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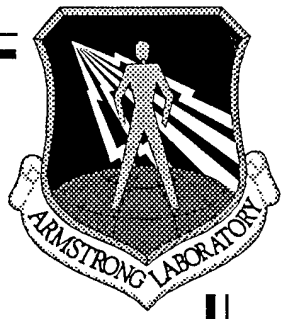

INSTALLATION OF ADDITIONAL 80 GPM WATER TREATMENT CAPACITY PILOT PROJECT, PHASE II, MOD 2, NEW BOSTON AIR FORCE STATION, NEW HAMPSHIRE

J. Esposito Alexant

Environmental Science and Engineering, Incorporated
Five Overlook Drive
Amherst, New Hampshire 03031

ARMSTRONG LABORATORY

OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
Bioenvironmental Engineering Division
2402 E Drive
Brooks Air Force Base, Texas 78235-5114

August 1995

Final Report for the Period January - June 1995

Approved for public release; distribution is unlimited.

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BROOKS AIR FORCE BASE, TEXAS

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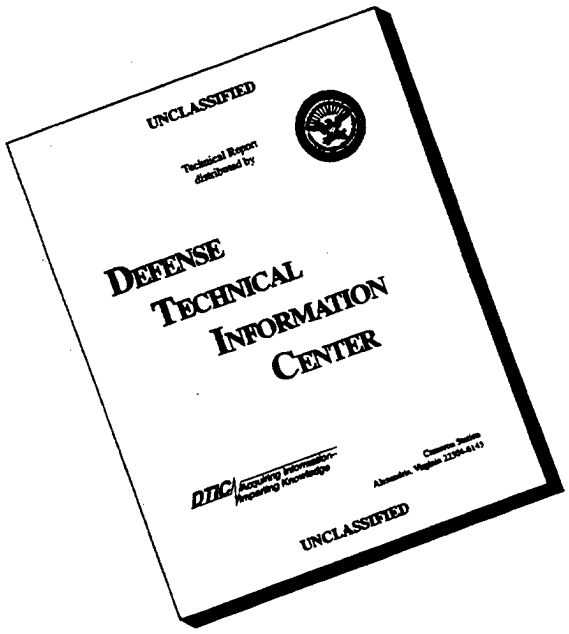

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Chief, Water Quality Branch

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13. ABSTRACT *(Maximum 200 words)*

This report summarizes activities related to the installation of the second phase of a pilot water treatment system at the New Boston Air Force Station in New Hampshire. This project included the installation, in the Spring of 1995, of an 80 gpm air stripper system to remove radon from a drinking water supply and to reduce the corrosivity of that water. The source consists of bedrock wells with high radon concentration.

14. SUBJECT TERMS

Drinking water treatment, radon corrosivity, aeration air stripping, New Boston Air Force Station

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MARCH 26, 1996

Final Report-June 15, 1995
Installation of Additional 80 GPM Pilot Water Treatment Capacity-Phase II Mod 2
New Boston Air Force Station

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1. INTRODUCTION

A. Project History:

This report summarizes activities related to the implementation of the second phase of a pilot treatment program for drinking water at the New Boston Air Force Station (NBAFS) in New Boston, New Hampshire (mailing address Amherst, New Hampshire). This project was performed under United States Air Force (USAF) Project F33615-89-D-4001, Task Order 0023, Mod 2, administered by the USAF Armstrong Laboratories located at Brooks Air Force Base, Texas. Mod 2 was issued by the USAF with an effective issue date of January 30, 1995, to Galson Technical Services, Inc., (Galson) of East Syracuse, New York, the prime contractor to the USAF. Environmental Science & Engineering, Inc. (ESE), a subcontractor to Galson, performed the engineering design and installation work for the project. This Mod 2 work was implemented subsequent to the installation of a 25 gpm pilot treatment system, which was completed in 1994.

As of late 1992, the NBAFS water system included two bedrock groundwater wells and well pumps which conveyed well water up to a 66,000 gallon gravity concrete storage tank which forms the basement of Building 107. Building 107 is located centrally within the base building complex, at an elevation approximately 55 feet higher than the well pump houses. Building 107 includes system pumps and a 2,000 gallon hydropneumatic tank, which serve to pressurize the water for distribution through the base piping network.

