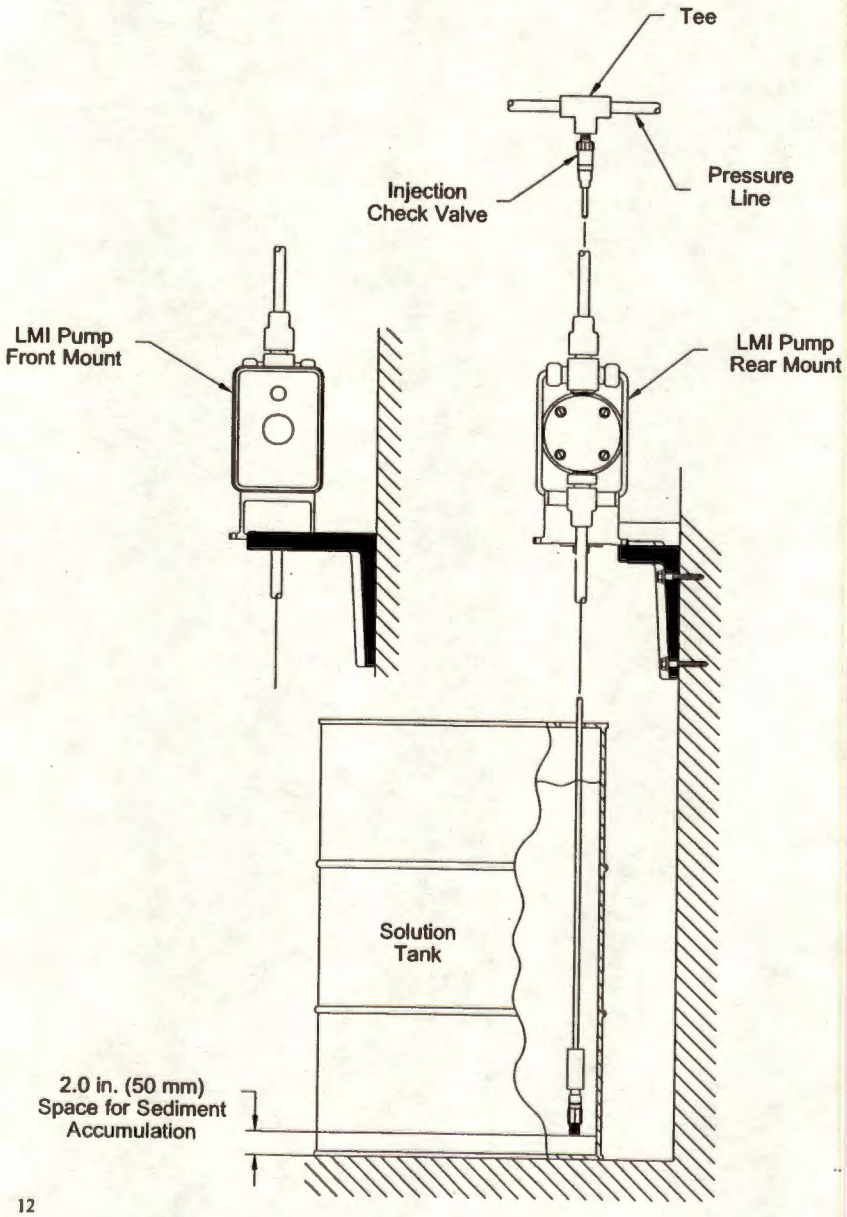


Avoid this type of false flooded suction.



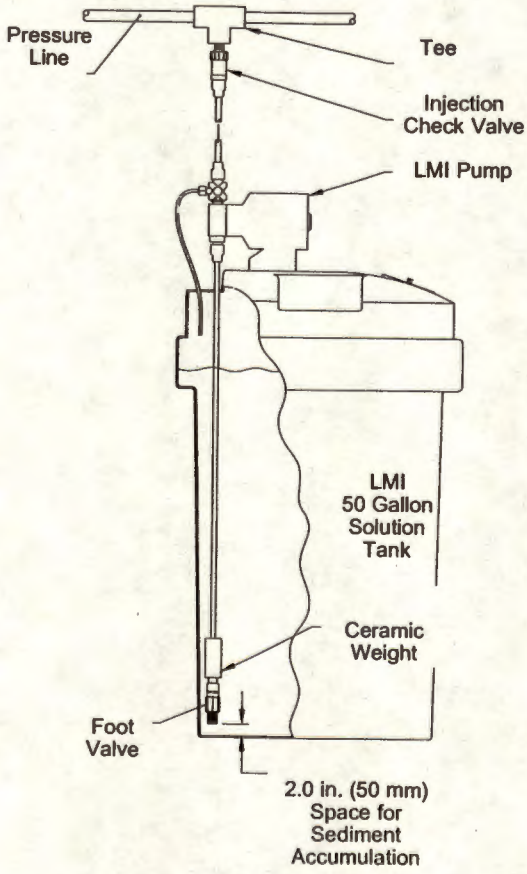
4.2.2 Suction Lift - Wall Bracket Mount

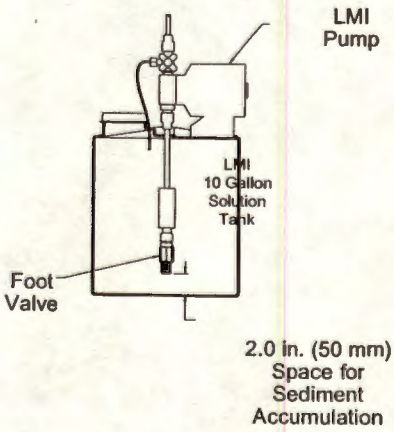
The pump may be mounted using an LMI Wall Mount Bracket Assembly (part no. 34643) directly above the solution tank. A pump mounted in this manner allows for easy changing of solution tanks or drums.



4.2.3 Suction Lift - Tank Mount

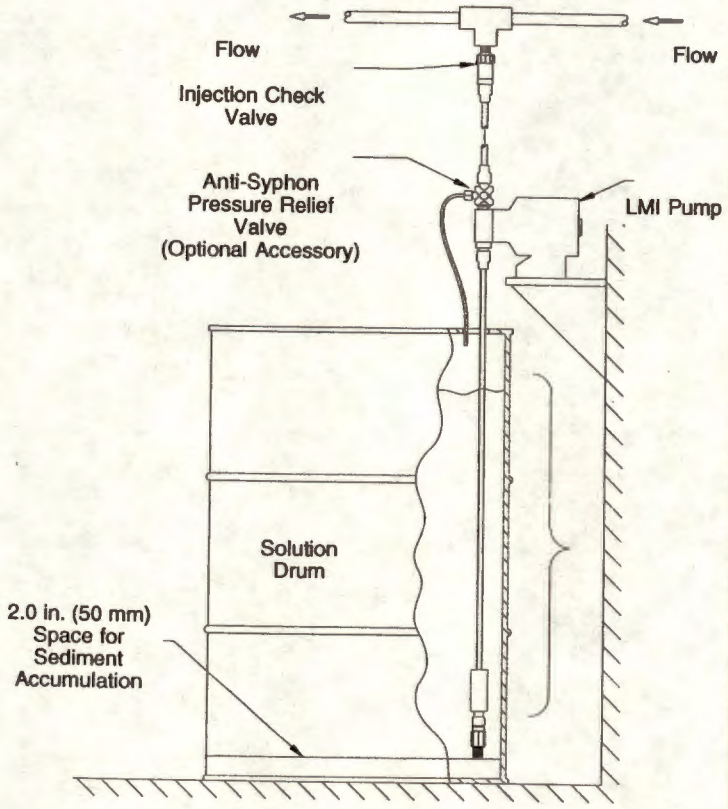
The pump may be mounted on a molded tank provided there is a recess to keep the pump stationary. LMI 10-gallon tank (part no. 27421), 35-gallon tank (part no. 27400), and 50-gallon tank (part no. 26350) have molded recesses for pump mounting.





4.2.4 Suction Lift - Shelf Mount

The pump may be mounted on a shelf (customer supplied) maintaining a suction lift of less than 5 ft (1.5 m). An LMI mounting kit (part number 10461) is available for securing the pump to a shelf.



4.3 Tubing Connections

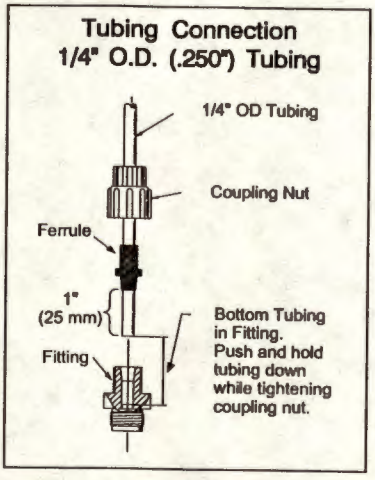
A. Use only LMI tubing.

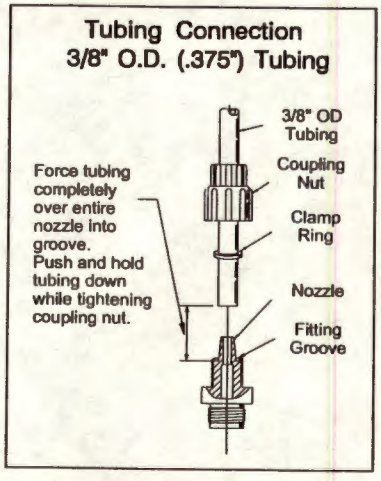
B. ***DO NOT USE CLEAR VINYL TUBING ON THE DISCHARGE SIDE OF THE PUMP.*** The pressure created by the pump can rupture vinyl tubing.

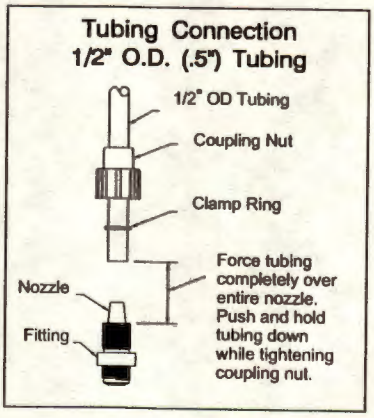
C. Before installation, all tubing must be cut with a clean square end.

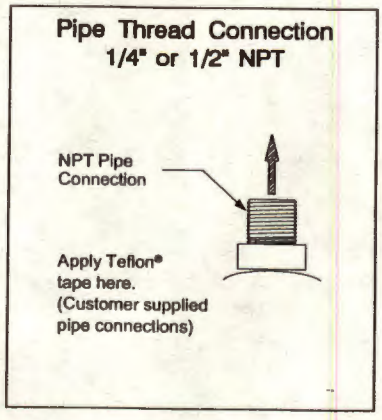
D. Valve and head connections from the factory are capped or plugged to retain pre-prime water. Remove and discard these caps or plugs before connecting tubing.

DO NOT USE PLIERS OR PIPE WRENCH ON COUPLING NUTS OR FITTINGS.









4.4 Multi-Function Valves

Your pump may be equipped with one of the following multi-function valves: 3-FV, 4-FV, Bleed 4-FV, or standard discharge valve. If your pump is not equipped with a multi-function valve and you feel it is needed in your application, it can be purchased as an accessory. Contact your local LMI stocking distributor.

4.4.1 Three Function Valve (3-FV)

1. **Pressure Relief**

   If the discharge line is over pressurized, the valve opens sending solution back to the supply tank.

2. **Line Depressurization**

   Opening the relief knob provides line drain back to the supply tank.

3. **Priming Aid**

   Opening the relief knob assists in priming the pump by venting the discharge line to the atmosphere.

4.4.2 Four Function Valve (4-FV)

1. **Pressure Relief**

   If the discharge line is over pressurized, the valve opens sending solution back to the supply tank.

2. **Line Depressurization**

   Opening the relief knob provides line drain back to the supply tank.

3. **Anti-Syphon**

   Prevents syphoning when pumping solution downhill or into a vacuum.

4. **Back Pressure**

   Supplies approximately 25 psi back pressure to prevent overpumping when little or no system back pressure is present.

4.4.3 Bleed Four Function Valve (Bleed 4-FV)

1. **Line Depressurization**

   Opening the relief port provides line drain back to the supply tank.

2. **Anti-Syphon**

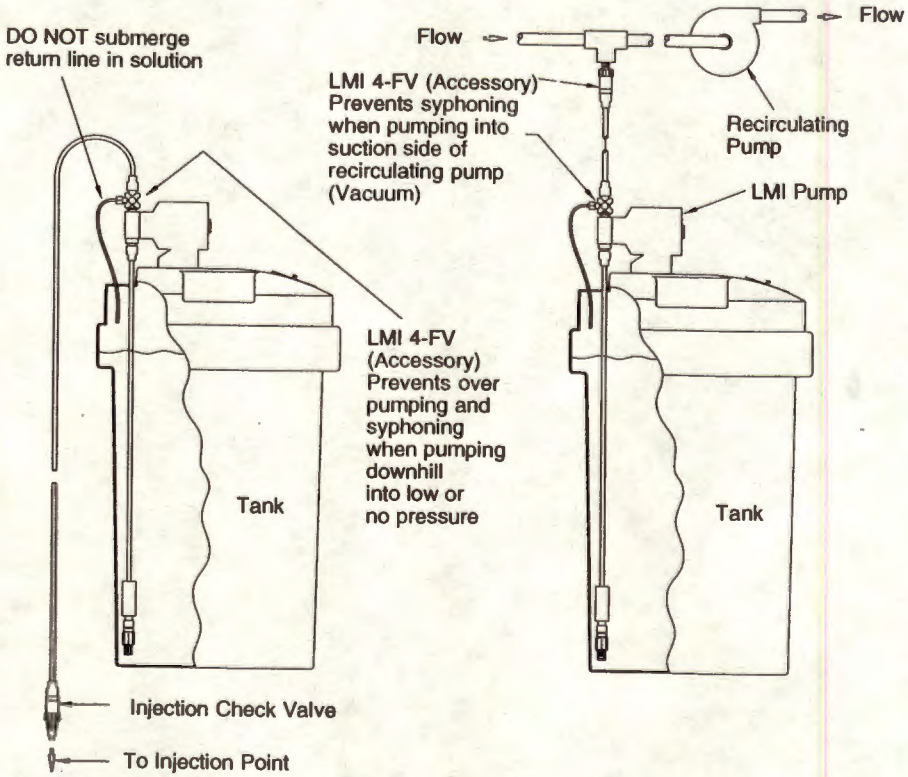
   Prevents syphoning when pumping solution downhill or into a vacuum.

3. **Back Pressure**

   Supplies approximately 25 psi back pressure to prevent overpumping when little or no system back pressure is present.

4. **Bleed Function**

   Manually adjusted valve provides continuous bleed of entrapped vapors from Sodium Hypochlorite or Hydrogen Peroxide.



Typical 4-FV Installation

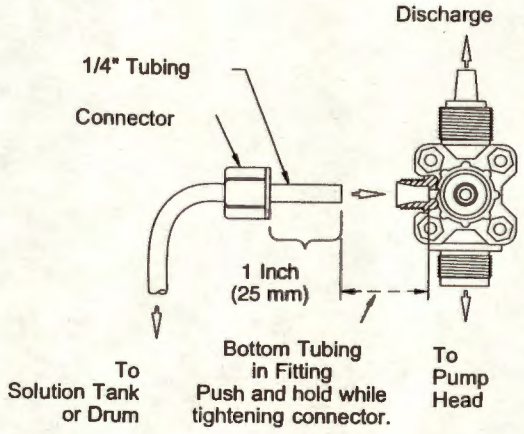
4.5 Multi-Function Valve Installation

To install the multi-function valve, remove the yellow screw cap on the top of the pump head and screw in the valve so that it contacts the seal ring. An additional 1/8 - 1/4 turn may be necessary to prevent leakage.

1/4" O.D. tubing connects to the side of the valve and acts as a return line to the solution tank. To ensure priming, this tubing must **NOT** be submerged in the solution.

CAUTION

This return line tubing must be secured to ensure pumped solution will safely return to supply tank.



Multi-Function Valve Tubing Connection

4.6 Foot Valve/Suction Tubing Installation

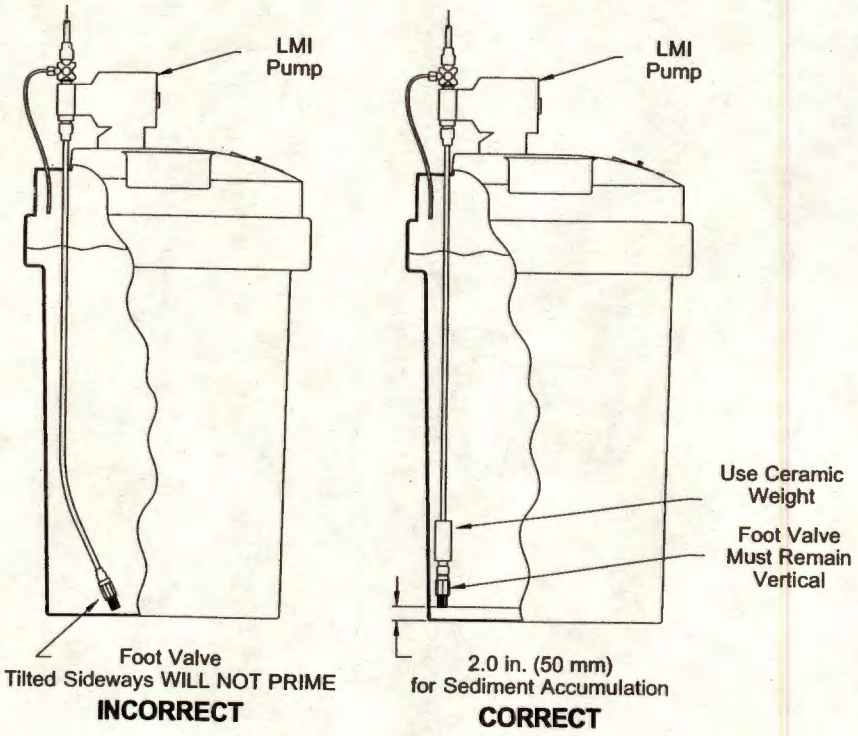
The Foot Valve acts as a check valve to keep the pump primed in suction lift applications.

The foot valve is designed to be submersed in the solution tank or drum and must sit in a vertical position at the bottom. Position approximately 2 inches (50 mm) off the bottom if the tank or drum contains sediment.

Pump models equipped with high-viscosity liquid ends are not equipped with foot valves. Flooded suction is recommended. A 1/2" NPT connector is included for flooded suction installations.

The ceramic weight, when installed, positions the foot valve in a vertical position.

1. Attach the foot valve to one end of the suction tubing (see Tubing Connections, Section 4.3).
2. Slide the ceramic weight over the tubing end until it contacts the top of the foot valve coupling nut.
3. Place foot valve and tubing into the solution tank. Check that the foot valve is vertical and approximately 2 inches (50 mm) from the bottom of the tank or drum (see illustration). Connect the other end of the tubing to the suction side of the pump head (bottom side) (see Tubing Connections, Section 4.3).



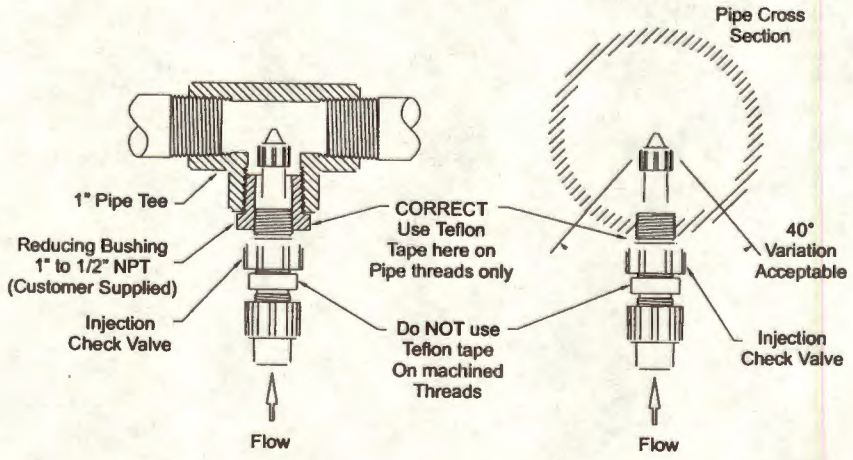
Proper Foot Valve Position

4.7 Injection Check Valve and Discharge Tubing Installation

The Injection Check Valve prevents backflow from a treated line. Connect the Injection Check Valve to your "DISCHARGE" (outlet) line. Any size NPTF fitting or pipe tee with a reducing bushing to 1/2" NPTF will accept the injection check valve. Use Teflon® tape or pipe dope to seal the pipe threads ***only***.

When installing the Injection Check Valve, be sure to position it so that the valve enters the bottom of your pipe in a vertical position. Variations left and right within 80° are acceptable (see illustration below).

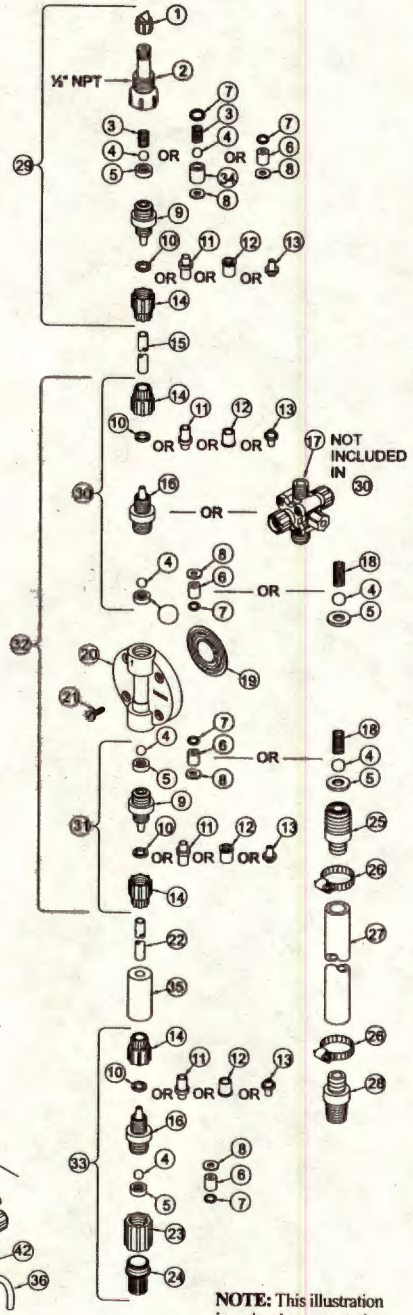
After cutting an appropriate length of tubing, connect tubing to the injection check valve then back to the discharge side of the pump head valve or discharge fitting (top side), making sure it does not crimp or come into contact with hot or sharp surfaces (see Tubing Connections, Section 4.3).

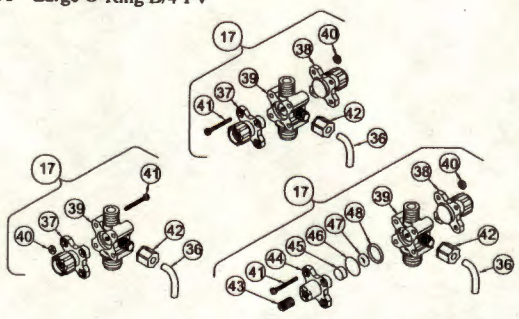


Typical Injection Check Valve Installations

5.0 Liquid End Parts List

1 Flapper valve
2 Injection check valve body
3 Injection check valve spring
4 Check valve ball
5 Seal ring
6 Cartridge valve
7 Cartridge valve o-ring
8 Cartridge valve washer
9 Valve seat
10 Clamp ring
11 Ferrule
12 Clamp sleeve
13 Tubing adapter
14 Coupling nut
15 Discharge tubing
16 Valve housing
17 Multi-function valve
18 High-viscosity spring
19 Liquifram
20 Pump head
21 Pump head screw
22 Suction tubing
23 Foot valve seat
24 Foot valve screen
25 High-viscosity valve seat
26 H.V. tubing clamp
27 H.V. suction tubing
28 H.V. Tubing x 1/2 NPT connector
29 Injection check valve assembly
30 Discharge valve assembly
31 Suction valve assembly
32 Pump head assembly
33 Foot valve assembly
34 Injection Seat PTFE
35 Ceramic Weight
36 Return Line
37 Cap ASM (Black Knob)
38 Cap ASM (Yellow Knob)
39 Multi-Function Valve Body
40 Nut Multi-Function Valve
41 Screw Multi-Function Valve
42 Return Line Coupling Nut
43 Adjustment Screw B/4-FV
44 Cap B/4-FV
45 Plug B/4-FV
46 Gasket B/4-FV
47 Small O-Ring B/4-FV
48 Large O-Ring B/4-FV





NOTE: This illustration is a visual representation of all LE components. Liquid ends will not include all parts shown.

6.0 Start-up and Adjustment

a.) The pump is normally self-priming if suction lift is 5 ft (1.5m) or less and the steps below are followed.

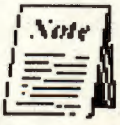
b.) Pumps are shipped from the factory with water in the pump head to aid in priming.

6.1 Output Adjustment Controls

Manual series pump controls are not equipped with pressure control.

1. Pressure Control Adjustment (if equipped): Pressure control provides the adjustment of the pump's pressure capability and power consumption, reducing heat, pipe shock and pulsation while increasing pump life. See Section 7.0 after priming for proper adjustment settings.
2. Speed Adjustment (Upper Knob) (if equipped): Speed control provides adjustment of the percent of maximum strokes per minute. Turning this knob clockwise increases stroke frequency (speed).
3. Stroke Adjustment (Lower Knob): Stroke control provides adjustment of the percent maximum of solution discharged during each pump actuation. Turning this knob clockwise ↻ increases solution displacement.

***A7 and P7 Only**: When operating the pump in external mode, the speed control knob should be turned fully counter-clockwise ↺.*



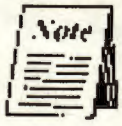
***A34 and A37 Only:** Pump comes equipped with a range selector switch which provides high or low speed adjustment. The high setting provides speed adjustments between 8 and 100 strokes per minute. The low setting provides accurate speed adjustments between 1 and 12.5 strokes per minute for applications requiring infrequent stroking.*

6.2 Start-Up/Priming for Pump Supplied with Multi-Function Valve

Read this entire section completely before proceeding.

When all precautionary steps have been taken, the pump is mounted, and the tubing is securely attached, you may now start priming the pump.

1. Plug in or switch the pump on.
2. While the pump is running, set the speed knob at 80% and the stroke knob at 100%.



If the pump is equipped with pressure control, turn fully clockwise.↶

3. 1/4 turn open the relief side (black knob) of the multi-function valve.

3A. (Bleed 4FV only) With screwdriver rotate bleed adjustment screw counter-clockwise ↶. 2 full turns. When solution begins to flow through translucent bleed return tubing, the pump is primed. Stop pump.

4. The suction tubing should begin to fill with solution from the tank.
5. A small amount of solution will begin to discharge out the return line of the multi-function valve. Once this happens, 1/4 turn or release the knob and **SHUT THE PUMP OFF**. (If pump is not equipped with an on/off switch, disconnect the power cord.)
6. The pump is now primed.

6A. (Bleed 4FV only)

a. Start pump and let pump inject solution into the discharge line.

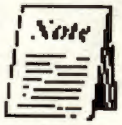
b. Close the bleed adjustment screw by rotating it clockwise ↶ with a screwdriver.

c. Now adjust the pump stroke length and/or speed (frequency) to a range approximately 25% higher than you would normally want for the process.

d. Slowly rotate bleed adjustment screw counter-clockwise ↶. until just a small amount of solution begins to trickle

down inside the bleed return tubing. A small amount of solution pumped back to the tank with each stroke of the pump will allow gas and air to escape without air or gas locking in the pump head.

7. Proceed to output adjustment, Section 6.4.



If the pump does not self-prime, remove the multi-function valve on the discharge side of the pump head. Remove the check valve and pour water or solution into the port until the head is filled. Replace valve, then follow start up/priming steps.

6.3 Start-Up/Priming without Multi-Function Valve

Read this entire section completely before proceeding.

When all precautionary steps have been taken, the pump is mounted, and the tubing is securely attached, you may now prime the pump.

1. Plug in or switch on the pump.
2. While the pump is running, set the speed knob at 80% and the stroke knob at 100%.

If the pump is equipped with pressure control, turn fully clockwise ↻.

3. The suction tubing should begin to fill with solution from the tank.
4. Once the solution begins to exit the pump head on the discharge side, **SHUT THE PUMP OFF**. (If pump is not equipped with an on/off switch, disconnect the power cord).
5. The pump is now primed.

6. Proceed to output adjustment, Section 6.4.

If the pump does not self-prime, remove the fitting on the discharge side of the pump head. Remove the ball and pour water or solution into the port until the head is filled. Replace valve, then follow start up/priming steps.

6.4 Output Adjustment

Once the pump has been primed, an appropriate output adjustment **MUST** be made. Pump output should be calculated and adjustments made accordingly.

6.5 Total Pump Output

Calculate the total output of the pump as follows:

PUMP OUTPUT = MAX PUMP OUTPUT x % SPEED x % STROKE

Example: A151-392SI

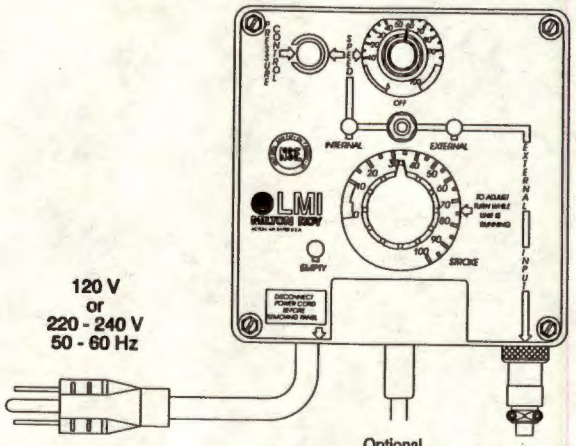
Use MAX Output (from dataplate on bottom center of pump control panel) = 24 GPD (24 gallons per day).

If the pump is set at 60% speed and 70% stroke length, the approximate pump output is:

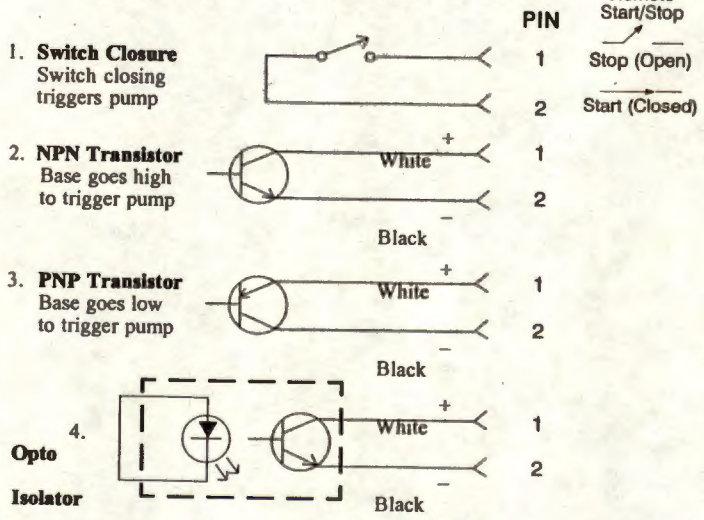
24.0 x 0.60 x 0.70 = 10.08 GPD (gallons per day). Divide by 24 (hours in one day) to calculate in gallons per hour.

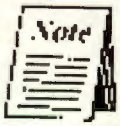
If pump is not equipped with speed adjustment, calculate by ***Max Pump Output x % Stroke*** *only.*

7.0 Methods of Externally Triggering

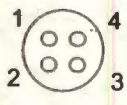


Method of Triggering LMI Pump Through 4-Pin Connector

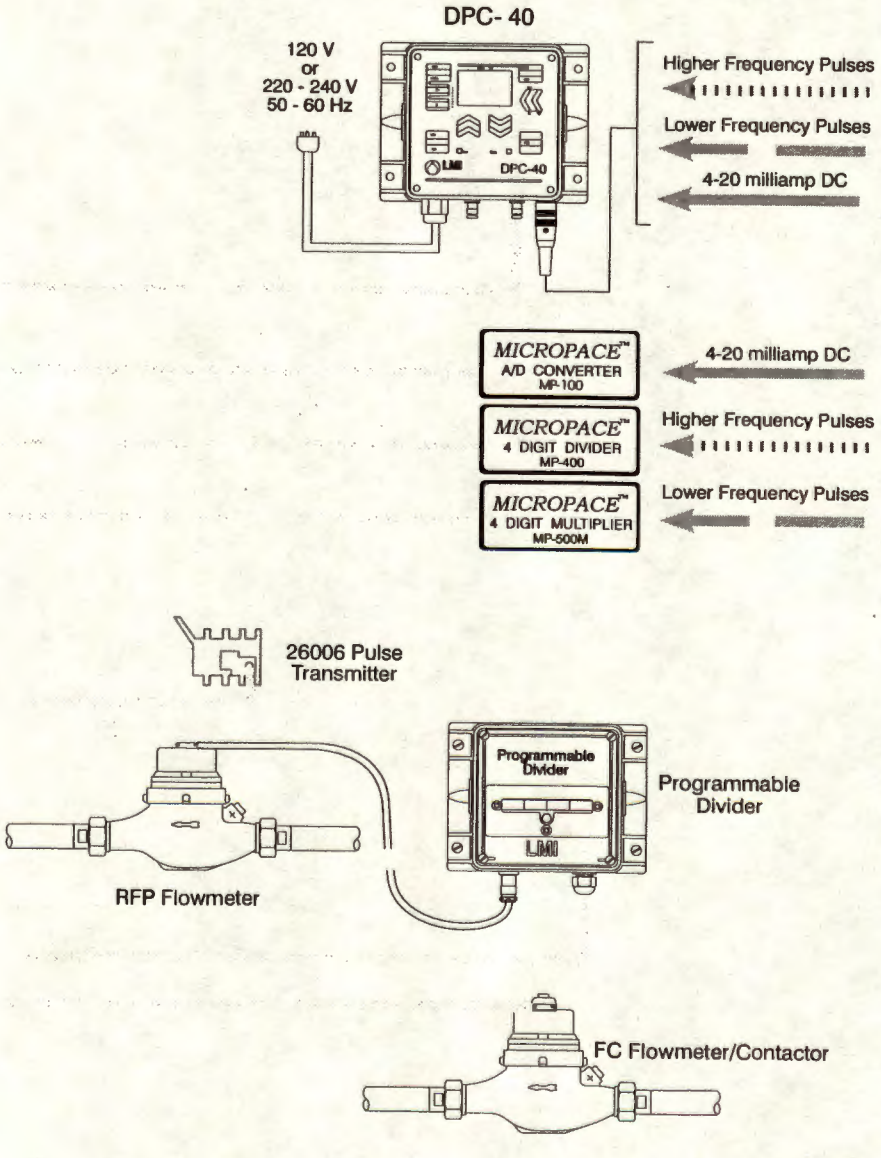




Switch or transistors must be capable of switching 15V DC at 2 milliamperes. Minimum time in low impedance state (ON) is 50 milliseconds. Minimum time in high impedance state (OFF) is 100 milliseconds.



or Pacing A7, B7, C7 and P7 Pumps



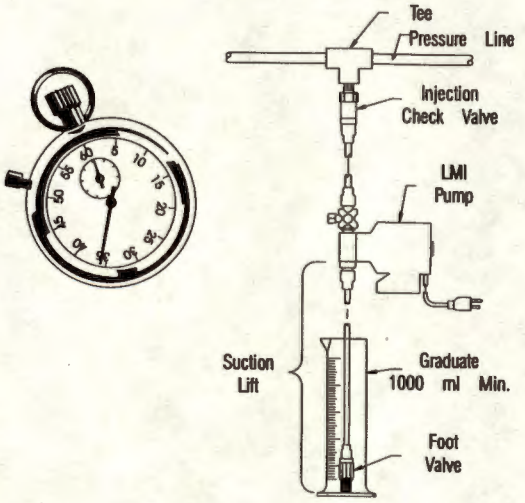
8.0 Calibration

Once installation is complete and the approximate output has been determined, the pump should be calibrated to adjust speed and stroke for your actual desired output. (Calibration cylinders may be purchased from your local LMI distributor, ref. publication 1798.)

1. Be sure the pump is primed, and discharge tubing and Injection Check Valve are installed as they would be in normal service (i.e., including factors such as injection pressure, fluid viscosity, and suction lift).
2. Place the Foot Valve in a graduated container with a volume of 1000 ml or more.
3. Plug in and switch pump to Internal Mode. Pump until all the air is exhausted from the suction line and head.
4. Turn the pump off. Refill graduated container to a level starting point.

If pump is equipped with pressure control, see Section 8.1 before proceeding.

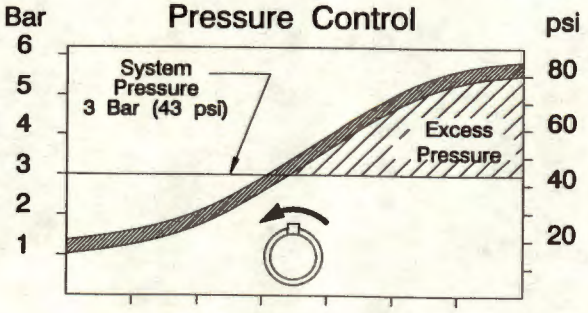
5. Using a stopwatch or timer, turn the pump on for a measured amount of time (50 pump strokes minimum). The longer the time period, the more confident you can be of the results. Be sure to count the number of strokes during the calibration period when making comparisons.
6. Turn the pump off. Note the time elapsed in relation to volume displaced in the graduate. Now, calculate the output in the time unit you choose (minutes, hours, days, etc.).
7. If the output is too low or too great, adjust speed and or stroke, estimating required correction and repeat steps 1-7.



8.1 Pressure Control

Adjust Pressure Control: While unit is running, turn Pressure Control Potentiometer slowly counter-clockwise ↺ until unit just begins to stall. From this stall point, now turn Pressure Control Potentiometer clockwise ↻ halfway between the stall point and maximum setting. This is the optimum pressure control setting for your application.

Increase setting if back pressure is increased. Adjusting pressure control decreases pressure rating of pump.



Adjust pressure control to reduce heat, shock, and pulsations; and to prolong pump life.

8.2 Calibration Procedure - On-Site Volumetric Calibration in External Mode

1. Since pump output is governed by an external device such as Flowmeter-Pulser, Liquitron™ Controller, or 4-20 mA DC signal from an instrument with an LMI Analog-to-Digital Converter, **only the output per stroke may be calibrated**.
2. With pump primed and discharge tubing connected to the injection point as it would be in normal service, place Foot Valve Assembly in a graduated container with a volume of 1000 ml or more.
3. Switch pump to **Internal** mode with Speed Knob set at 100 until air is exhausted from suction line and pump head.
4. **Adjust Pressure Control (if desired)** - See Section 8.1.
5. Switch pump **OFF** and note solution level in graduated container. Refill graduate to a starting point.
6. Switch pump **ON** and **count the number of strokes** for exactly one minute, then switch pump **OFF**.
7. Note volume pumped during the calibration period of one minute. Divide into this the number of strokes to determine the volume of solution pumped per stroke.

   Example: 500 ml in 100 strokes = 5.0 ml per stroke.

Multiply this by your expected stroke rate per minute, per hour or per day and compare with desired output requirements.

8. Adjust Stroke Length Knob (lower knob) to your best estimate of required correction and repeat calibration procedure.

9.0 Spare Parts Replacement Routine Maintenance

9.1 Depressurizing the Discharge Line (For Pumps Equipped with a 3-FV or a 4-FV only)

ALWAYS wear protective clothing, face shield, safety glasses and gloves when performing any maintenance or replacement on your pump.

Read steps 1 and 2 below before proceeding.

1. Be sure the Injection Check Valve is properly installed and is operating. If a shut off valve has been installed downstream of the Injection Valve, it should be closed.

Be sure your relief tubing is connected to your multi-function valve and runs back to your solution drum or tank.

2. 1/4 turn the black knob on the valve. The discharge line is now depressurized. Keep valve open until solution drains back down the discharge tubing into solution drum or tank. Then 1/4 turn knob to normal position.

9.2 Liquifram™ (Diaphragm) Replacement

ALWAYS wear protective clothing, face shield, safety glasses and gloves when working near or performing any maintenance or replacement on your pump. See MSDS information from solution supplier for additional precautions.

LMI metering pumps are designed for trouble-free operation, yet routine maintenance of elastomeric parts is essential for optimum performance. This involves replacing the Liquifram™, cartridge valves or seal rings/valve balls, multi-function valve cap assemblies and the injection check valve spring. LMI recommends replacing these parts at least once a year; however, frequency will depend on your particular application.

When replacing the Liquifram™ and the cartridge valves or seal rings/valve balls, the injection check valve spring should also be replaced (see next Section 9.3). A Spare Parts Kit (SP-#) or RPM Pro Pac™ kit containing these parts may be obtained from your local distributor.

Replacing the Liquifram™:

1. Carefully depressurize, drain, and disconnect the discharge line (see Section 8.1 in this manual). Place the Foot Valve into a container of water or other neutralizing solution. Turn the pump on to flush the head assembly. Once the pump head has been flushed, lift the Foot Valve out of the solution and continue to pump air into the pump head until the pump head is purged of water or neutralizing solution.

If the liquid cannot be pumped due to Liquifram™ rupture using protective clothing, gloves and face shield, carefully disconnect the suction and discharge tubing. Remove the four screws to the head and immerse the head in water or other neutralizing solution.