Previous project activities completed through 1994 included preparation of a preliminary study of techniques for the removal of radon and the reduction of corrosivity in the drinking water system of the NBAFS; final design of the recommended pilot project treatment system, which included a 25 gpm air stripper; and the installation and startup of that 25 gpm air stripper in Building 107 of the NBAFS. The findings of the preliminary study were submitted in an August 23, 1992, ESE report entitled "Engineering Evaluation Report on the Potable Water System, prepared for 23rd Space Operations Squadron, New Boston Air Force Station, New Boston, New Hampshire." At the request of the USAF, project activities also included the design of an intermediate raw water storage tank and related intermediate raw water transfer pumps and controls at the NBAFS. Due to budget limitations, installation of the intermediate storage tank and transfer pumps were subsequently deleted from the pilot project. Based on input from the USAF, the 25 gpm pilot air stripper treatment system installation was completed in early 1994, with the understanding that the USAF would in the near future install the intermediate raw water storage tank and transfer pumps under a program separate from the F33615-89-D-4001 Task Order 0023 project.

Monitoring data on the performance of the 25 gpm pilot air stripper, which was put into operation in March, 1994, indicated good performance in the removal of radon and in the reduction of

corrosivity. Based on those results, the USAF authorized the design and installation of a second pilot air stripper unit at Building 107, to provide an additional 80 gpm of treatment capacity, to further evaluate the applicability of the air stripping technique. That authorization was provided through the Mod 2 Work Order Revision issued on January 30, 1995. To support the 80 gpm pilot project air stripper treatment equipment installation, the USAF agreed to design and construct a building addition to Building 107, and to extend electrical power and control interlocks.

Pursuant to the Mod 2 authorization, ESE drafted a design for the 80 gpm pilot project treatment system, prepared final installation plans and specifications dated April 17, 1995, and obtained subcontractor bids for the installation of the system. Due to time constraints related to the June 22, 1995 project deadline, ESE purchased the air stripper directly from the equipment supplier, and subcontracted local plumbers and electricians to assist with the installation. The installation and mechanical and electrical testout of the 80 gpm pilot project air stripper equipment was completed on June 13, 1995. On June 13, 1995, the new 80 gpm pilot air stripper was operated for testing while still isolated from the existing treated drinking water system. ESE collected raw and treated water samples on June 13, 1995 for analysis of radon, to confirm the successful performance of the new 80 gpm pilot air stripper system.

B. Other Separate Projects:

During the course of Phases I and II of this project, the NBAFS has also been separately implementing other modifications to the water system, including upgrades to the supply wells, the treated water distribution piping network, emergency booster pumps, and electrical controls, including modifications to equipment in Building 107. These separate activities have included preliminary engineering reports, final designs, and construction. Related documents include a June, 1992 preliminary study report entitled "Upgrade of Water Distribution System, New Boston AFS, NH (Project #RNGE 87-3003 E1)", and a set of plans and specifications entitled "Specifications and Drawings to Upgrade Water Distribution System at New Boston A.F.S. New Hampshire, Project Nos. RNGF 87-3003B, RNGF 87-3003C, RNGF 94-1008B, RNGF 1008C," dated July 25, 1994, prepared by Allied Architects/Engineers, Westbrook, Maine. As of June, 1995, construction activity related to those separate project designs had been initiated.

2. DESIGN

It was determined by the USAF in late 1994 that an additional water treatment pilot system capacity of 80 gpm was desirable, to supplement the 25 gpm pilot treatment system which had been installed in early 1994. Monitoring subsequent to the installation of the 25 gpm pilot system provided preliminary indications that air stripping was successful in reducing radon levels to below 300 picocuries per liter, and in reducing the corrosivity of the water such that copper and lead levels within the water distribution piping system were below regulatory action levels. The

goals of the additional 80 gpm pilot treatment system were to confirm the efficacy of the air stripping technique in removing radon and in reducing corrosivity in the NBAFS drinking water system.

The 80 gpm pilot air stripper system designed by ESE included a 600 cfm air blower and four aeration trays, equivalent to the ShallowTray Model 2641 as manufactured by North East Environmental Products, Inc., (NEEP) of West Lebanon, New Hampshire or approved equal. New water piping was designed by ESE for the proposed Building 107 addition, which was to be designed and constructed by the NBAFS. ESE prepared a draft set of installation plans and specifications and met with NBAFS personnel on April 6, 1995 to review those documents. An April 20, 1995 ESE memo summarized that meeting. Based on input from NBAFS personnel, ESE prepared a final set of installation documents entitled "Contract Documents and Technical Specifications-Installation of Water Treatment System Pilot Project Phase 2" dated April 17, 1995. ESE issued those plans and specifications with a request for bids on April 18, 1995, and submitted them to the New Hampshire Department of Environmental Services (NHDES), Water Supply Division on April 21, 1995.

As agreed upon by NBAFS personnel, the design was based on the premise that the new 80 gpm pilot stripper local control panel would be driven by the temporary control relay connections to the existing well pump starter circuits, and that the NBAFS planned to consolidate overall water system controls in the Building 107 addition in the near future. The design also was based on manual changeover from the 25 gpm treatment system to the new 80 gpm pilot system.

Details of the design are provided in the above-mentioned plans and specifications.

3. INSTALLATION

Based on review of equipment supplier bids, ESE ordered a NEEP Model 2641 ShallowTray air stripper on May 17, 1995. The NEEP ShallowTray Model 2641 system was delivered to ESE at the Building 107 location on June 7, 1995. ESE arranged for local licensed plumbing and electrical subcontractors to assist in the installation of the system. This was accomplished by breaking out the mechanical and electrical portions of the specifications and drawings, and inviting bids from three potential subcontractors in each trade. The selected subcontractors were Tavela Mechanical Contractors of Brookline, New Hampshire, and Beldon Electric of Amherst, New Hampshire. The electrical wiring to the stripper was completed on Friday, June 9, 1995. The water piping for the stripper was completed on Monday, June 12, 1995. Operation and maintenance manuals were provided to the NBAFS operating personnel on June 12, 1995.

Temporary braces were constructed to support water lines and exhaust air ductwork until the building addition superstructure is constructed. The new stripper local control panel was designed as NEMA 3R rain and ice-resistant. However, ESE has advised NBAFS personnel that the 80

gpm pilot stripper system was designed on the premise that the NBAFS would construct a heated building superstructure by the winter of 1995-96, because severe cold winter weather would cause freezing in the 80 gpm pilot system stripper if unprotected. In the course of building the Building 107 addition floor slab, the specified condensate drip drain was left out of the concrete floor slab constructed by the NBAFS. ESE has recommended that the NBAFS use a low portable container placed at the drip pan drain outlet to allow the condensate drainage to be periodically disposed of.

4. STARTUP

Under ESE supervision, field representatives of NEEP conducted mechanical testout activities on the newly-installed 80 gpm ShallowTray pilot air stripper on Monday, June 12, 1995, and the system successfully operated through its control cycle. The new piping and stripper equipment were disinfected on June 12, 1995, using sodium hypochlorite solution. A temporary hose was used to discharge treated water away from the area rather than to the treated water storage tank during this activity. A temporary blind flange diaphragm was inserted into the treated water piping connection with the Building 107 storage tank, to temporarily prevent water from the 80 gpm pilot stripper from traveling to the storage tank until the entire system had received final approval from the NHDES.