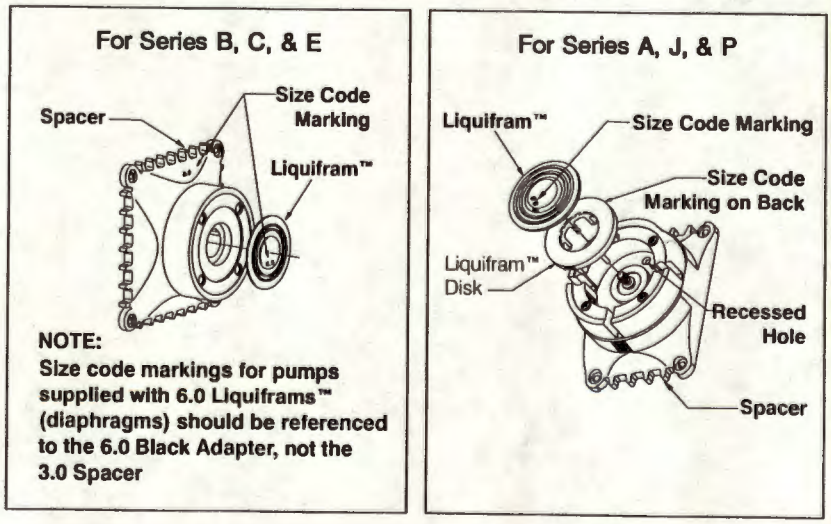
2. Start the pump. While running, set the stroke knob to zero and turn the pump off.

See Section 10.0 for proper zero

3. With the unit off, unscrew the Liquifram™ by carefully grasping the outer edge and turning it counter-clockwise ↺. Discard old Liquifram™. Remove the Liquifram™ disk if so equipped (located behind the Liquifram™) and check that the size code matches the size code on the replacement Liquifram™ (see illustration).

4. Reinstall the disk so the alignment pin on the disk (if present) seats in the recessed hole in the EPU.

CAUTION ***Be careful not to scratch the Teflon® face of the new Liquifram™.***



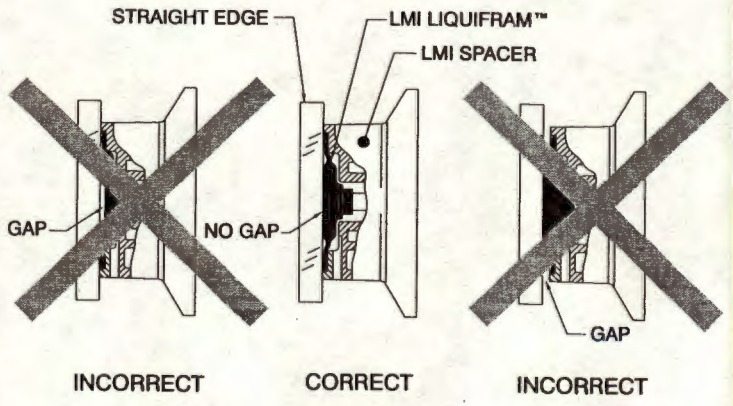
5. Start the pump and turn the stroke knob to the setting indicated on the following Stroke Setting Chart which matches the pump series number located on the pump dataplate. With the pump stroking (running), screw on the new Liquifram™ clockwise ↻ until the center begins to buckle inwards. Stop the pump.

Liquifram™ Stroke Setting Chart

Pump Series	Stroke Knob Setting
All A, B, J, P, Z Series C10, C11, C12, C70, C71, C72, C76, C90, C91, C92, E70, E71, E72	90%
All L Series	85%
C78	50%
C13, C14, C73, C74, C77, C93, C94, E73, E74	70%
All M Series	100% *

* Liquifram™ on M Series pumps only, must be bottomed completely (turned all the way in). ***Do Not Use Straight Edge.***

6. Grasp the outer edge of the Liquifram™ and adjust by screwing it in or out so that the center of the Liquifram™ is flush with the outside of the spacer edge (see illustration below).



(Liquifram™ is flush with spacer and straight edge.)

7. Once the Liquifram™ is properly positioned, remount the pump head to the spacer using the four (4) screws. Tighten in a criss-cross pattern. After one week of operation, recheck the screws and tighten if necessary.

9.3 Cartridge Valves, Seal Rings/Valve Balls and Injection Check Valve Spring Replacement

ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or performing any maintenance or replacement on your pump. See MSDS information from solution supplier for additional precautions.

1. Refer to the LMI Metering Pump Price List for the proper Spare Parts Kit or RPM Pro Pac™ kit number or contact your local LMI stocking distributor.
2. Carefully depressurize and disconnect the discharge line (see Section 9.1 in this manual). Place the Foot Valve into a container of water or other neutralizing solution. Turn the pump on to flush the head assembly. Once the pump has been flushed, lift the Foot Valve out and continue to pump to let air into the pump head until pump is purged of water or neutralizing solution.

   Once the pump has been flushed, lift the Foot Valve out and continue to let air into the pump head until pump is purged of water or neutralizing solution.

   If the liquid cannot be pumped due to Liquifram™ rupture, with protective clothing, gloves and face shield, carefully disconnect the tubing and four screws to remove the head. Immerse the head in water or other neutralizing solution.

   Spare part replacement kits include specific instructions for valve replacement. Please follow the instructions included with the replacement kit.

***IMPORTANT**: Before disassembling the check valves, note the orientation of the valve.*

3. Carefully disconnect one tubing connection and fitting at a time, then remove and replace the worn valve.

   If necessary, carefully loosen stuck valves by prying side to side using a small screwdriver through the center hole of the valve.
4. Install new check valves in each location.

IMPORTANT: *Note correct orientation of each check valve.*

5. Install the new spring in the Injection Check Valve.

Depressurize and drain pipeline (or isolate I.C.V. point using valves) so that I.C.V. can safely be disassembled.

10.0 Checking Pump for Proper Zero Position (Stroke Knob)

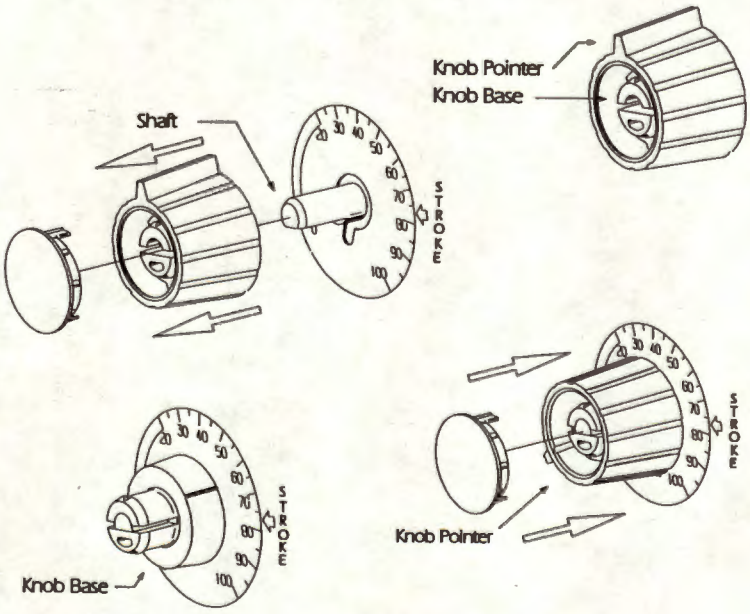
1. With pump running, turn stroke knob counter-clockwise ↺ toward zero or end of black or red band on dial.
2. LISTEN to the clicking as the pump is running. The pump should operate quietly at the zero position (no clicking).
3. If the pump continues to click at zero or stops clicking before zero is reached, the pump zero must be reset (see Section 10.1 or 10.2).

10.1 Type I - Push on Knob Re-Zeroing and Stroke Knob Disassembly and Assembly

1. Remove stroke knob from the pump by grasping the knob firmly and pulling it toward you.
2. Pry off the yellow cap.
3. Place the knob on a flat surface.
4. Using needle-nose pliers, squeeze the inner section together while lifting the outer section up.
5. Push the inner section back onto the "D" shaped stroke shaft.
6. With the pump running, zero the pump by turning the inner section of the knob counter-clockwise ↺ until the pump stops clicking.

7. Position the outer section of the knob so that the pointer aligns with zero on the nameplate or end of the black or red band.
8. Push down on the outer section (a snap sound indicates parts are locked together).
9. Replace the yellow cap over the outer section of the knob, aligning the tabs on the cap with the slots inside the knob.

Stroke Knob Assembly (Type I)



10.2 Type II Collet Knob
Re-Zeroing and Stroke Knob Disassembly and Assembly

1. Remove Yellow Cap.
2. Hold knob with soft jaw pliers.
3. Disconnect knob by loosening 5/16" (8 mm) collet nut. There is no need to remove nut.
4. Remove knob by pulling towards you.
5. With pump running, zero the pump using a screw driver to turn the stroke shaft counter-clockwise ↺ until the pump just stops clicking.
6. Pump is now zeroed.
7. Position knob at zero, or the end of the low range band, and tighten 5/16" (8 mm) collet nut.
8. Replace yellow cap.

11.0 Troubleshooting

PROBLEM	POSSIBLE CAUSE
Pump Will Not Prime	1. Pump not turned on or plugged in.
	2. Output dials not set properly.
	3. Foot Valve not in vertical position on bottom of tank.
	4. Pump suction lift too high.
	5. Suction tubing is curved or coiled in tank.
	6. Fittings are over tightened.
	7. Air trap in suction valve tubing.
	8. Too much pressure at discharge. (Pumps without multi-function valve.)
Pump Loses Prime	1. Solution container ran dry.
	2. Foot Valve is not in a vertical position on the bottom of the tank.
	3. Pump suction lift is too high.
	4. Suction tubing is curved or coiled in tank.
	5. Fittings are over tightened.
	6. Air trap in suction valve tubing.
	7. Air leak on suction side.

	SOLUTION
	1. Turn on pump/plug in pump.
	2. Always prime pump with speed at 80% and stroke at 100%.
	3. Foot Valve must be vertical (see Foot Valve Installation, Section 4.6).
	4. Maximum suction lift is 5 ft (1.5 m). Pumps with High Viscosity Liquid Handling Assemblies require flooded suction.
	5. Suction tubing must be vertical. Use LMI tubing straightener supplied with pump (see Section 4.6).
	6. Do not overtighten fittings. This causes seal rings to distort and not seat properly which causes pump to leak back or lose prime.
	7. Suction tubing should be as vertical as possible. AVOID FALSE FLOODED SUCTION! (see Section 4.2.1).
	8. Shut off valves in pressurized line. Disconnect tubing at injection check valve (see Priming Section 6.0). When pump is primed, reconnect discharge tubing.
	1. Refill container with solution and reprime (see Section 6.0).
	2. Foot Valve must be vertical (see Foot Valve Installation, Section 4.6).
	3. Maximum suction lift is 5 ft (1.5 m). Pumps with High Viscosity Liquid Handling Assemblies require flooded suction.
	4. Suction tubing must be vertical. Use LMI tubing straightener supplied with pump (see Section 4.6).
	5. DO NOT OVERTIGHTEN FITTINGS. This causes seal rings to distort and not seat properly which caused pump to leak back or lose prime.
	6. Suction tubing should be as vertical as possible. AVOID FALSE FLOODED SUCTION! (see Section 4.2.1).
	7. Check for pinholes, cracks. Replace if necessary.

Troubleshooting (continued)

PROBLEM	POSSIBLE CAUSE
Leakage at tubing	1. Worn tubing ends.
	2. Loose or cracked fitting.
	3. Worn seal rings.
	4. Solution attacking Liquid Handling Assembly material.
Low Output or Failure to Pump Against Pressure	1. Pump's maximum pressure rating is exceeded by injection pressure.
	2. Worn Seal Rings.
	3. Ruptured Liquifram™.
	4. Incorrect stroke length.
	5. Tubing run on discharge may be too long.
	6. Clogged Foot Valve strainer.
Failure to Run	1. Pump not turned on or plugged in.
	2. EPU failure.
	3. Pulser failure.
Excessive Pump Output	1. Syphoning. (Pumping downhill without a multi-function valve).
	2. Little or no pressure at injection point.
	3. Excessive strokes per minute.

	SOLUTION
	1. Cut about 1 in (25 mm) off tubing and then replace as before.
	2. Replace fitting if cracked. Carefully hand tighten fittings. *DO NOT USE PIPE WRENCH.* Once fitting comes into contact with seal ring, tighten an additional 1/8 or 1/4 turn.
	3. Replace balls and seal rings (see Section 8.3) Spare Parts (SP-#).
	4. Consult your local distributor for alternate materials.
	1. Injection pressure cannot exceed pump's maximum pressure. See pump data plate.
	2. Worn seal rings or cartridge valves may need replacement (see Section 9.3). Spare Parts (SP- #), or RPM Pro Pac™ kit.
	3. Replace Liquifram™ (see Section 9.2).
	4. Check zero on pump/Re-zero pump (see Section 10.0).
	5. Longer tubing runs may create frictional losses sufficient to reduce pump's pressure rating. Consult factory for more information.
	6. Remove Foot Valve strainer when pumping slurries or when solution particles cause strainer to clog.
	1. Turn on or plug in pump.
	2. Disassemble pump and measure the resistance of the EPU across the EPU wires. Resistance reading should be in accordance to the EPU Resistance Chart (see Section 12.0). Also, check EPU leads to ground. Consult supplier or factory.
	3. The pulser should be replaced if EPU checks out OK. Consult supplier or factory.
	1. Move injection point to a pressurized location or install an LMI 4-FV (see Section 4.4).
	2. If pressure at injection point is less than 25 psi (1.7 Bar), an LMI 4-FV should be installed (see Section 4.4).
	3. Replace pulser or resistor. Consult factory.

12.0 EPU Resistance Chart

Pump Series	Voltage	Coil Resistance (Ohms) @ 20° C (68° F)*
A14, A15, A16, A34 A74, A75, A76 A94, A95, A96 J02, J03, J04, J05, J06 J13, J15, J16 PW4, PW5, PW6 P04, P05, P06 P08, P14, P15 P16, P18, P74 P75, P76, P78	115 VAC 230 VAC	76 - 87 307 - 353
(see Note 1) A17, A37, A77, A97, A18, A78 P02,P03 P12,P13	115 VAC 230 VAC	152 - 176 583 - 671
(see Note 2) A17, A37, A77, A97, A18, A78 P02, P03 P12, P13	115 VAC 230 VAC	76- 87 291- 335
J54D, J55D, J56D	12 VDC	1.1 - 1.3
D10, D11, D12, D13, D14 D70, D71, D72, D73, D74	115 VAC 230 VAC	25.7- 29.6 97 - 112
E70, E71, E72, E73, E74	115 VAC 230 VAC	22.8 - 26.2 91 - 105
B11, B12, B13, B14 B71, B72, B73, B74	115 VAC 230 VAC	43 - 49 167 - 193
C10, C11, C12, C13, C14 C70, C71, C72, C73, C74	115 VAC 230 VAC	22.8 - 26.2 91 - 105
C76, C77, C78	115 VAC 230 VAC	14.4 - 16.6 57.7 - 66.3

* Let pump cool down completely before checking resistance. EPU checked within 10 hours of operation can increase coil resistance reading as much as 20%.

NOTES:

1. Pumps with serial numbers **LOWER** than: **960113429**
2. Pumps with serial numbers **HIGHER** than: **960113429**

LMI MILTON ROY

8 Post Office Square
Acton, MA 01720 USA
TEL: (978) 263-9800
FAX: (978) 264-9172
http://www.lmipumps.com

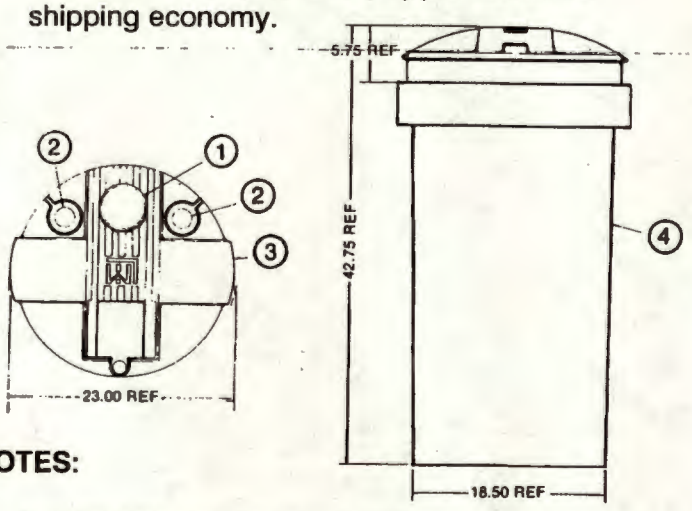
Information Sheet

Polyethylene Tank and Cover Assembly and Accessories

MODEL NO. 26350
50 GALLON TANK ASSEMBLY

- Ultraviolet resistant, molded yellow polyethylene tank.
- High rigidity black polyethylene cover with molded recess for mounting of pump, agitator* and liquid level switch.
- 5 gallon (20 liter) graduations
- Self supporting, tapered sides.
- Suitable for most corrosive and noncorrosive solutions.
- Can be nested up to four (4) per carton for shipping economy.

Model No. 26350



COMPONENT PARTS

Ref No.	Part No.	Description	Qty
1	25985	Caplug Assembly Black Polyethylene	1
2	10346	Caplug Assembly Black Polyethylene	2
3*	26637	Cover, Black Polyethylene	1
4	25688	Tank, 50 Gallon Yellow Polyethylene	1

Shipping wt. 25 lbs (11.4 kg)

NOTES:

1. Full, flat bottom support required.
2. Maximum solution/ambient temperature 110° F (43° C)
3. Minimum solution/ambient temperature 0° F (-18°C)
4. Maximum weight limit for cover 50 lbs (23 kg)
5. Not suitable for use with concentrated organic solvents, oils and related materials.

Cover must be drilled at factory for agitator mounting. Please indicate your desire for this option when ordering.

LMI
LIQUID METRONICS DIVISION
MILTON ROY
A unit of Sundstrand Corporation

8 Post Office Square
Acton, MA 01720 USA
TEL: (978) 263-9800
FAX: (978) 264-9172
http://www.lmipumps.com

ISO9001

Replaces same of Rev. C 6/96
1057.D 3/97

METERS
- KWH
- Demand/Load Profiling
- Power Quality
- Wireless/ Multi-Family
- Outdoor KWH

METER OPTIONS & ACCESSORIES

ENERGY INTELLIGENCE SOFTWARE

ONLINE PROFILING & ANALYSIS

CUSTOMERS

Meters > KWH > E-MON D-MON Three Phase > Pricing Information

Meters

E-MON D-MON Three Phase KWH Meters Pricing Information

NOTE: Kits include one set of (3) split core current sensors

E-MON D-MON KWH Meter (1 display)
3 Phase, 120/208-240 Volt

Model Number	Amperage	Trade Cost
20825 Kit	25 Amp	$517.00
20850 Kit	50 Amp	$517.00
208100 Kit	100 Amp	$532.00
208200 Kit	200 Amp	$532.00
208400 Kit	400 Amp	$532.00
208800 Kit	800 Amp	$647.00
2081600 Kit	1600 Amp	$647.00
2083200 Kit	3200 Amp	$860.00

E-MON D-MON KWH Meter (1 display)
3 Phase, 277/480 Volt

Model Number	Amperage	Trade Cost
48025 Kit	25 Amp	$574.00
48050 Kit	50 Amp	$574.00
480100 Kit	100 Amp	$591.00
480200 Kit	200 Amp	$591.00
480400 Kit	400 Amp	$591.00
480800 Kit	800 Amp	$705.00
4801600 Kit	1600 Amp	$705.00
4803200 Kit	3200 Amp	$944.00

Related Links

Complete Specification Sheet (Downloadable PDF)
General Specifications
Engineering Specifications
Installation Diagrams
Technical Specifications

Send E-Mail

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

APPENDIX B

AIRSTRIPPER PACKAGE O&M MANUAL

ShallowTray®
low profile air strippers

Installation, Operation, & Maintenance Manual

North East Environmental Products, Inc.
7 Commerce Ave. West Lebanon New Hampshire 03784
Tel: 603-298-7061 Fax: 603-298-7063 Email: sales@neepsystems.com

TABLE OF CONTENTS

Special Cautions!

Prior to start-up:

• ***Connect the Interlock Switches.***
Connect the High Water Level Interlock, the Low Air Pressure/Vacuum Interlock, and the High Air Pressure/Vacuum Interlock (if required).

It is important that a qualified, licenced electrician perform these installations.

• ***Fill the Sump Tank and Stripper Tray Inlet Chambers.***
Fill the sump tank to a depth of at least 5 inches (12.7cm), and fill the seal pots on each tray. Use clean water only.
Please see Equipment Set-up in the Operationg Instructions section of this manual.