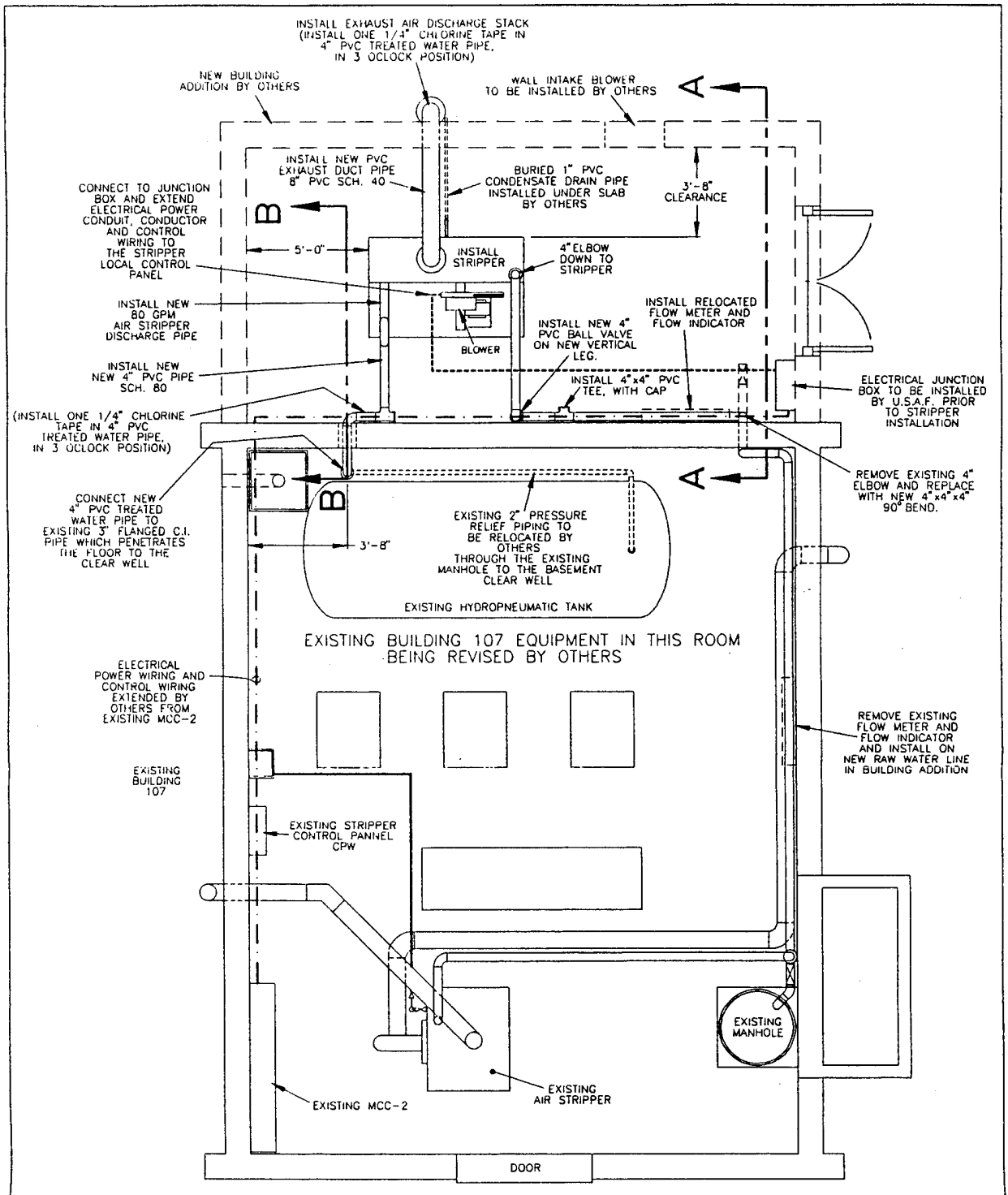
On June 13, 1995, during trial operation of the new 80 gpm pilot system stripper, ESE collected four samples for radon analysis, including one raw water sample and two aerated water samples with one duplicate. Samples were delivered June 13, 1995, to New England Radon, Ltd., in Salem, New Hampshire for liquid scintillation analysis for radon. Copies of the results of those analyses are contained in the Appendix, which are attched to this report. Those results indicate good performance in reducing raw water radon concentrations from over 93,000 picocuries per liter to less than 300 picocuries per liter.

Mr. J. E. Alexant, PE, of ESE spoke by telephone with a representative of the NHDES Water Supply Division on June 14, 1995. That representative, Mr. Jim Gill, indicated on June 14 that there was nothing significant in the ESE design which would prevent the new 80 gpm pilot system from being approved, and estimated that he would send a review letter within several days. On June 15, 1995, ESE transmitted a letter to the NHDES concerning that June 14, 1995 telephone discussion, requesting confirmation as soon as possible.

ESE recommends that the NBAFS keep the new 80 gpm pilot system inactive until receipt of NHDES approval. At that time, the blind flange diaphragm insert will be removed, and the NBAFS will relocate the hypochlorite solution feed pump to the new 80 gpm pilot project stripper system and activate it.

A

Installation Drawings



REVISION NO.	DATE	DESCRIPTION	BY	CHKD.

Environmental Science & Engineering, Inc.