NEEP Systems

7 Commerce Ave.
West Lebanon, NH 03784
603-298-7061 Fax: 603-298-7063
www.neepsystems.com info@neepsystems.com

Section 1: Title Page

ShallowTray®

low profile air strippers

MODEL NUMBER

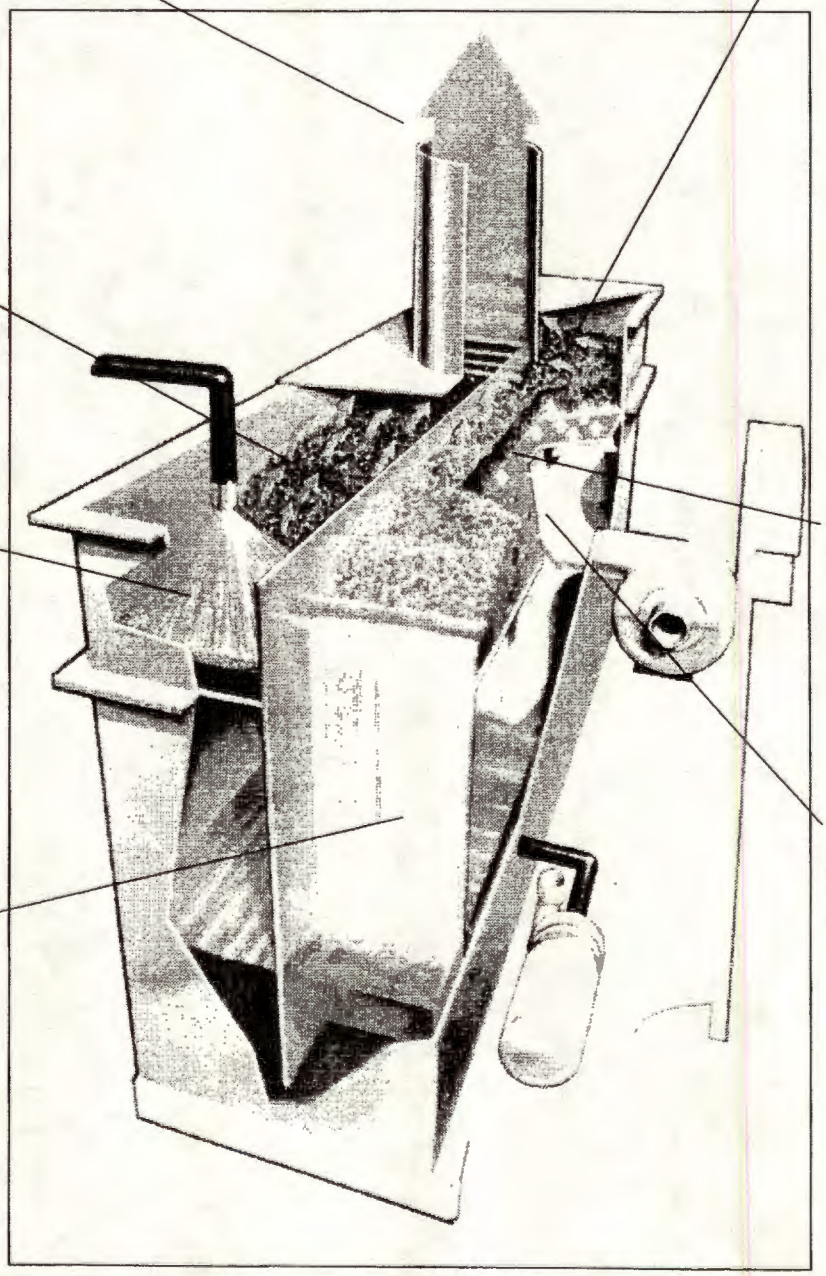
SERIAL NUMBER

Part Number 500-200-00560

North East Environmental Products, Inc.
7 Commerce Ave. West Lebanon New Hampshire 03784
Tel: 603-298-7061 Fax: 603-298-7063 Email: sales@neepsystems.com

Section 2: ShallowTray System

The ShallowTray Process



THE SHALLOWTRAY PROCESS

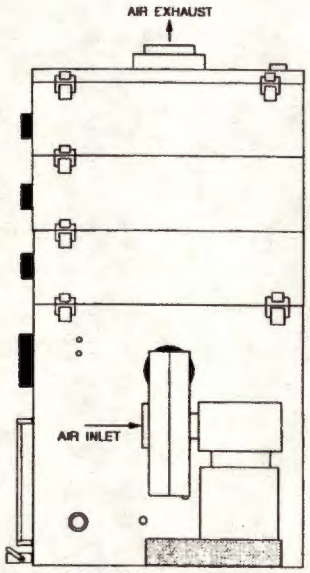
The Treatment Process

The purpose of air stripping is to treat contaminated groundwater for the removal of certain dissolved volatile organic compounds (VOC). The ShallowTray low profile air stripper is a compact, low-maintenance solution to groundwater treatment.

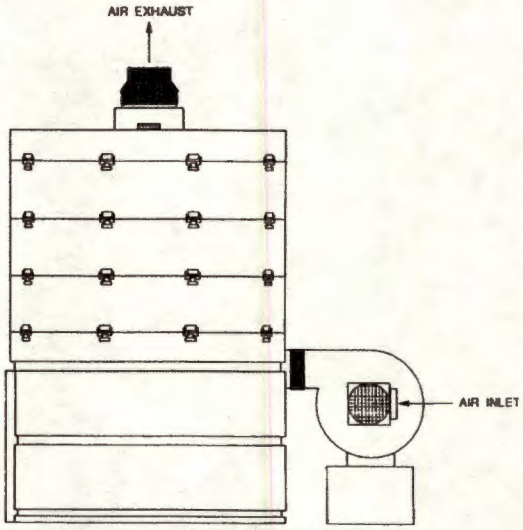
The active components of a ShallowTray low profile air stripper are patent-protected tray-type stripper trays. (The ShallowTray process is protected under U.S. Patent #5,045,215 and 5,240,595; other international patents pending.) Fresh air is blown up through hundreds of $^{3}/_{16}$" (5mm) diameter holes in each stripper tray. The air forms a froth of bubbles approximately six inches deep on the stripper tray, generating a large mass transfer surface area where the contaminants are volatilized. The necessary contact or residence time to reach required volatilization is achieved through model size, addition of trays, and flow rate selection.

Typically constructed of corrosion resistant type 304L stainless steel or polyethylene, the tray unit utilizes countercurrent air and water flow through an array of baffled stripper trays. Sizing and design of a ShallowTray low profile air stripper are determined by a variety of factors that include water flow rate, contaminant concentration, temperature, required removal efficiency, and the physical/chemical properties of the contaminants that govern their solubility in water.

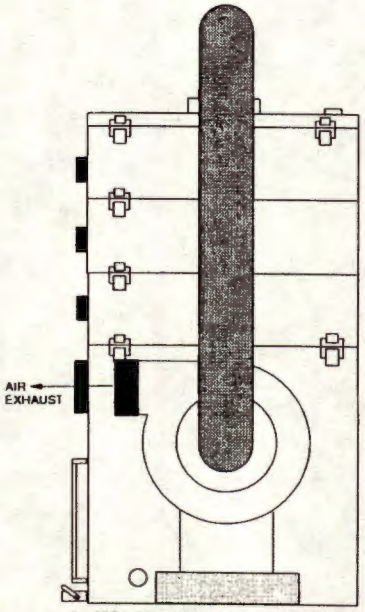
The ShallowTray Basic System



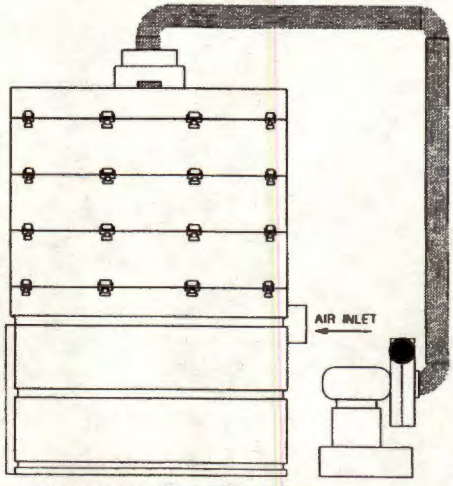
1. 2331 STAINLESS PRESSURE SYSTEM (FORCED DRAFT)



2. 2331-P LLDPE PRESSURE SYSTEM (FORCED DRAFT)



3. 2331 STAINLESS VACUUM SYSTEM (INDUCED DRAFT)



4. 2331-P LLDPE PRESSURE SYSTEM (INDUCED DRAFT)

ShallowTray systems are fabricated from rugged 304L stainless steel, 316L stainless steel, or molded polyethylene, and are typically supplied with all the components listed in this section. Read through each component description for a better understanding of its function.

Pressure Versus Vacuum Set-up

There are two versions of the basic system referred to in this manual. They are defined as follows:

1. Pressure System – The blower is installed so that the stripper tank and stripper trays are pressurized. This arrangement can be used when the maximum total system pressure (air stripper plus other downstream air equipment) does not exceed 26 inches (56cm) water column (W.C.) pressure or vacuum for plastic strippers, and 32 inches (82cm) W.C. for stainless steel strippers.

2. Vacuum System – The blower is installed so that the stripper cover and stripper trays are under a vacuum. Removal efficiency is the same as for a pressure system. This is the proper arrangement when total system pressure exceeds the values listed above. In this setup, the blower induces the required vacuum on the stripper, and also provides the required additional pressure for downstream air equipment.

High Water Flow Versus Low Water Flow Systems

There are two water flow range options for the basic system. They are referred to in this manual as **Low Flow** and **High Flow** systems. The high flow system requires a blower that produces an additional 4 inches (10.2cm) W.C. pressure/vacuum compared to the low flow system blower. The low and high water flow ranges for each ShallowTray series are listed in the table below:

ShallowTray Series	Low Water Flow Range	High Water Flow Range
1300P	0.5 - 15 gpm	N/A
1300	0.5 - 15 gpm	16 - 24 gpm
2300P	1 - 30 gpm	31 - 50 gpm
2300	1 - 30 gpm	31 - 45 gpm
2600	2 - 60 gpm	61 - 115 gpm
3600	3 - 90 gpm	91 - 160 gpm
31200	4 - 150 gpm	151 - 425 gpm
41200	6 - 200 gpm	201 - 550 gpm

Basic System Components

Component manufacturer information sheets ("cutsheets") are included in the Components Information Section (Section 7) at the back of this manual.

Blower

The blowers on the ShallowTray low profile air stripper units are typically type B spark resistant with a cast aluminum wheel, direct driven @ 3450 rpm with motor options of Totally Enclosed Fan Cooled (TEFC) or Explosion Proof (EXP). Each blower is selected by our engineering staff to exceed the minimum cubic feet per minute (CFM) air flow requirements at the nominal working pressure (inches of W.C.) of each system. It is critical that the blower damper be opened wide enough to provide the unit with the designated minimum fresh air flow.

It is also critical that water does not enter the blower housing while the blower is in operation; this will damage your blower and void the warranty. The high water level alarm switch prevents this from happening. Make sure it is installed properly.

The motor horsepower is selected to provide a reasonable operating range. However, there is potential for the blower motor to overload if it is not working against sufficient pressure drop. Therefore, the blower must be protected with a thermal overload switch. Also, the blower damper should be set so that the blower produces at least the minimum air flow requirement (see table below), and does not exceed the nameplate amperage limit of the motor.

Damper

There is a damper on the blower, used to make air flow rate (SCFM) adjustments to your system. Open the damper to increase air flow rate, and close the damper to decrease air flow rate. Note that air pressure may vary as the air flow rate is changed.

To get the most accurate air flow measurement, we recommend installing an air flow meter in the air piping.

If this is not possible, then an estimated air flow can be obtained by measuring the stripper pressure or vacuum. For initial start-up, simply adjust the damper until the air pressure is at least the minimum required for your system. (Refer to the pressure gauge description for minimum pressure readings).

The table below gives the minimum and maximum air flow rates for each ShallowTray series.

ShallowTray Model	Air Flow Minimum		Maximum	
1300 & 1300P	150 cfm	(250m³/hr)	**195 cfm**	**(330m3/hr)**
2300 & 2300P	300 cfm	(500m³/hr)	**390 cfm**	**(660m3/hr)**
2600	600 cfm	(1020m³/hr)	**780 cfm**	**(1320m3/hr)**
3600	900 cfm	(1530m³/hr)	**1170 cfm**	**(1990m3/hr)**
31200	1800 cfm	(3060m³/hr)	**2340 cfm**	**(3980m3/hr)**
41200	2400 cfm	(4080m³/hr)	**3210 cfm**	**(5450m3/hr)**

Beware when making damper adjustments after initial start-up. Fouling may occur in the system which may reduce the air flow rate, and may increase the air pressure reading.

Demister

A wire mesh mist eliminator pad is installed beneath the air exhaust port, located on the top cover of the unit. The purpose of the mist eliminator pad is to remove water droplets that would have blown through the vent line. It is possible, though unlikely, that the mist eliminator pad may become plugged or fouled. If this occurs the mist eliminator pad is easily removed for cleaning. Disconnect the vent line, take off the top cover, and remove the retaining plates on the bottom side of the cover. The mist eliminator pad can be cleaned with a pressure washer, or replaced with a new one.

Gasket

A black nitrile (or neoprene on the 2300P) sponge gasket is used to form an airtight/watertight seal around the sump tank and stripper trays. If there are any problems with the gaskets, please contact North East Environmental Products. A replacement gasket can be glued to the sealing flange using an industrial contact adhesive. We recommend using Rubatex adhesive # R-27780. Please contact North East Environmental Products prior to making any gasket repairs or adjustments.

Sight Tube

The sight tube provides a means of easily viewing the water level in the sump tank. Make sure the valve to the sight tube is open during stripper operation.

Spray Nozzle

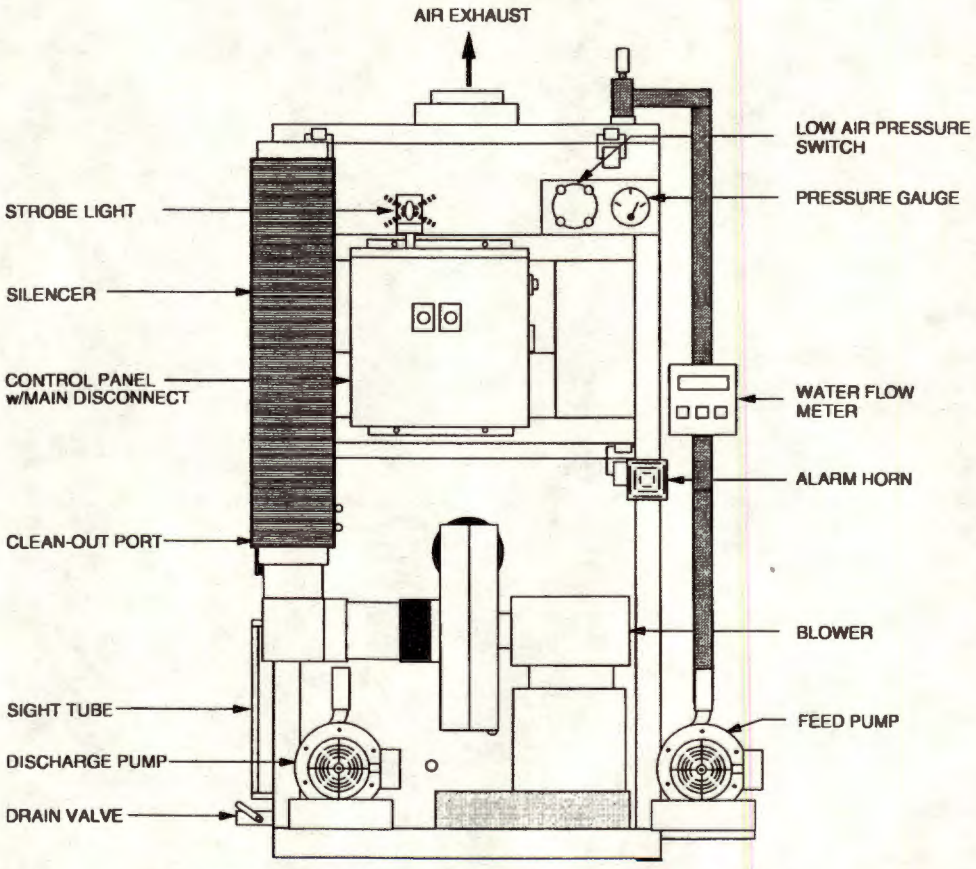
A spray nozzle is installed in all units except those with a gravity feed option. The nozzle directs the contaminated water to the first inlet chamber and begins the volatilization process. The nozzle is typically rated for 15 psig at the system's maximum water flow rate.

It is recommended that a strainer be installed somewhere in the inlet process water line, especially during initial start-up, to prevent sediment from plugging the nozzle.

If the nozzle becomes plugged, it is easily removed by first removing the top cover and then unscrewing the nozzle from the inlet piping. Clean it with a wire brush or a pipe cleaner. If the nozzle causes too much back pressure or becomes plugged too often, it can be removed without any serious effects on the system's performance. Units that have a gravity feed system should not use a spray nozzle – it causes too much back pressure. In these cases, the inlet piping should extend below the water level of the inlet chamber to provide a water seal.

Note: System performance is based on ShallowTray operation without a nozzle, and warranty is valid whether a nozzle is installed or not.

ShallowTray System Options



2331 STAINLESS PRESSURE SYSTEM WITH OPTIONS

NOT ALL OPTIONS SHOWN

SHALLOWTRAY OPTIONS

ShallowTray System Options

ShallowTray low profile air strippers are custom built to meet site and project specifications. Please refer to the components list insert (Section 1) to see which options were selected for your system. Component information cutsheets are included in Section 7 of this manual.

Air Blower Silencer

The air blower silencer reduces the dynamic noise level of the blower. The size of the silencer and the type of connection used to mount are dictated by the size of the blower, and whether the silencer is mounted horizontally or vertically. Silencers should be supported to avoid over-stressing the connections, and should be secured if exposed to high wind loads.

Air Flow Meter

The air flow meter measures the amount of air flowing through the system. It consists of a pitot tube mounted in the air line and a differential pressure gauge. The measured velocity pressure is then converted to an air flow rate. The pitot tube must be located at least 8½ pipe diameters of straight pipe after any pipe fitting or transition, and at least 1½ diameters of straight pipe before the end of the pipe or any elbow. The best pitot tube location is before the stripper because the air is less humid and the gauge hose is less likely to fill with condensate.

The air flow meter typically gives readings in inches of water column (W.C.), which is then converted to feet per minute (FPM) using the provided chart. You then multiply the feet per minute by the interior cross sectional area (square feet) of the vent line. This gives cubic feet per minute (CFM). As stated in the damper section, the air flow meter in conjunction with the pressure gauge provides the most accurate damper adjustments, especially after initial start-up.

The table below lists the minimum and maximum air flow rates for each stripper model, and the minimum exhaust pipe diameters. Note that the airflow must be at least the minimum for proper stripping efficiency.

Stripper Model	Air Flow Minimum	Air Flow Maximum	Recommended Exhaust Pipe Diameter
1300	150 cfm (250m³/hr)	195 cfm (330m³/hr)	6 in.(16cm)
2300	300 cfm (510m³/hr)	390 cfm (660m³/hr)	6 in.(16cm)
2600	600 cfm (1020m³/hr)	780 cfm (1320m³/hr)	8 in.(20cm)
3600	900 cfm (1530m³/hr)	1170 cfm (1990m³/hr)	10 in.(25cm)
31200	1800 cfm (3060m³/hr)	2340 cfm (3980m³/hr)	16 in.(40cm)
41200	2400 cfm (4080m³/hr)	3210 cfm (5450m³/hr)	18 in.(45cm)

Note: Low airflow is the most common reason for poor removal efficiencies. Thus, an airflow meter is highly recommended to help ensure adequate air flow.

Air Pressure Gauge

The air pressure gauge reads the pressure differential in inches of water column (W.C.) between the point of highest pressure in the air stripper and the atmosphere. The gauge is connected to the system via an air hose that attaches to a pressure port on the system. Instructions to connect the gauge for the two types of systems are as follows:

Pressure System – Using tubing, connect the "High" pressure port on the gauge to the ⅛" (3mm) shutoff valve/hose barb located on the air stripper sump tank. The matching "Low" pressure port is to be open to the atmosphere. Highest pressure is in the sump tank.

Vacuum System – Using tubing, connect the "Low" pressure port on the gauge to the hose barb located on the exhaust vent line of the air stripper. The matching "High" pressure port is to be open to the atmosphere. Highest vacuum is in the cover air exhaust pipe.

Note: There are two pairs of pressure ports on the gauge. One pair should be used to measure the differential pressure, and the other set must be plugged.

At initial start-up, the pressure gauge can be used to make proper blower damper adjustments. Adjustments should be made according to the following nominal air pressure/vacuum table:

	Nominal Air Pressure/Vacuum	
Number of trays	**Low Water Flow System**	**High Water Flow System**
1 tray system	4 - 6 inches W.C. (10 - 15cm)	7 - 10 inches W.C. (18 - 25cm)
2 tray system	7 - 10 inches W.C. (18 - 25cm)	11 - 14 inches W.C. (28 - 36cm)
3 tray system	11 - 14 inches W.C. (28 - 36cm)	16 - 18 inches W.C. (40 - 46cm)
4 tray system	16 - 18 inches W.C. (40 - 46cm)	20 - 22 inches W.C. (50 - 56cm)
5 tray system	20 - 22 inches W.C. (50 - 56cm)	24 - 26 inches W.C. (60 - 66cm)

Note: The nominal pressures or vacuums shown are for the air stripper only, and do not include additional air stream equipment pressure requirements. Fouling may occur in the system, which may increase the nominal air pressure reading, and may decrease the air flow rate.

Control Panel

The control panel serves two basic functions required for the safe operation of the system. The first is to provide the required electrical safety components for each motor (blowers and pumps) per NEC standards. These components consist of fuses, motor starters, and overload relays.

The second function is to provide the required process control and alarm components. The alarm circuit monitors the low air pressure switch and the high water level alarm switch. If either of these alarms occur, then the alarm contacts will shut off the incoming water source (feed or well pumps) if the appropriate connections have been made. Other alarm options are also available.

Control Panel Intrinsically Safe Components

ShallowTray low profile air stripper systems that operate in or near potentially explosive concentrations of vapors may require intrinsically safe (IS) signals to all electrical components housed in non-explosion proof enclosures. The IS signal is not capable of creating a spark or a temperature rise great enough to ignite any concentration of any NEC classified explosive vapor. Typical components that need IS signals are the float switches and well probes. Determination of when IS signals are required is generally the responsibility of the groundwater remediation engineer who is specifying a system.

Digital Water Flow Indicator

The digital water flow indicator, typically installed in the water feed piping to the stripper, reads the rate of flow (gpm) and the totalized flow (gallons). The flow meter is selected to exceed the maximum flow of your system while providing a wide working range. The digital face plate is battery operated and intrinsically safe (typically Halliburton brand). The only moving meter component is the turbine rotor, which spins around a shaft axial to the flow of water.

It is possible to plug the turbine rotor with particles and sediment. An ⅛" (3mm) screen filter should be installed somewhere in the incoming process water line prior to the meter. If the meter becomes plugged it can be disassembled and cleaned. Please disassemble per the manufacturer's instructions, if necessary.

Feed and Discharge Pumps

The pumps on each system have been selected by our engineering staff to meet the appropriate flow and pressure requirements. The pumps are typically cast iron and bronze, with either EXP or TEFC motors. The pumps are not self-priming. Prior to initial start-up, the pumps must be primed by filling the pump impeller housing with clean water. Throttle valves are typically installed on the discharge lines. If the pump is running wide open and it is not pumping against the required head, the pump may cavitate. This is the nature of centrifugal pumps; they must be throttled back if they are not pumping against the required head. Also, the valve should be throttled back until the motor draws less than the nameplate amps current rating.

If the pump is wired by someone other than North East Environmental Products, please **double check the rotation**. A pump rotating in the wrong direction could cause the pump impeller to spin off, causing serious damage to the pump.

Systems using pumps should have the flow rates tuned so that the discharge flow rate is greater than the inlet flow rate. This will prevent blower flooding.

High Water Level Float Alarm Switch

The high water level float alarm switch is one of the alarm interlocks that must be properly connected, by a licensed electrician, prior to the system's initial start-up. Please see *Special Cautions* at the beginning of Operating Instructions section for more information. The purpose of the high water level float alarm switch is to prevent water from flooding the system. It does this by shutting off the incoming contaminated water once clean water has reached a designated level in the sump tank. The high water level float switch will send an alarm signal when it rises approximately 3 1/2 inches (9cm) above the coupling it is installed in.

Line Sampling Ports

The line sampling ports provide a quick and easy way to take water samples of both incoming contaminated water and outgoing clean water. The sampling ports are the typically 1/2" (1cm) ball valves located on both the inlet and outlet piping.

When taking a water sample, open the valve and let the water flow for at least 1 minute prior to bottling the sample. This purges the sample port of any stagnant water.

When purging the sample ports be sure to capture the water and properly dispose of it. When starting the unit for the first time double check that the valves on the sample ports are closed.

Low Air Pressure/Vacuum Alarm Switch

The low air pressure/vacuum alarm switch monitors the blower for continuous water treatment. This switch is one of the alarm interlocks that must be properly connected by a licensed electrician prior to the system's initial start-up. Please see *Special Cautions* at the beginning of Operating Instructions section for more information.

Should the blower fail, the low air pressure switch should be wired to shut off all incoming water. Using tubing, connect the switch to the hose barb on the tank (pressure system) or in the cover exhaust pipe (vacuum system).

Pressure system – The air hose is connected from the sump tank 1/8" (3mm) hose barb (without valve) to the "high" pressure port on the switch using the provided hose barb. The "low" pressure port must be open to the atmosphere. The switch measures the differential pressure between the sump tank and the atmosphere.

Vacuum system – The air hose is connected from the exhaust piping 1/8" (3mm) hose barb to the "low" pressure port on the switch using the provided hose barb. The "high" pressure port must be open to the atmosphere.The switch measures the differential pressure between the top tray and the atmosphere.

Periodically inspect the air hose for water build-up which will affect the switch's operation. The tubing must remain open at all times.

Test the switch at initial start-up by removing the air hose from the hose barb on the sump tank or exhaust pipe once the system is in full operation. This should set the system into an alarm condition and shut off the incoming contaminated water.

High Air Pressure/Vacuum Alarm Switch

The high air pressure/vacuum alarm switch prevents the system from exceeding its highest rated pressure/vacuum value. If the blower has the ability to produce pressure/vacuum higher than 32 inches (82cm) W.C. for stainless units or 26 inches (56cm) W.C. for plastic units then it should have a high pressure/vacuum alarm switch. Be sure to check that the setpoint for alarm shutdown is at the proper setting for the system.

Main Disconnect Switch

The main disconnect switch removes power from the ShallowTray low profile air stripper. A disconnect is required by the National Electric Code (NEC) and must be installed. North East Environmental Product's panels typically contain a disconnect integral with the control panel to remove power, but may also use disconnects external to the control panel depending on the situation. Make sure a qualified licensed electrician installs the power line into the disconnect switch. Be sure to ground the switch to the main service ground.

Water Temperature Gauge

Water temperature gauges can be installed on both the inlet and outlet piping. Influent water temperature is an important variable affecting the system's removal efficiency.

Water Pressure Gauge

Water pressure gauges can be installed on both the inlet and outlet water piping. Excessively high readings could signal that something in the piping system is plugged. Large pressure fluctuations could be a sign that the water flow rate is varying.

Section 3: Operating Instructions

Special Cautions!

The following operations must be carried out prior to initial system start-up:

Step 1

Connect the Interlock Switches.

1. To avoid damaging the blower and flooding the equipment with contaminated feed water, install the high water level and low air pressure/vacuum interlock switches.

It is important that a qualified licensed electrician perform these installations.

High water level interlock

If the water level in the sump tank rises beyond the maximum level, it could flood the blower. This may damage the blower and void the warranty. The high water level interlock switch will also shut off the feed water pump in an emergency situation.

Low Air Pressure/ Vacuum Interlock

If the blower fails, untreated water could flow directly to the discharge line. The low air pressure/vacuum interlock switch will shut off the feed water pump to prevent this from occurring.

High Air Pressure/ Vacuum Interlock

If a system has a blower capable of producing more than 32 inches (82cm) W.C. for stainless units or 26 inches (56cm) W.C. for polyethylene units then it requires a high pressure/vacuum switch. If a unit fouls or pressure increases due to off-gas treatment, it may exceed the maximum pressure rating of the system and cause damage to the gaskets, sump, or trays.

Note: These recommended interlock options might not have been provided as part of North East Environmental Product's scope of supply.

Step 2

Fill the Sump Tank and each tray's Inlet Chamber.

On initial start-up, the sump tank must be filled with **clean water** to a height of about 5 inches (13cm). Make sure the valve to the sight tube is open. The sump tank can be filled via the clean-out ports on the end of the stainless units, or through the inlet water port located on the cover. The inlet chamber on each tray (referred to as seal pots) can be filled manually by pouring **clean water** through the 1 inch (3cm) inlet chamber filling ports or the 4 inches (10cm) clean out ports located on the ends of the stainless units, or by disassembling the plastic units and filling the seal pots as you reassemble. The seal pots on both the plastic and stainless systems can also be filled at initial start-up by connecting a **clean water** line to the inlet water port and running the system for ten minutes with the blower on and the damper 1/4 open. For complete instructions on this method, please follow initial Start-up procedures later in this section.

Do Not Run Free-Product Through the ShallowTray Air Stripper.

Free product will contaminate the unit by coating the sidewalls with a film of free-product. ShallowTray units are designed to remove dissolved VOCs only.

Always provide fresh, clean air for the system air intake. Air that is heavily contaminated with VOC's will significantly reduce the Shallow Tray's performance.

Equipment Set-up

Drawings

Drawings referred to in the following sections are located in Section 6.

Please follow codes.

The plumbing and electrical installations must be performed by qualified personnel, and must be done in accordance with local, state, and national codes.

Protect critical items from the environment.

In areas that could be below freezing, the stripper should be installed in a heated building. Plastic units, control panels, and motors should be protected from direct sun. Explosion proof motors should be protected from rain due to the absence of motor gaskets.

Install adequate supports.

Since **none** of the external piping associated with the ShallowTray unit is designed to support process water lines or air piping, adequate supports must be installed.

Assemble Unit.

All ShallowTray units are assembled and hydraulically tested at the factory. However, to safeguard the units from shipping damage, some components are removed prior to shipping and will require re-assembling. Follow all relevent steps in this section to properly set-up your ShallowTray unit.

Check for loose fittings.

Shipping your system to the site may have caused piping joints or assembly hardware to loosen. Please re-tighten as necessary.

Step 1

Bolt your unit together.

For shipping purposes, the ShallowTray unit may come in two sections; the blower frame assembly and the sump and tray assembly. Bolt the base frames together using the bolts and spacers provided. (This step is done at the factory for the 1300 and 2300 series.)

Step 2

Connect Blower.

For positive pressure systems install the rubber coupling provided from the blower outlet to the air inlet nozzle on the sump tank. (See Section 6 coupling layout drawing for air inlet nozzle location.) For vacuum systems, install a vent line from the stripper air exhaust located on the top cover to the blower intake. North East Environmental Products may not have provided this piping. Make sure the

pipe diameter is large enough to maintain the required air flow without adding a pressure drop, and be sure the pipe has a suitable vacuum rating to prevent collapse.

Caution: Blower must draw clean air. Do not vent storage tanks that contain substances that will contaminate the air in the same room the blower draws air from. Do not duct intake air from an area that has contaminated air. Contaminated air will contaminate the water.

Step 3

Assemble trays and level the ShallowTray unit.

Some of the larger units may have the top tray and cover shipped separately. Install trays shipped separately by lining up the arrows and numbers on the trays and cover. To prevent damaging the gasket, do not drag the trays or cover across the gasket during assembly. Fasten all latches properly. The tray being installed must have the downcomer line up with the sealpot on the tray below it. Check all the trays to make sure they are installed correctly, and not backwards. If the system is not set up properly the water could bypass a tray allowing water to miss a large portion of the treatment path. Refer to the "base subassembly" exploded view drawing in Section 6.

Level the ShallowTray unit. This is a critical step in the proper assembly of the equipment. If not level, the water depth on the trays will be uneven, causing the water to seep through the tray holes untreated.

Step 4

For a gravity discharge unit

Install the outlet pipe.

For a gravity discharge unit (no discharge pump): Refer to the Section 6 outlet piping drawings to assemble the plumbing components, which are typically shipped in a separate carton. Positive pressure systems require a riser pipe to compensate for the pressure generated by the blower. It is important that the riser pipe height is adjusted to create a 5 inch (13cm) water depth in the sump tank during normal operating conditions. The provided vacuum relief valve must be installed to prevent the sump from siphoning below the 5 inch depth.

It is essential that the riser pipe be mounted in the vertical direction, and that it be properly supported.

Note: Some systems have an internal trap. Please refer to the plumbing drawing.

The purpose of having the 5 inch (13cm) water depth in the sump tank is twofold. First, it is to keep the downcomer (from the bottom tray) and the water discharge port (which elbows down internally) submerged. Both are set to a height of 2 inches (5cm) from the bottom of the sump. Keeping them submerged forms a water seal which prevents air from escaping up the downcomer pipe or out the discharge trap.

Second, the 5 inch (13cm) depth is low enough to allow our high water level switch to reset. The switch, located in its typical position, has an approximate reset deadband of six inches, meaning the water level must drop 6 inches (15cm) below the alarm trip point before it resets. Consult with North East Environmental Products for additional options or questions about float switch location or normal operating water depth.

Use proper pipe sealant and PVC cement when needed. We recommend running the system and adjusting the riser pipe before permanently bonding the fitting.

Caution: The vertical height of the trap should create a 5 inch (13cm) water depth in the sump tank during normal operating conditions. Depths lower than 5 inches (13cm) may allow air to escape through the water discharge line or up through the downcomer. This may result in untreated water falling into the sump tank.

Step 5

For a unit with a discharge pump

Install the outlet pipe.

For a pumped discharge unit: Refer to the Section 6 outlet piping drawing to assemble the water line from the sump tank to the pump suction, using components supplied in a separate carton.

Install outlet piping to the pump's discharge port. A ball valve is typically provided and should be used to adjust flow and prevent the pump from cavitating. Use proper pipe sealant and PVC cement when needed. To reduce pressure losses, it is recommended that the connected pipe size remain at least as large as the fitting provided.

Prime the pump. Pour clean water in the pump's inlet port until it has filled the entire pump chamber. A check valve is supplied to keep the pump primed. Remove the top air bleed plug on the pump housing to let air bleed out, then replace plug tightly.

Step 6

Install the inlet piping manifold.

Install the inlet piping manifold (typically shipped in a separate carton). Follow the Section 6 inlet piping diagram for proper installation. The spray nozzles are installed on the inside of the cover, or may have been shipped separately. The nozzles are typically selected to produce a 15 psig pressure drop at the highest anticipated water flow rate.

During start-up, a strainer should be installed in the water inlet line to prevent the spray nozzle and process water line components from plugging with sand and sediment. If necessary, the strainer can be permanently installed.

Use proper pipe sealant and PVC cement when needed.

Caution: For all systems other than 31200 and 41200, there are two inlet port locations on the cover; one is plugged, the other is used. The 31200 and 41200 series, have three and four ports respectively, and all are used. *You must use the port located above the sealpot of the top tray.* Otherwise contaminated water will bypass the treatment path of the first tray and fall directly into the downcomer to the next tray. This will result in poor removal efficiency.

Step 7

Install the sump drain valve and the sight tube.

Install the sump drain valve and the sight tube. Refer to the Section 6 coupling layout drawing for port locations. Be sure to open the valve to the sight tube during start-up and operation. The valve should be closed only to replace a damaged sight tube.

Step 8

Connect the water lines.

If the seal pots have not yet been filled with *clean water*, connect a *clean water* line to the inlet port or piping manifold and fill the seal pots according to the steps outlined in the initial start-up section.

If the seal pots are filled with clean water, connect the process water line to the inlet piping manifold.

Connect the discharge water line.

Firmly support the process water lines to prevent stress on the piping and ports. **The system is not designed to support the weight of the process water lines.**

Use proper pipe sealant and PVC cement when needed.

Step 9

Connect the tubing.

Connect the tubing from the ShallowTray to the optional low air pressure/ vacuum switch, optional high air pressure/vacuum switch, and the optional pressure/vacuum gauge. Read the component descriptions on each for detailed connection information, and also refer to the Section 6 drawings. For the air pressure gauge, be sure to install the tubing to the 1/8" (3mm) shutoff valve. Open the valve only when a reading is required. This will reduce condensation build-up in the gauge. The air pressure switch tubing should always be open for continuous sensing. The switch is designed to drain excess condensation.

Step 10

Connect the air discharge line.

Connect an air vent line on the top of the unit.

Caution: Do not use a vent line with a smaller diameter than the air exhaust port. A smaller diameter may cause a pressure drop larger than the blower was designed for, resulting in low air flow and poor removal efficiency.

Connect the air vent line to the exhaust port using the flexible rubber coupling provided. Support the vent line independently of the air stripper so that it can be easily disconnected when the cover is removed for maintenance purposes.

Step 11

Wire the electrical components.

Have a qualified licensed electrician wire the electrical components in compliance with local, state, and national codes.

Make sure the safety interlocks, described in the Special Cautions section, are connected properly!

(If North East Environmental Products is supplying your control panel, see Section 6 wiring diagrams.)

Step 12

Install optional items.

Air flow meter

Mount the pitot tube on the vent line per Dwyer bulletin # H-11 (located in the separate shipping box) or per the Section 6 air flow meter assembly drawings using the mounting hardware provided. Connect pitot tube to the 0-0.5 or 0-1.0 inches W.C. air pressure gauge using the tubing provided. (See pitot tube mounting diagram in Section 6.) There are two air hoses required, one connects to the high pressure port on the gauge and on the pitot tube, and measures internal static pressure plus velocity pressure. The other connects to the low pressure ports on the gauge and on the pitot tube, and measures the internal static pressure only. The optimum pitot tube location is before the stripper, because the air is less humid and the tubing will be less prone to filling with condensate.

Air blower silencer

Pressure systems – Install the silencer on the inlet side of the blower.

If the silencer is to be in the vertical position, install the piping and elbow as shown on the Section 6 silencer diagram.

If the silencer is in the horizontal position, attach it directly to the blower inlet using a rubber coupling.

Vacuum systems – Install the silencer on the blower. The standard silencer's maximum pressure/vacuum rating is 20 inches (50cm) W.C. Be sure not to exceed the silencer's limit.

Water flow meter

Install the water flow meter into the inlet piping per the Section 6 water inlet piping diagrams.

The flow meter owner's manual was sent with the unit. Be sure to refer to it when installing the meter.

Please install an 1/8" (3mm) strainer in the incoming process water line prior to the water flow meter. This will prevent rotor jamming.

Note: There may be other optional equipment that requires installation or assembly. Please refer to the Section 6 specification sheet and drawings for more information.

Initial Start Up

Upon completion of the equipment set-up and mechanical/electrical installation, proceed with the following steps:

Step 1

Check all connections, and close drain and sample valves.

Double check that all electrical, water, and vent connections are properly made. Close drain and sample valves.

Note: Be sure that the sight tube valve is open.

Step 2

With other switches 'OFF', turn 'ON' the main power disconnect switch.

Turn all panel control switches to the 'OFF' position, then turn 'ON' the main power disconnect switch.

Note: Turn all panel control switches to the 'OFF' position before applying power. Systems with intermittent operation will show an alarm condition (low air pressure) five seconds after power is applied because the blower is not operating. Once the blower is supplying proper pressure, the alarm low air pressure condition will reset. Some systems may require pushing an 'Alarm Reset' button.

Step 3

Check the blower rotation.

Check the blower rotation by momentarily switching 'ON' (bumping) the blower switch and observing whether the blades turn in the direction of the arrow on the blower casing. You can also observe the motor's cooling fan blades for proper rotation.

Note: If system panel has the intermittent operation feature, the blower motor must be bumped in the 'HAND' position. Refer to the Routine Operation Section for a description of "intermittent operation".

Step 4

Attach clean water line to the inlet.

If you did not fill the seal pots on each tray manually, please fill them now by attaching a (clean) water line to the water inlet piping manifold or port, and then follow Step 5.

If you have filled the seal pots manually, please skip Step 5 and go to Step 6.

Step 5

Fill the seal pots (inlet chamber) with clean water.

***Special Caution*: Make sure to use *clean water* when filling the seal pots. If contaminated water is used it will go through the system untreated.**

To fill the seal pots (inlet chambers), set the blower damper to ¼ open, and start the blower and the clean water flow to the unit. Let the blower and clean water run for about five to ten minutes, then shut them off. Setting the damper at ¼ open reduces the air flow enough to allow the water to flow through the downcomers and into the seal pots.

Note: If your system has the intermittent operation feature, you must start the blower in the 'HAND' position for this procedure.

If you have trouble filling the seal pots by this method you can fill them manually, either by using the one inch sealpot filling ports (if provided), or by spraying a stream of clean water through the clean-out ports (not provided on plastic systems). The stream of water must be directed into the sealpot on the far side of the unit, until the sealpot is full.

For plastic systems and older model stainless systems, you must remove the trays and fill the sealpots manually.

Step 6

Connect contaminated feed water line.

Connect contaminated feed line. Install all piping to allow for future removal for maintenance or repair. Make sure it is supported independently of the ShallowTray. Start system with the blower damper ½ open.

Note: For systems with intermittent operation, you must turn 'OFF' the power at the main disconnect, turn all control switches to the auto position, and then reapply main power. All motors will start automatically based on control functions.

Note: Each control panel is custom designed for each site. Become familiar with the panel logic and proper operation before attempting to start the system. The panel might have been provided by a panel manufacturer other than North East Environmental Products.

Step 7

Check the air pressure readings and set damper.

Run the unit for 5 minutes, and then adjust the blower damper setting to produce the required air pressure/vacuum reading on the pressure gauge. Since the blowers provided by NEEP are selected and tested to exceed the minimum flow requirements of the system, you can use the following table to set the damper during initial start-up.

	Nominal Air Pressure/Vacuum	
Number of trays	**Low Water Flow System**	**High Water Flow System**
1 tray system	4 - 6 inches W.C. (10 - 15cm)	7 - 10 inches W.C. (18 - 25cm)
2 tray system	7 - 10 inches W.C. (18 - 25cm)	11 - 14 inches W.C. (28 - 36cm)
3 tray system	11 - 14 inches W.C. (28 - 36cm)	16 - 18 inches W.C. (40 - 46cm)
4 tray system	16 - 18 inches W.C. (40 - 46cm)	20 - 22 inches W.C. (50 - 56cm)
5 tray system	20 - 22 inches W.C. (50 - 56cm)	24 - 26 inches W.C. (60 - 66cm)

Note: Double check pressure reading after system has been running for about ½ hour. Adjust damper again if needed. Also check the airflow meter for proper airflow rate.

Pressure readings may vary somewhat depending on your venting system. See the components list in Section 1 for the minimum air flow requirements for your system.

The system is ready for operation.

The system is now ready for normal operation. It is not necessary to perform initial start-up procedures each time the system is shut down.

However, note that anytime water is completely removed from the seal pots or sump tank, the initial start-up procedure must be done again. For example, after the system has been taken apart for cleaning, or after an extended shutdown where the water may have evaporated from the tank or seal pots.

Routine Operation

Air Flow

The table below lists the minimum and maximum air flow rates for each stripper model and the minimum exhaust pipe diameters.

Note: The airflow must be at least the minimum shown for proper stripping efficiency.

Stripper Model	Air Flow Minimum	Maximum	Minimum Air Pipe Diameter
1300	150 cfm (250m3/hr)	195 cfm (330m3/hr)	6 in. (15cm)
2300	300 cfm (510m3/hr)	390 cfm (660m3/hr)	6 in. (15cm)
2600	600 cfm (1020m3/hr)	780 cfm (1320m3/hr)	8 in. (20cm)
3600	900 cfm (1530m3/hr)	1170 cfm (1990m3/hr)	10 in. (25cm)
31200	1800 cfm (3060m3/hr)	2340 cfm (3980m3/hr)	16 in. (40cm)
41200	2400 cfm (4080m3/hr)	3210 cfm (5450m3/hr)	18 in. (46cm)

Adjust water flow rate by setting the water throttle valves.

Now that the system has been primed per the initial start-up procedures, it is ready for fine tuning. Adjust throttle valves on inlet and outlet piping to obtain the desired water flow rates. Refer to the Section 6 specification sheet for your system's design and maximum water flow rates. To prevent a high water level alarm, it is critical that the discharge pump flow rate exceed the influent water flow rate.

Pumps provided by NEEP have throttle valves on the discharge side of the pump. Once the desired water flow rate is achieved, check the amp draw of the motor.
It must not exceed the pump nameplate amp draw. If the pump is cavitating, it is not pumping against the required head, and should be throttled back.

Alarm switches

High water level switch – The switch is typically installed in the middle of three half inch switch ports located on the front of the unit (refer to the Section 6 coupling layout drawings). If more sump capacity is required, the high level float switch can be moved to the top port location.

Caution: If the float is moved to the higher port and the discharge line plugs or the discharge pump fails, the water level could rise above the air inlet port, allowing water to drain into the blower housing or onto the floor. The blower may become damaged if it is running while water is in the blower housing. Be sure to check that the 1/8" (3mm) hole in the bottom of the blower housing is open to allow for drainage of water that may get into the housing.

Section 4: Cleaning Proceedures

Intermittent Operation

If continuous blower operation is a concern, ShallowTray low profile air stripper systems can be designed to run intermittently. When the feed water is flowing into the system, the blower will be in operation and the outlet pump (if provided) will maintain proper sump tank levels. When the feed water is shut down, the blower will run for an additional five minutes to treat the water already in the trays, then it will also shut down. When the feed water is restored, the blower will automatically start up to treat the new batch of water.

If there is an alarm condition that lasts longer than five minutes the blower will shut down and the alarm circuit light will remain on. Once the blower shuts off, the system will sense a low air pressure condition. To reset the alarm circuit or light once the blower has shut off, you must disconnect power at the main disconnect. Some systems may also have a "reset" push button on the control panel door.

System Shut Down

Shut feed water off.

Shut off the water feed to the system.

Wait 5 minutes, then shut off the blower.

Wait 5 minutes to allow the water in the stripper trays to be completely treated, then shut off the blower. Treated water in the trays will drain into the sump tank, so it is important to keep the outlet pump in "auto" to remove this extra water.

Shut main power off.

Shut off the power at the main disconnect switch if the shutdown is more than temporary.

Caution: If proper shut down procedures are not followed, contaminated water will drain into the sump tank. This will contaminate the water that has been collected in the tank. Therefore, always allow the blower to run an additional 5 minutes after the feed water is shut-off.

Equipment Maintenance Instructions

Cleaning Instructions

Minerals dissolved in high concentrations tend to precipitate out of groundwater during air stripping processes. These minerals form insoluble deposits commonly referred to as 'fouling.' Although the ShallowTray low profile air stripper system is designed to be fouling resistant, proper steps must be taken when treating water with high mineral concentrations. Deposits from iron-rich feed water can be reduced by pre-treating it with **sequestering agents.** For more information, please call Remede Products, Inc., 802-365-7200. The recommended cleaning procedure is pressure washing. Please follow the detailed instructions in this section.

Equipment Required

Pressure Washer

2 gpm minimum flow at 900 psig minimum. Equipment rental companies can usually supply such a unit on a daily rental basis.

Washer Wand

Washer wand with spray nozzle, (obtainable from North East Environmental Products as an option) and an adapter to connect the wand to the pressure washer hose end. All washer wand connections are ¼" (6mm) NPT.

Clean Water Supply

Clean water supply with a capacity of at least 2 gpm at 20 psig. Connect to the pressure washer using an ordinary garden hose.

Cleaning the Unit

Step 1

Turn off equipment.

Turn off the feed water to the stripper.

Step 2

Provide for waste disposal.

Make provisions for disposing of the sludge and waste generated during cleaning. A wet/dry vacuum may be required, or possibly the outlet pump (if provided) can pump out to a storage tank. Be aware that large pieces of debris might possibly clog the outlet pump or check valve.

Step 3

Remove cleanout port covers.

Remove all cleanout port covers.

Step 4

Turn on water and pressure washer.

Turn on the water supply to the pressure washer. Then, turn on the pressure washer. Wear protective goggles or face shield while spraying.

Step 5

Insert wand and start pressure washer water flow.

Insert the wand all the way into the 8" (20cm) cleanout port on the sump tank. Have the spray nozzle pointed up toward the bottom of the lowest tray. Holding the wand tightly, pull the trigger to start the pressurized water flow. Expect the wand to kick back as flow starts.

Step 6

Move wand side to side.

Move the wand side to side at a rate of about 1 inch (3cm) per second. Be sure to cover the entire tray bottom area. Recommended cleaning times for one side of one tray are given below:

Model 1300	2 min
Model 2300	4 min
Model 2600	8 min
Model 3600	12 min
Model 31200	24 min
Model 41200	32 min

Step 7

Inspect cleaned area.

Periodically stop the cleaning operation and inspect the cleaned area by shining a light into the unit. The area is clean when there are no deposits in or around the stripper tray holes.

Caution: Check the water level in the sump tank periodically, and drain it when necessary.

Step 8

Clean top side of tray.

When the bottom surface appears clean, move the wand to the top side of the same tray by inserting it in the next highest cleanout port. Continue spraying with the nozzle pointed down onto the top surface of the tray. Remove all visible deposits from the tray baffles and the walls of the unit.

Step 9

Repeat for all trays.

Repeat the procedure for the bottom of the next higher tray, etc., working up to the top tray.

Step 10

Rinse.

After the cleaning operation is finished, rinse the trays, baffles, and walls with the pressure sprayer. Work down from the top tray to the sump tank. Make sure the surfaces are clean and the holes are not blocked by loosened debris.

Step 11

Remove the top cover, flip it over, and wash the bottom side. Inspect spray nozzle and the wire mesh mist eliminator pad for fouling.

Clean the spray nozzle.

If the spray nozzle shows evidence of deposits, it should be removed and cleaned with a wire brush. Some systems have more than one spray nozzle.

Check the mist eliminator pad.

Clean the mist eliminator pad.

Use the pressure sprayer to remove debris, deposits, and gummy residues on the mist eliminator pad.

Replace the mist eliminator pad.

Mist eliminator pads that are excessively plugged should be replaced. The old pad is removed by loosening the retainer plates on the corners of the pad. Reinstall the new pad in the same orientation as the old one.

Section 5: Trouble Shooting

Caution: A competent electrician should perform any work inside the electrical control panel. Do not perform troubleshooting if you are not familiar with the procedures or the equipment.

Problem — Blower Won't Start Or Run

No power to blower

Check that all switches are in "ON" or "AUTO" position.

Position main disconnect switch to "ON" position. Turn control switches to "ON" or "AUTO."

Blown Fuse

Check to see if fuses are ok. Check fuses in main disconnect switch and in control panel.

If blown, replace with fuse of the same size and rating to avoid the risk of fire or electrical shock.

Overload relay trips

Locate reset button on blower overload relay.

Push reset button in. Reasons for tripping: incorrect line voltage, motor wired incorrectly, inadequate ventilation, worn bearings.

Tubing to air pressure switch plugged with water or debris.

Remove tubing from air pressure switch and blow into it towards tank.

Clean or replace tubing if plugged or kinked.

Blower does not rotate freely.

TURN OFF ALL power to the system. Try to spin wheel by hand. Wheel should rotate freely.

If not, call North East Environmental Products.

Problem — Outlet Pump Won't Shut Off

Suction or discharge piping for pump is clogged.

Check water flow from discharge pipe. Piping should be clean inside. Look for narrowing caused by scale or iron accumulation.

Remove piping. Inspect, clean, or replace as necessary.

Float switch in tank is stuck in down position.

Remove 8 inch (20cm) inspection cap and check that all floats are floating on the water.

Clean all deposits from float. Replace float if necessary.

Normal Operation – Water level in sump is OK.

Pump will stop when water level reaches pre-determined height in tank.

Allow water level to decrease until pump turns off.

Let water level reach predetermined lower level, which will cause outlet pump to turn off. Water level may be just below the bottom of clear sight tube before pump shuts off – this is normal.

Problem — Outlet Pump Won't Run Or Pump Water

No power to pump

Check that all switches are in "ON" or "AUTO" position.

Position main disconnect switch to "ON" position. Turn control switches to "ON" or "AUTO."

Blown fuse.

Check to see if fuses are ok. Check fuses in main disconnect switch and in control panel.

If blown, replace with fuse of the same size and rating to avoid the risk of fire or electrical shock.

Overload relay trips.

Locate reset button on pump overload relay.

Push reset button in. Reasons for tripping: incorrect line voltage, motor wired incorrectly, inadequate ventilation, worn bearings.

Normal operation – Water level in sump is OK.

Pump will start when water level reaches predetermined height in tank.

Allow water level to increase until pump turns on. Be sure pump switch is in "Auto" position.

Let water level reach predetermined upper level, which will cause outlet pump to turn on.

Level switch in tank is wired incorrectly in control panel.

Check wiring circuit against diagram. See that all connections are tight and no short circuits exist because of worn insulation, crossed wires, etc.

Rewire any incorrect circuits. Tighten connections, replace defective wires.

Pump does not rotate freely.

TURN OFF ALL POWER TO THE SYSTEM. Try to turn impeller by hand.

If impeller won't turn, remove housing and locate source of binding. It could be due to impeller, seal, or bearing damage, or excessive fouling.

Impeller or check valve is fouled.

TURN OFF POWER.

Remove pump outer housing and inspect impeller for blocked openings. Be sure to have a new housing gasket kit available before removing housing. Remove check valve from line and inspect for stuck or fouled valve. Clean or replace impeller or check valve as necessary.

Problem — Low Air Pressure/Vacuum In Stripper Tank

Blower damper closed.

Visually check position of damper on inlet of blower.

Open damper to get proper reading on pressure gauge. Firmly tighten damper set screw.

Motor rotation backwards.

Watch rotation of blower wheel at slow speed. It must match direction of the rotation arrow on the blower housing.

Reconnect wiring for proper rotation as per motor diagram.

Gravity discharge trap installed incorrectly.

Trap should be positioned vertically, as an "upside down U."

Install discharge trap per outlet plumbing drawings located in Section 6.

Inlet chamber (sealpot) in each tray is not full of water.

Remove "4 inch" (10cm) rubber caps or slide tray aside and look at water level in chambers.

Remove 4 inch (10cm) rubber caps on end of trays. Fill up inlet chambers with a hose. Or, follow the sealpot fill procedure as described in the Initial Start Up section.

Rubber clean out caps not in place.

All cleanout ports must have a rubber cap installed.

Tighten clamp on all rubber caps.

Tubing to pressure gauge plugged with water or debris.

Remove tubing from pressure gauge and blow into it towards tank.

Clean or replace tubing if plugged or kinked.

Unit has gravity feed, and inlet pipe on inside of ShallowTray cover is not submerged in inlet chamber water.

Remove cover and measure length of piping hanging from inside of cover. Length is to be about 10½ inches (27cm) from cover surface.

Adjust length of inlet pipe on inside of cover until total length is about 10½ inches (27cm). DO NOT INSTALL NOZZLE ON A GRAVITY FEED UNIT.

Debris blocking blower intake.

Look at blower intake screen.

Remove debris from screen.

Normal operation for automatic unit.

When inlet pump starts, the blower will start and air pressure will increase to required operational level.

No action necessary.

Problem High Pressure/Vacuum In Stripper

Air exhaust piping is restricted.

Check vent piping for bird nests or other obstructions. Check that vent pipe diameter does not decrease.

Intake or exhaust air pipe diameter must be at least as big as the cover vent or blower intake diameters.

Air holes in bottom of trays are plugged.

Remove inspection and cleanout caps and visually inspect aeration holes.

For iron fouling, clean out the unit with a pressure washer. For scaling, scrape or bang the scale from all surfaces, then use a pressure washer to open the 3/16 inch (5mm) diameter holes. Consider using a sequestering agent to prevent scaling.

Mist eliminator pad is plugged.

Remove cover from ShallowTray and inspect the bottom of the mist eliminator pad in the cover.

Remove mist eliminator pad from cover and clean. If fouled, replace with a new mist eliminator.

Problem — Water Won't Flow Into Unit

Inlet/well pump functioning properly.

Allow water level to rise in well pump, which will turn on the inlet pump and start water flow to system.

No action necessary.

Stripper Sump Tank air pressure is low. System is in alarm condition.

Read sump tank air pressure from pressure gauge. System should be in alarm condition if pressure is below about 2 inches (5cm) W.C.

Check that blower is operating properly, and has correct rotation. Check that all rubber caps are in place on end of trays.

Spray nozzle or inlet piping is plugged.

Remove cover and inspect nozzle and piping for debris and buildup.

Clean or replace clogged parts.

Problem Iron Fouling Is A Problem

Iron precipitates out of water when treated with an air stripper, causing iron build up in unit.

Remove cleanout caps and inspect inside of tray for buildup/fouling.

- Clean out unit with pressure washer on a routine basis.
- Pretreat incoming water to reduce fouling problems in stripper.
- Meter a sequestering agent into the inlet water.

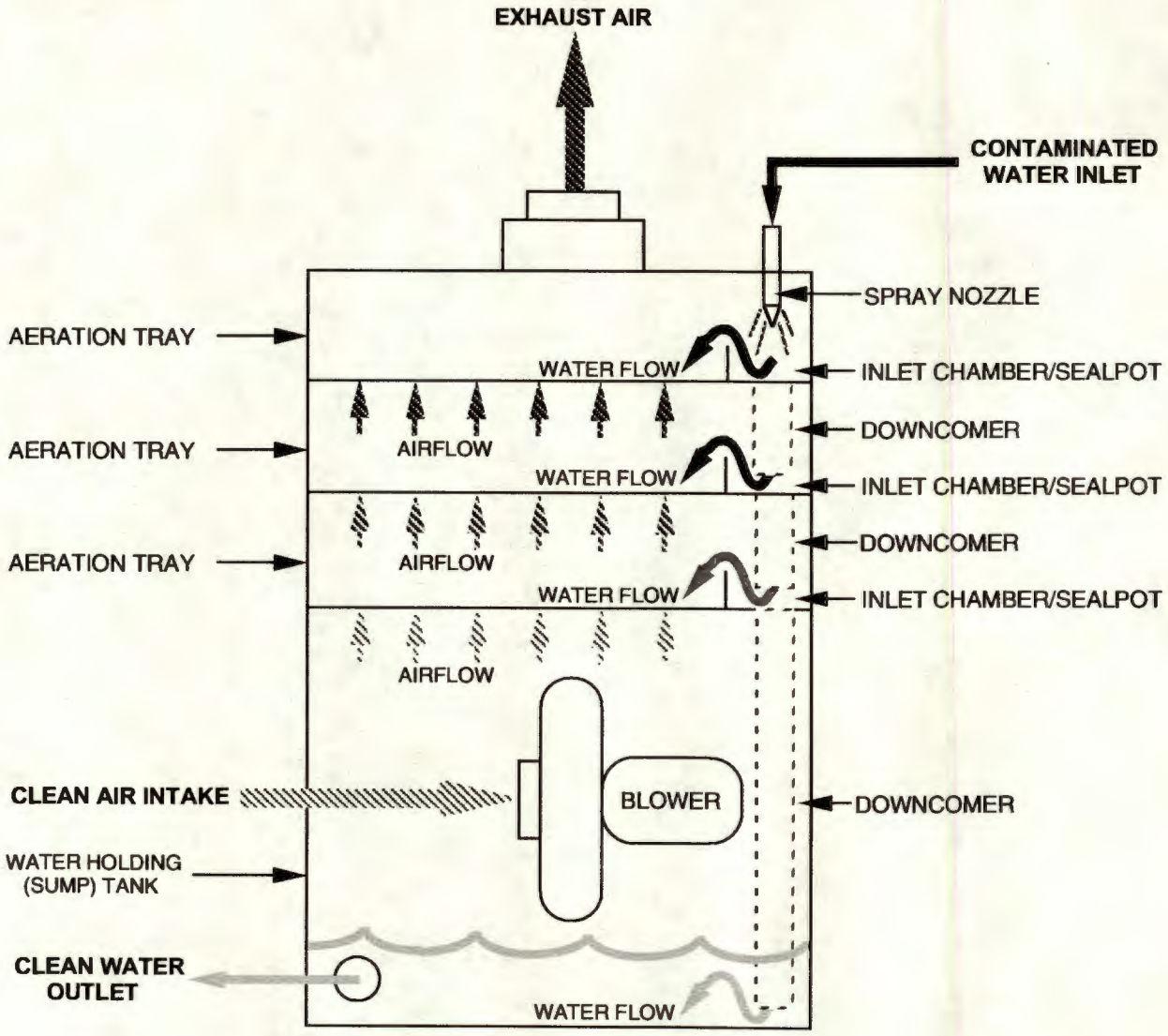
Problem VOC Removal Is Less Than Expected

There are many possible reasons for poor stripper efficiency. Please review the following list of questions to determine what the problem might be.

1. Have the trays been taken apart? Are they put back together as supplied from the factory, i.e., nozzle over sealpot, downcomers from each tray underwater in the sealpot of the tray below?
2. What is the sump tank air pressure reading? Is it steady, slowly changing over time, or rapidly fluctuating?
3. What is the air flow rate through the stripper? How is it measured? Where is the sensor mounted?
4. What is the air intake and exhaust piping design (size of ducts, number of elbows, length of pipe run, GAC, heaters, other restrictions)?
5. Are sample ports installed on each tray to verify per-tray removal efficiency?
6. Is sump tank contaminated? Where are effluent samples taken from?
7. Are sample ports purged for 30 seconds-1minute before taking sample?
8. Are samples being taken, stored, and tested per approved methods?
9. Are seal pots on each tray full of water?
10. Does the sump tank have at least 4 inches (10cm) of water at all times?
11. Is the water suction elbow in the tank pointing down and always underwater?
12. What is the inlet water temperature?
13. What else is in the water besides the contaminants in question?
14. Are there occasional slugs of free product, or much higher than normal contaminant concentrations that could enter the stripper?

15. Is inlet water supplied as a continuous stream (as from an electric pump), or is the flow pulsed (as from a pneumatic pump)?
16. Are there surfactants, detergents, greases, fats, etc. in the water that are causing foaming in the stripper?
17. Is there equipment near the blower intake that could be contaminating the air?
18. Has the air entering the blower been tested for VOCs?
19. How far away from each other are the air intake and air exhaust points? Is the air intake downwind or upwind from the exhaust? Is it possible for contaminated air to be sucked back into the stripper air intake?
20. Is the blower spinning in the correct direction (top of blower wheel spinning towards tank)? Watch wheel when it is almost stopped.
21. Is there air coming out of the discharge piping?
22. Is outlet piping siphoning all water out of the sump tank, until it sucks air from tank?
23. What is the outlet plumbing design (gravity discharge, pumped discharge, uphill, downhill, other equipment in-line, size of piping, etc.)?
24. What do the bubbles look like in each tray? Install view ports to see.
25. Are the undersides of the trays free of drips and drizzles?
26. Are tray holes closed or plugged? Is there any scaling or fouling on the trays?
27. Is the system level?
28. When shutting system down, is inlet water shut off, blower allowed to operate for an additional 5 minutes, then blower shut off?

AERATION PROCESS, COUNTER-CURRENT AIR AND WATER FLOW



FOR REFERENCE ONLY !

DO NOT ASSEMBLE PER THIS DRAWING. SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ±1 in.	DRAWING NAME: AERATION PROCESS		
	DRAWING #: 900-200-00003		
DRAWN: MS DATE: 1/11/93	CUSTOMER:		
REV: A 3/9/94	SCALE:	SIZE: A	SHEET : OF:

Troubleshooting Guide for Poor Removal

WATER ISSUES

1. What is the water flow rate through the stripper?

2. Is there foam in the air stripper caused by surfactants, greases, fats , etc.?

3. What else is in the water besides the contaminates in question?

4. Are there occasional slugs of free product that could contaminate the sump of the air stripper?

5. Does the sump tank have at least 4 inches of water at all times?

6. Are the seal pots on each tray full of water?

7. Are the samples being taken, stored, and tested per approved methods?

AIR ISSUES

1. What is the air flow rate through the stripper?
   - How is it measured?
   - How does it compare with the shop tests?

2. Is there water blowing out the exhaust stack?

3. Is there air blowing out the water discharge piping?

4. What is the design of the air intake and exhaust?
   - Is there any constriction of the flow of air?

14. is there any way contaminated air can get into the blower intake?

MECHANICAL AND OTHER ISSUES

1. Is the blower spinning in the correct direction? i.e.Top of blower wheel spinning towards blower outlet. (The blower will blow air even if running backwards.)

2. Is the system level?

3. When system shuts down, does blower continue to run for 5 minutes after influent water stops?

4. Have there been any power outages that would cause untreated water to fall into the sump?

5. Are trays properly stacked so that the downcomers are in seal pots?

FOULING ISSUES

1. Is there any scaling or fouling on the trays? The holes in the trays should be 3/16 of an inch in diameter.

2. What is the sump tank pressure reading? Has it changed over time?

TYPICAL VENT LINE INSTALLATION

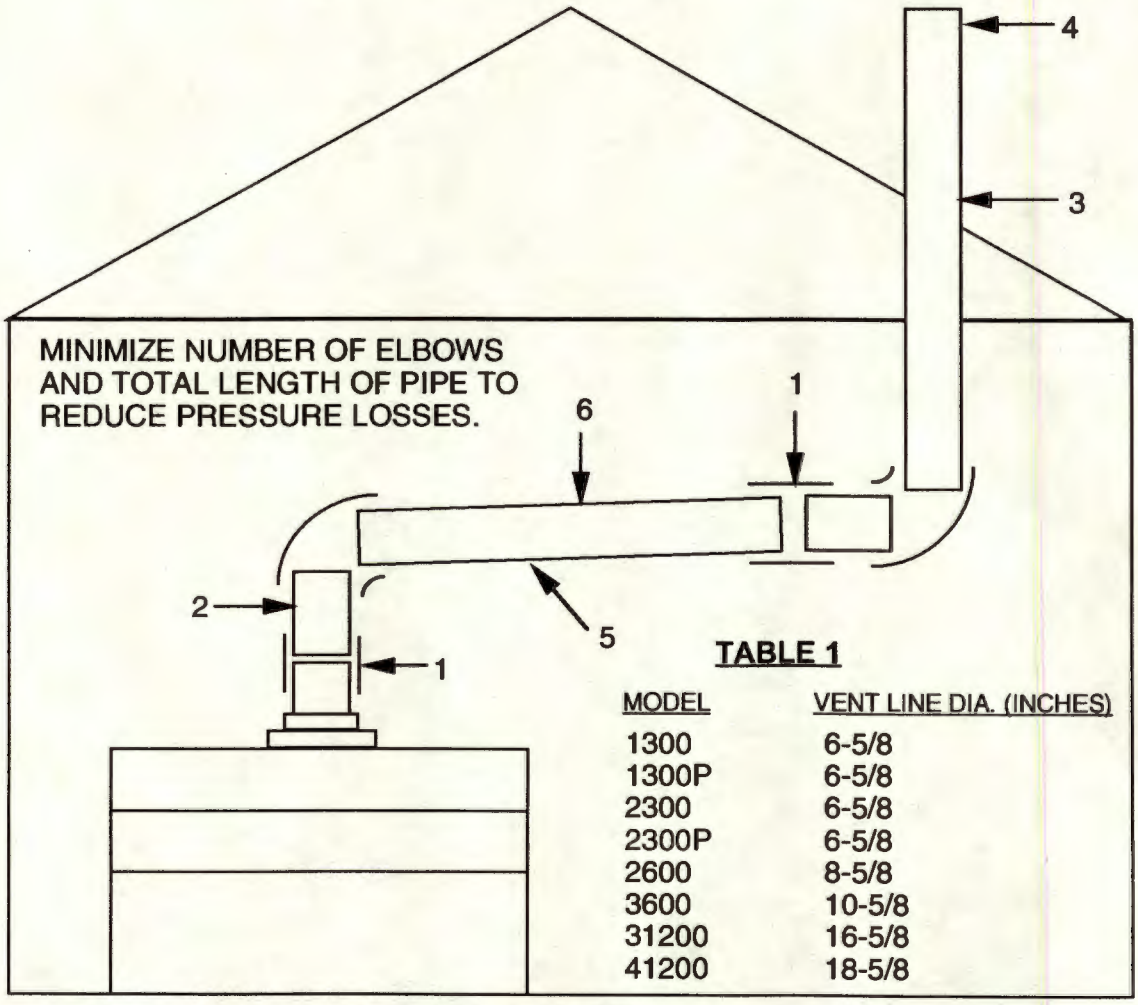
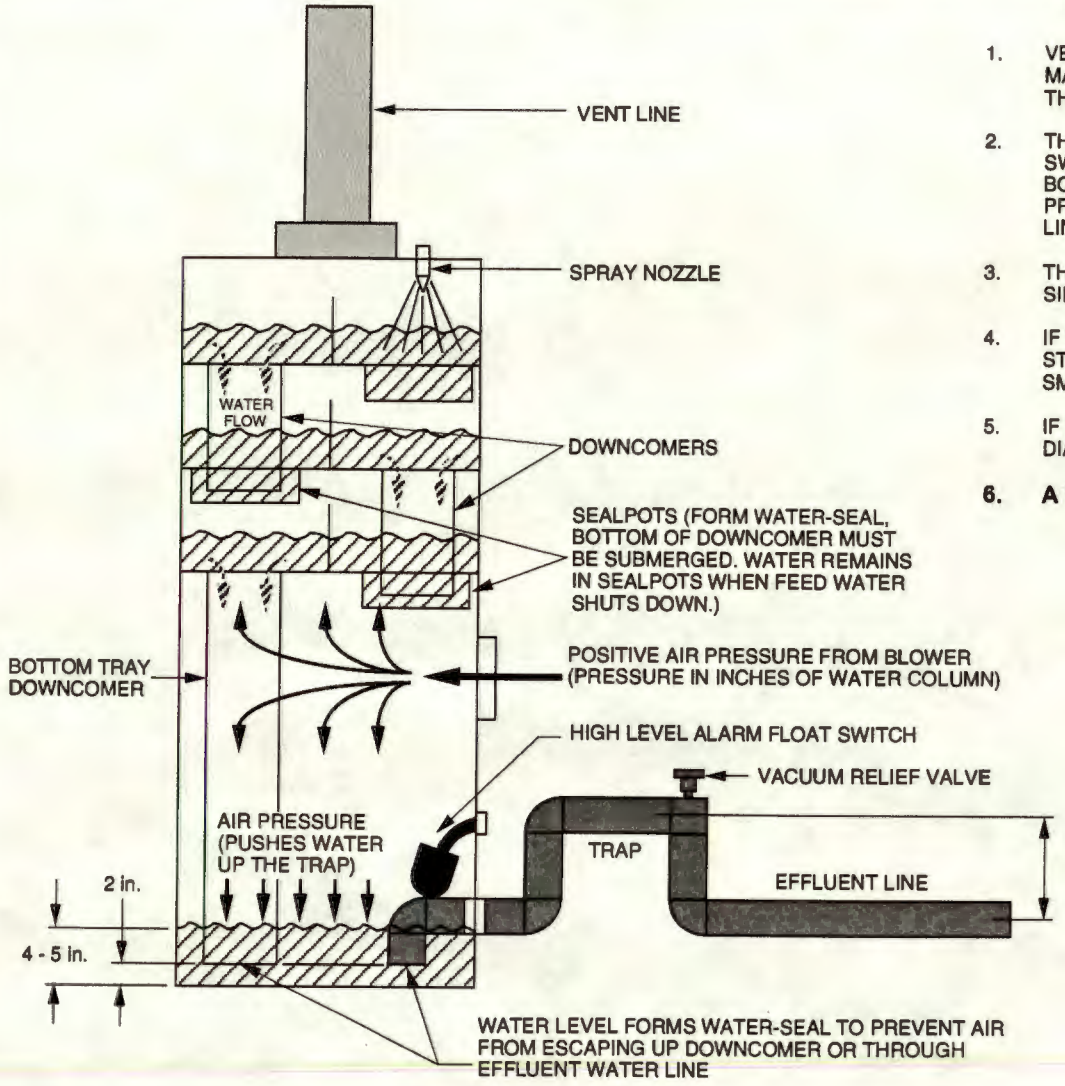


TABLE 1

MODEL	VENT LINE DIA. (INCHES)
1300	6-5/8
1300P	6-5/8
2300	6-5/8
2300P	6-5/8
2600	8-5/8
3600	10-5/8
31200	16-5/8
41200	18-5/8

NOTES:

1. RUBBER COUPLING WITH STAINLESS STEEL RING CLAMPS.
2. VENT LINE PIPE DIAMETER MUST BE EQUAL TO OR GREATER THAN THE AIR EXHAUST VENT DIAMETER ON THE AIR STRIPPER COVER.
3. FIRMLY SUPPORT PIPE AT ROOF PENETRATION.
4. FOR INTERMITTENT OPERATION, INSTALL WIRE MESH OF 1/4" (OR LARGER). FOR DRINKING WATER SUPPLY, INSTALL ELBOW WITH WIRE MESH.
5. ALLOW CLEARANCE FOR REMOVING SECTION OF VENT LINE FOR EASY ACCESS TO AERATION TRAYS.
6. PITCH VENT LINE TOWARD SHALLOW TRAY UNIT.
7. USE PIPING THAT HAS ADEQUATE STRENGTH (PRESSURE OR VACUUM) SPECIFICATIONS, AND THAT IS OF SUITABLE MATERIAL.



SIDE VIEW

DO NOT USE THIS TRAP WHEN PUMPING OUT OF ShallowTray OR WITH INDUCED DRAFT SYSTEMS

GRAVITY DISCHARGE TRAP SET-UP (SEE NOTE 6)

1. VERTICAL TRAP HEIGHT SHOULD BE SET SO THAT THE SYSTEM MAINTAINS A SUMP TANK WATER LEVEL OF 4-5 INCHES (FROM THE BOTTOM OF THE SUMP TANK) DURING NORMAL OPERATION.
2. THE 4-5 INCH WATER LEVEL ALLOWS THE HIGH LEVEL ALARM SWITCH TO RESET AND ALSO FORMS A WATER SEAL AROUND THE BOTTOM TRAY DOWNCOMER AND THE EFFLUENT WATER LINE. THIS PREVENTS AIR FROM ESCAPING THROUGH THE EFFLUENT WATER LINE AND BOTTOM TRAY DOWNCOMER.
3. THE VACUUM RELIEF VALVE PREVENTS THE WATER FROM SIPHONING OUT THE EFFLUENT WATER LINE.
4. IF THE SUMP TANK WATER IS DEEPER THAN 4-5 INCHES WHEN THE STRIPPER IS IN OPERATION, THEN EITHER THE LINE SIZE IS TOO SMALL OR THERE IS SOME TYPE OF RESTRICTION IN THE LINE.
5. IF THE EFFLUENT LINE BECOMES FOULED, IT WILL REDUCE THE DIAMETER OF THE LINE AND CAUSE THE WATER LEVEL TO RISE.
6. **A TRAP IS NOT NEEDED IF THERE IS A DISCHARGE PUMP.**

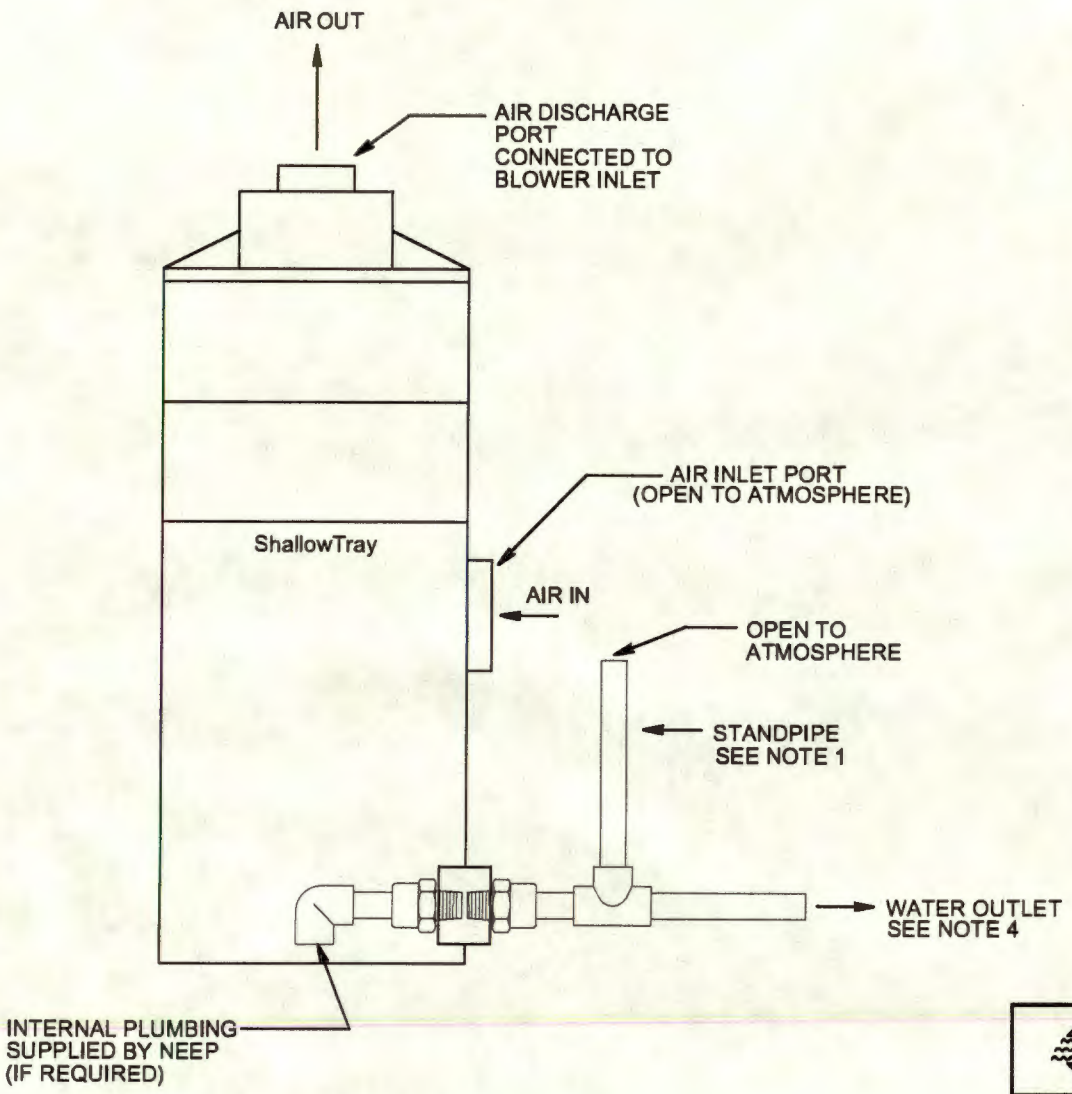
FOR REFERENCE ONLY !

DO NOT ASSEMBLE PER THIS DRAWING. SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

SET HEIGHT OF INVERTED U-TRAP TO MAINTAIN 4-5 in. WATER LEVEL IN SUMP TANK DURING STRIPPER OPERATION

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 in.	DRAWING NAME: GRAVITY DISCHARGE TRAP HEIGHT		
	DRAWING #: 900-140-00001		
DRAWN: MS	CUSTOMER:		
DATE: 11/8/93	SCALE:	SIZE: A	SHEET: OF:



NOTES

1. HEIGHT TO TOP OF STANDPIPE SHOULD BE 1" HIGHER THAN LOWEST POINT ON AIR INLET PORT.
2. DO NOT USE THIS SETUP IF PUMPING OUT OF ShallowTray.
3. DISHARGE PIPING SHALL BE GREATER THAN OR SAME SIZE AS WATER DISCHARGE PORT.
4. PIPING RUN MUST PITCH AWAY FROM STRIPPER.

DRAWING FOR REFERENCE ONLY
DO NOT ASSEMBLY PER THIS DRAWING.
SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

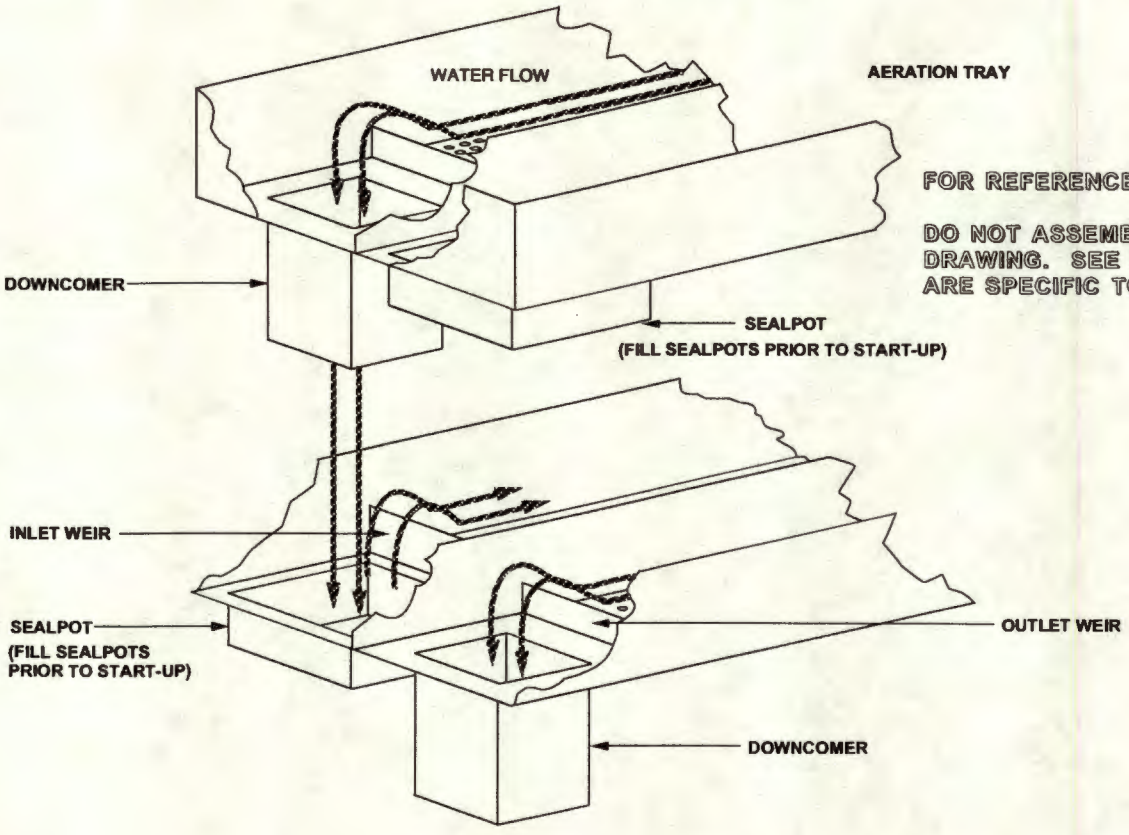
TITLE

RECOMMENDED GRAVITY DISCHARGE SETUP FOR INDUCED DRAFT SYSTEMS

SIZE	DWG NO.	SHEET	REV
A	900-140-00003	1 OF 1	Ø

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	7-7-95

SEALPOT FUNCTION - WATER SEAL

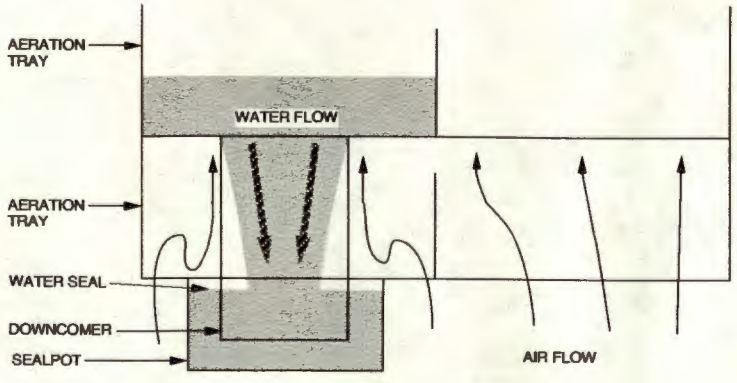


FOR REFERENCE ONLY !

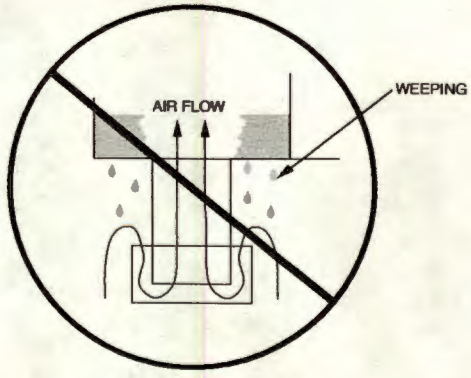
DO NOT ASSEMBLE PER THIS DRAWING. SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

CAUTION!

SEALPOT MUST BE FILLED WITH WATER TO CREATE WATER SEAL.



FILLED SEALPOT



UNFILLED SEALPOT

1. EACH AERATION TRAY CONTAINS A SEALPOT. ALL SEALPOTS MUST BE FILLED WITH WATER TO FORM A WATER SEAL AROUND THE DOWNCOMERS.
2. IF SEALPOTS ARE NOT FILLED, AIR WILL TRAVEL UP THE DOWNCOMER AND PREVENT WATER FROM FLOWING DOWN THEM. THIS WILL CAUSE THE WATER TO WEEP THROUGH THE 3/16" AERATION HOLES ON THE BOTTOM OF EACH TRAY, RESULTING IN POOR REMOVAL EFFICIENCY.
3. THE SUMP TANK WATER LEVEL ACTS AS A WATER SEAL FOR THE BOTTOM TRAY DOWNCOMER. MAINTAIN AT LEAST 3" OF WATER IN THE SUMP TANK AT ALL TIMES.
4. SEALPOTS CAN BE FILLED MANUALLY, OR BY FOLLOWING THE PROCEDURES LISTED IN THE OPERATION AND MAINTENANCE MANUAL.

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 in.	DRAWING NAME: SEALPOTS		
	DRAWING #: 900-160-00061		
DRAWN: MS DATE: 11/19/92	CUSTOMER:		
REV: A 3/9/94	SCALE:	SIZE: A	SHEET : OF :

TO PREVENT PLASTIC DAMAGE

- Keep water temperature inside the system less than 95°F (35°C).
- Keep air temperature around the system less than 95°F (35°C).
- Keep ShallowTray system out of direct sun.
- Make sure all piping to the tank/cover mates up properly, without stress.
- Make sure all piping is supported independent of the tank/cover.

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

APPENDIX C

PRODUCT DATA SHEET
REDUX 300 DEPOSIT CONTROL AGENT

Remede Products

Redux 300

DEPOSIT CONTROL AGENT

PRODUCT APPLICATION:

Redux 300 is a concentrated blend of sequestering agents and polymers specifically designed to prevent the precipitation and deposition of iron and other metallic oxides and hardness salts such as ca lcium carbonate in a wide variety of water handling systems. The product is particularly effective in preventing the deposition of iron, manganese and calcium contaminants in ground water remediation systems utilizing air stripping towers. By maintaining c lean packing surfaces, use of Redux 300 helps to increase water circulation rates, minimize pressure drops, reduce liquid hold -up and improve the mass transfer efficiency of the unit. When used on a con tinuous basis the product can also help to remove exi sting deposits from the system, thereby enabling a facility to reduce traditional chemical and manpower clean -up expenses.

Redux 300 is easy to use in that the product is environmentally -safe, does not promote microbio logical contamination, is active ov er a broad pH range and is compatible with all other water treatment compounds. The product is also chlorine -stable, does not contribute to foaming problems and is non - corrosive to metal surfaces.

PRODUCT DESCRIPTION:

Appearance:	Clear, Pale straw to yellow
Specific Gravity:	1.00 - 1.05 @ 25 degrees C
Density:	9.17 pounds per gallon
pH:	Approximately <5
Freeze Point:	Less than 32 degrees F

PRODUCT DOSAGE:

As product feed rates are highly dependent upon makeup water characteristics and system operating conditions, your sales representative should be consulted for specific dosage recommendations. Typically , however, Redux 300 is dosed to the system at a rate of 10 -100 ppm (as product). The recommended feed method is by continuous injecti on of the product into the system influent line (see Product Application Guidelines on the reverse side of this page for specific product feed recommen dations and procedures).

PRODUCT SAFETY:

As with any industrial chemical, Redux 300 should be handled with appropriate care. There fore, please have all supervisory personnel and operating employees review the Material Safety Data Sheet (MSDS) to obtain recommended application, storage and disposal procedures before using the product in your facility.

PRODUCT PACKAGING:

Redux 300 is available in 275 gallon totes, 55 and 30 gallon drums, 15 gallon containers, 6 gallon pails and bulk.

550 Vermont Rte.30, P.O. Box 331, Newfane, Vermont 05345
Phone: 802-365-7200 Fax: 802-365-4652 remedeproducts.com

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

APPENDIX D

AIRSTRIPPER FIXED DWYER PITOT TUBE PRESSURE /FLOW LOOK-UP TABLE

Former Brainerd Manufacturing Site
Air Stripper Fixed Dwyer Pitot Tube Pressure/Flow Look-up Table
For 6-inch Pipe

Differential Pressure (inches of water)	Velocity (feet per minute)	Flow (cubic feet per minute)
0.020	562.339	110.36
0.040	795.267	156.07
0.060	973.999	191.15
0.080	1124.677	220.72
0.100	1257.428	246.77
0.120	1377.443	270.32
0.140	1487.808	291.98
0.150	**1540.028**	**302.23**
0.160	1590.534	312.14
0.180	1687.016	331.08
0.200	1778.271	348.99
0.250	1988.168	390.18
0.300	2177.929	427.42
0.350	2352.432	461.66
0.400	2514.855	493.54
0.450	2667.407	523.48
0.500	2811.694	551.79

Target = 300 CFM

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

APPENDIX E

PROCESS MONITORING LOG SHEET

BENCHMARK
ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

DESPATCH INDUSTRIES, INC.
FORMER BRAINERD MANUFACTURING FACILITY
IRM GROUNDWATER PUMP AND TREAT PROCESS LOG

SHEET 1 OF 2

DATE	TIME	OPERATOR INITIALS	DEPOSIT CONTROL AGENT VOLUME REMAINING (GALS)	VOLUME OF DEPOSIT CONTROL AGENT USED DURING PERIOD (GALS)	AIR STRIPPER SIGHT TUBE LEVEL (IN. ABOVE FLOOR)	AIR STRIPPER AIR PRESSURE (in. WATER)	DISCHARGE PUMP FLOW RATE (GPM)	TOTAL VOLUME TREATED TO DATE (GALS)	VOLUME WATER TREATED DURING PERIOD (GALS)

FORMER BRAINERD MANUFACTURING FACILITY
IRM GROUNDWATER PUMP AND TREAT PROCESS LOG

SHEET 2 OF 2

DATE (CONT.)	TIME (CONT.)	KW-HRS USED TO DATE (KW-HR)	KW-HRS USED DURING PERIOD (KW-HR)	NOTES

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

APPENDIX F

DESPATCH INDUSTRIES
INDUSTRIAL DISCHARGE PERMIT

Department of **Environmental Services**
Monroe County, New York

Maggie Brooks
County Executive

John E. Graham, P.E.
Director

July 14, 2004

Mr. Alan Shaffer
Despatch Industries, Inc.
21 Wolf Trapp
Pittsford, NY 14534

Re: Sewer Use Permit

Dear Mr. Alan Shaffer:

Attached you will find your Sewer Use Permit No. 883 , which will expire on July 31, 2005
Prior to expiration, we will mail you a renewal application.

This issue of the above permit is in compliance with the requirements of Section 6.1 of the Monroe County Sewer Use Law. In no way does it imply that you have complied with all present regulations. During the next six (6) months, a representative from the Industrial Waste Section may inspect your premises and sample the industrial wastewater discharge. If there should be any violations, you will be notified by mail.

If you have any questions regarding the permit, please call Sean Keenan at 585-760-7610 extension 7143.

Sincerely,

Harry M. Reiter
Pretreatment Coordinator

TERMS AND CONDITIONS

GENERAL REQUIREMENTS:

A. The permittee agrees to accept and abide by all provisions of the Sewer Use Law of Monroe County and of all pertinent rules or regulations now in force or shall be adopted in the future.

B.1. In addition to the parameters/limits outlined, the total facility discharge shall meet all other concentration values as described in Article II, Section 10e of the Monroe County Pure Waters Districts, Rules and Regulations-Sewer Use Law of the County of Monroe.

B.2. Included in Article II, Section 10e, is the definition of "Normal Sewage". "Normal Sewage" may be discharged to the sewer system in excess of the concentrations outlined in the Joint Rules and Regulations, however, the facility will be subject to the imposition of a sewer surcharge and possible self monitoring requirements as a result. Surcharging procedures are outlined in Article X of the MCSUL.

B.3. Regulatory sampling for analytes not specified under "required monitoring" shall be conducted by the Industrial Waste Section at a minimum frequency of once every three (3) years.

C. This permit is not assignable or transferable. The permit is issued to a specific user and location.

D. Per Article VIII, Section 8.11 of the MCSUL, a violation by the permittee of the permit conditions may be cause for revocation or suspension of the permit after a Hearing by the Administrative Board, or if the violation is found to be within the emergency powers of the Director under Sections 4.5 or 5.5. The revocation is immediate upon receipt of notice to the Industrial User; however a Hearing shall be held as soon as possible.

E. As provided under Article VIII, Section 8.1, the Director and his duly authorized representatives shall gain entry on to private lands by permission or duly issued warrant for the purpose of inspection, observation, measurement sampling and testing in accordance with the provisions of this law and its implementing Rules and Regulations. The Director or his representatives shall not have authority to inquire into any processes used in any industrial operation beyond that information having a direct bearing on the kind and source of discharge to the sewers or the on-site facilities for waste treatment. While performing the necessary work on private lands, referred to above, the Director or his duly authorized representative shall observe all safety rules applicable to the premises as established by the owner and/or occupant.

SPECIAL CONDITION:

A. The pH range for this permit is 5.0 - 12.0 su. This range is specifically permitted by the Director as allowed under Article IV Section 4.2 of the Monroe County Sewer Use Law.

REPORTING REQUIREMENTS:

A. Per the requirements of 40 CFR Part 403.5., Significant Industrial Users must submit Periodic Reports on Continued Compliance to the Control Authority on a biannual (2/yr) basis. Deadline dates of submission for these reports will be August 15 and February 15 respectively.

B. Discharge monitoring reports shall be submitted to the Control Authority upon receipt from the permittee's testing laboratory.

C. Any Industrial User subject to the reporting requirements of the General Pretreatment Regulations shall maintain records of all information resulting from any monitoring activities required by 403.12 for a minimum of three (3) years. These records shall be available for inspection and copying by the Control Authority. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Industrial User or the operation of the POTW Pretreatment Program or when requested by the Director or the Regional Administrator.

NOTIFICATION REQUIREMENTS:

A. Pursuant to Article VIII, Section 8.4k, the permittee shall notify the Department within 24 hours of becoming aware that discharge monitoring is in violation of any permit limit. This notification shall be directed to the Industrial Waste Section at 760-7600. The User shall also repeat sampling and analysis for the analyte in non-compliance and submit the results of the repeat analysis to Monroe County within 30 days after becoming aware of the violation.
B. Notify the Director in writing when considering a revision to the plant sewer system or any change in industrial waste discharges to the public sewers. The latter encompasses either an increase or decrease in average daily volume or strength of waste or new wastes.
C. Notify the Director immediately of any accident, negligence, breakdown of pretreatment equipment or other occurrence that occasions discharge to the public sewer of any waste or process waters not covered by this permit.

SLUG CONTROL:

An Industrial User shall be required to report any/all slug discharges to the Monroe County sewer system. For the purpose of this permit enclosure, a slug discharge shall be defined as any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge. Following a review process, the control authority (Monroe County) shall determine the applicability of a facility slug control plan. If the Control Authority decides that a slug control plan is needed, the plan shall contain, at a minimum, the following elements:

1. Description of discharge practices, including non-routine batch discharges.
2. Description of stored chemicals.
3. Procedures for immediately notifying the Control Authority of slug discharges, including any discharge that would violate a prohibition under 40 CFR 403.5 (b), with procedures for follow-up written notification within five (5)days.
4. If necessary, procedures to prevent adverse impact from accidental spills, including, but not limited to, inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site run-off, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants (including solvents) and/or measures and equipment for emergency purposes.

SNC DEFINITION:

In accordance with 40 CFR 403.8 (f) (vii), an industrial user is insignificant noncompliance (SNC) if its violations meet one or more of the following criteria:

A. Chronic violations of wastewater discharge limits - defined as those which 66% or more of all the measurements taken during a six month period exceed (by any magnitude) the daily maximum limit or the average limit for the same pollutant parameter. This criteria does NOT apply to the following Monroe County surchargeable parameters:

Biochemical Oxygen Demand, Total Suspended Solids, Chlorine Demand and Total Phosphorus (ref. Article X - Monroe County Sewer Use Law).

B. Technical review criteria (TRC) violations - defined as those in which 33% or more of all the measurements for each pollutant parameter taken during a six month period equal or exceed the product of the daily maximum limit or the average limit times the applicable TRC. This criteria does NOT apply to the following Monroe County surchargeable parameters: Biochemical Oxygen Demand, Total Suspended Solids, Chlorine Demand, and Total Phosphorus (ref. Article X - Monroe County Sewer Use Law).

C. Any other violation of a pretreatment effluent limit (daily maximum or longer-term average) that the Control Authority had caused, alone or in combination with other discharges, interference or pass-through (including endangering the health or POTW personnel or the general public).

D. Any discharge of a pollutant that has: caused imminent endangerment to human health, welfare or the environment or has resulted in the POTW's exercise of its emergency authority under paragraph (t)(1)(vi)(8) of 40 CFR part 403 to prevent such a discharge.

E. Failure to meet, within 90 days after the scheduled date, a compliance schedule milestone contained in a local control mechanism or enforcement order, for starting construction, completing construction, or attaining final compliance.

F. Failure to provide, within 30 days after the due date required reports such as BMR's, 90 day compliance reports, periodic reports on continued compliance.

G. Failure to accurately report noncompliance.

H. Any other violation or group of violations which the Control Authority determines will adversely affect the operation and implementation of the local pretreatment program.

PENALTIES:

Should the facility be considered in Significant Non-Compliance (SNC), based on the above-mentioned criteria, the minimum enforcement response by Monroe County will be the publication of the company name in the Gannett Rochester newspaper. The company will be published as an Industrial User in Significant Non-Compliance (SNC). Fines and criminal penalties may follow this publication (ref. Article XII - Monroe County Sewer Use Law).

Nothing in this permit shall be construed to relieve the permittee from civil/criminal penalties for noncompliance under Article XII, Section 12.1(D) of the Sewer Use Law of the County of Monroe. Article XII, Section 12.1(D) provides that any person who violates a permit condition is subject to a civil penalty not to exceed $10,000 for any one case and an additional penalty not to exceed $10,000 for each day of a continuing violation.

INITIAL SEWER USE PERMIT

County of Monroe Pure Waters District No. 3520

RECEIVED
JUN 08 2004
By

Permit No: 883

Expires: 07-31-2005

Fee: $40.00

Check # 4599

Firm Name Despatch Industries, Inc.

Address 115 North Washington St. Mail Add. → 21 Wolf Trail

East Rochester, New York 14445 Pittsford NY 14534

Type of Business or Service: Former manufacturer of hardware and metal products.

I. The above-named applicant is permitted to discharge wastes into the Pure Waters Sewer system or Tributary thereto as applied for by an application dated _____ and verified by the applicant except the Director of Pure Waters requires the following terms and conditions to govern the permitted discharge:

A. _____

B. _____

C. _____

II. The applicant further agrees to:

1. Accept and abide by all provisions of the Sewer Use Law of Monroe County and of all pertinent rules or regulations now in force or shall be adopted in the future.

2. Notify the Director of Pure Waters in writing of any revision to the plant sewer system or any change in industrial wastes discharge to the public sewers listed in Exhibit "B". The latter encompasses either (1) an increase or decrease in average daily volume or strength of wastes listed in Exhibit "B" or (2) new wastes that were not listed in Exhibit "B".

3. Furnish the Director of Pure Waters upon request any additional information related to the installation or use of sewer or drain for which this permit is sought.

4. Operate and maintain any waste pretreatment facilities, as may be required as a condition of the acceptance into the public sewer of the industrial wastes involved, in an efficient manner at all times, and at no expense to the County.

5. Cooperate with the Director of Pure Waters or his representatives in their inspecting, sampling, and study of wastes, or the facilities provided for pretreatment.

6. Notify the Director of Pure Waters immediately of any accident, negligence, breakdown of pretreatment equipment, or other occurrence that occasions discharge to the public sewers of any wastes or process waters not covered by this permit.

Applicant's Signature _____ Date 6/4/04

Applicant's Title President

Emergency Contact Thomas H. Forbes, P.E. Phone (716) 856-0599

Permit Approved by John E Graham PE Date 7-6-2004

Director of Pure Waters

APPLICATION FOR LICENSE OR PERMIT FOR DISCHARGE INTO PURE WATERS SEWER SYSTEM OR TRIBUTARY

1. Name of Applicant: Despatch Industries, Inc.
   Company or Individual

2. Address of Applicant: 115 North Washington St.
   East Rochester, New York 14445

3. Location of Property: Same as above.

4. Ownership of Property: Name/Address if different than above: N.A.

5. Number of sewer connections requiring license/permit: One.

6. Type of activity producing wastes requiring license or permit pursuant to Sewer Use Law of Monroe County: Effluent from groundwater pretreatment system.

7. Department of Health or of New York State Permit # (if any): N.A.

8. Number of Attachments: Three

   Exhibit "A" Location Map

   Exhibit "B" Schedule of Remediation Water Produced

   Exhibit "C" Summary of Industrial Waste Characteristics

Note: Fill in all applicable spaces. If not applicable, mark N.A. in appropriate space.

ATTACHMENTS TO ACCOMPANY APPLICATION

1. A plot or tape location map of the property showing accurately the size and location of all sewer and drainage connections to the sewerage system, all pretreatment devices and all manholes or other accessible sampling points. Each sewer or drain connection shown on drawing shall be designated by an identification number. The plot or tape location map shall be attached as Exhibit "A".

2. A complete schedule of all process waters and industrial wastes produced or expected to be produced at said property, including a description of the character of each waste, the daily volume and whether the flow is continuous or intermittent. The schedule shall be attached as Exhibit "B".

3. A summary of the total waste water characteristics to be received from the applicant shall be submitted in proper form as Exhibit "C".

4. Additional information requested by the Director of Pure Waters shall be prepared as Exhibit "D" and be attached to the application as required.

Mr. Alan Shaffer

Despatch Industries, Inc.

Phone # 585-339-1283

Person to be contacted for inspection or emergency purposes and phone number

Mr. Thomas H. Forbes, P.E.
Benchmark Environmental Engineering & Science, PLLC
716-856-0599 ext. 15

COUNTY OF MONROE
SEWER USE PERMIT ENCLOSURE

Despatch Industries, Inc.
115 North Washington St.
East Rochester, N.Y. 14445

PERMIT NUMBER: 883
DISTRICT NUMBER: 8515

TYPE OF BUSINESS: Groundwater Remediation
SIC CODE: N/A
SAMPLE POINT: Sample Port After Air Stripper

MONITORING

SELF MONITORING FREQUENCY:
1. **Performance Testing prior to discharge**
2. **First three consecutive days system is in operation.**
3. **Weekly for the next three weeks.**
4. **Monthly monitoring thereafter.**

SAMPLING PROTOCOL: Sampling and analysis shall be performed in accordance with the techniques prescribed in 40 CFR Part 136 and amendments thereto. In the absence of 40 CFR Part 136 testing methodology, a New York State Department of Health, approved method is acceptable. A grab sample, collected from the above noted sample points shall be analyzed for the following:

Total Volitile Organic Compounds (TVOC's)

DISCHARGE LIMITATIONS: The summation of the VOC' shall not exceed 2.13 ppm.

SPECIAL CONDITIONS:

1. All groundwater must be treated regardless of the influent concentrations.

2. Quarterly flow summaries shall be submitted for billing purposes. It is imperative these summaries are submitted in a timely manner.

3. Discharge to the sanitary sewer may not commence until performance testing from the treatment system discharge has been approved.

07-06-2004