DESIGNED	CHECKED	NEW BOSTON AIR FORCE STATION NEW HAMPSHIRE WATER TREATMENT PILOT PHASE 2
JEA		
DRAWN	CHECKED	
DJB		

DESCRIPTION: MECHANICAL FLOOR PLAN

SCALE: AS SHOWN	DATE: 4-17-95	SHEET NO.
DRAWING NO.		M-1
NAME OF ENGINEER	392-9110G	

STATE OF NEW HAMPSHIRE — J. ESPOSITO ALEXANT No. 4261 LICENSED PROFESSIONAL ENGINEER

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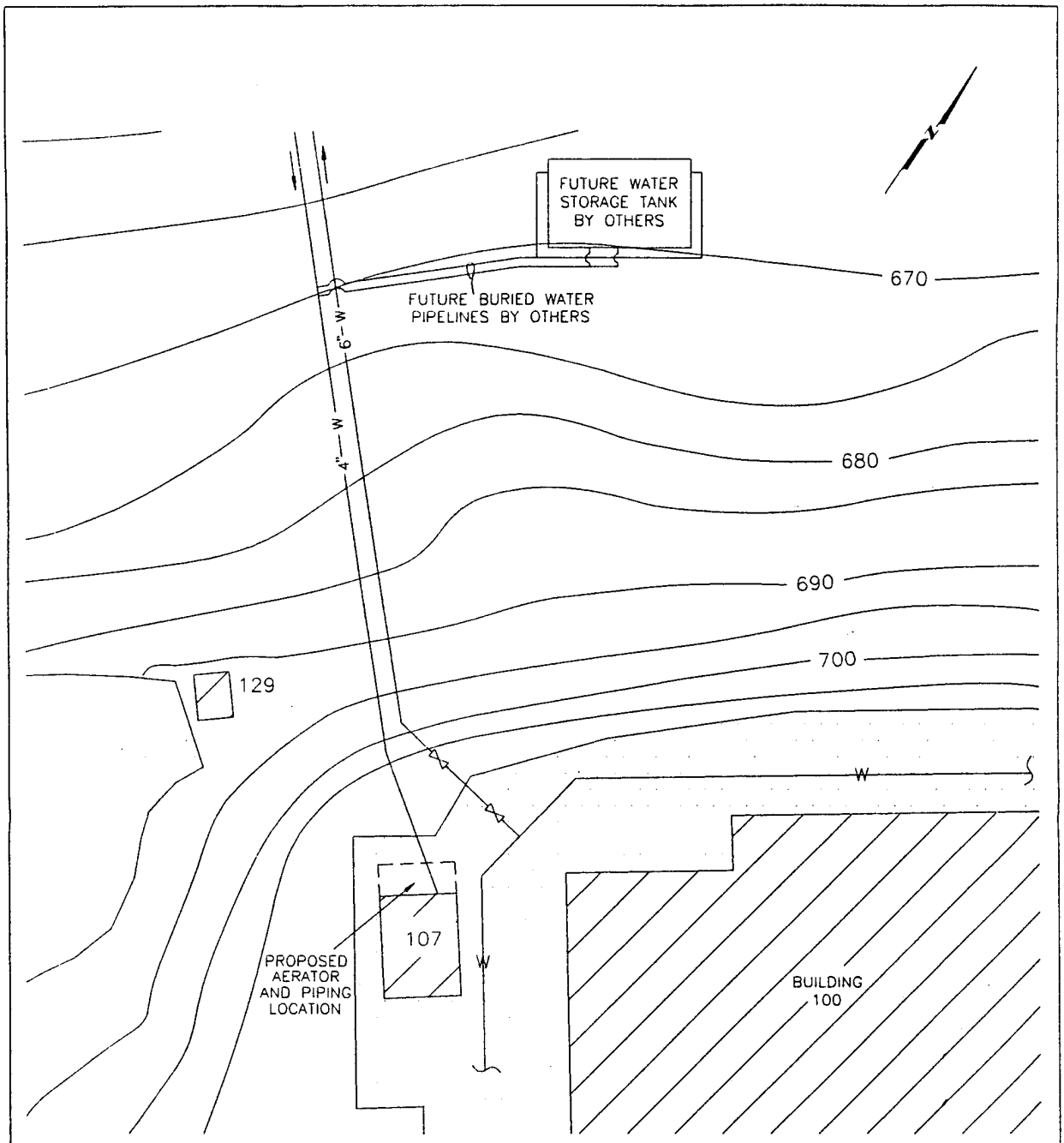

J. Esposito Alexant 4/18/95

STATE OF NEW HAMPSHIRE - J. ESPOSITO ALEXANT No. 4261 LICENSED PROFESSIONAL ENGINEER

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DESIGNED	CHECKED	NEW BOSTON AIR FORCE STATION NEW HAMPSHIRE WATER TREATMENT PILOT PHASE 2
JEA		
DRAWN	CHECKED	
DJB		

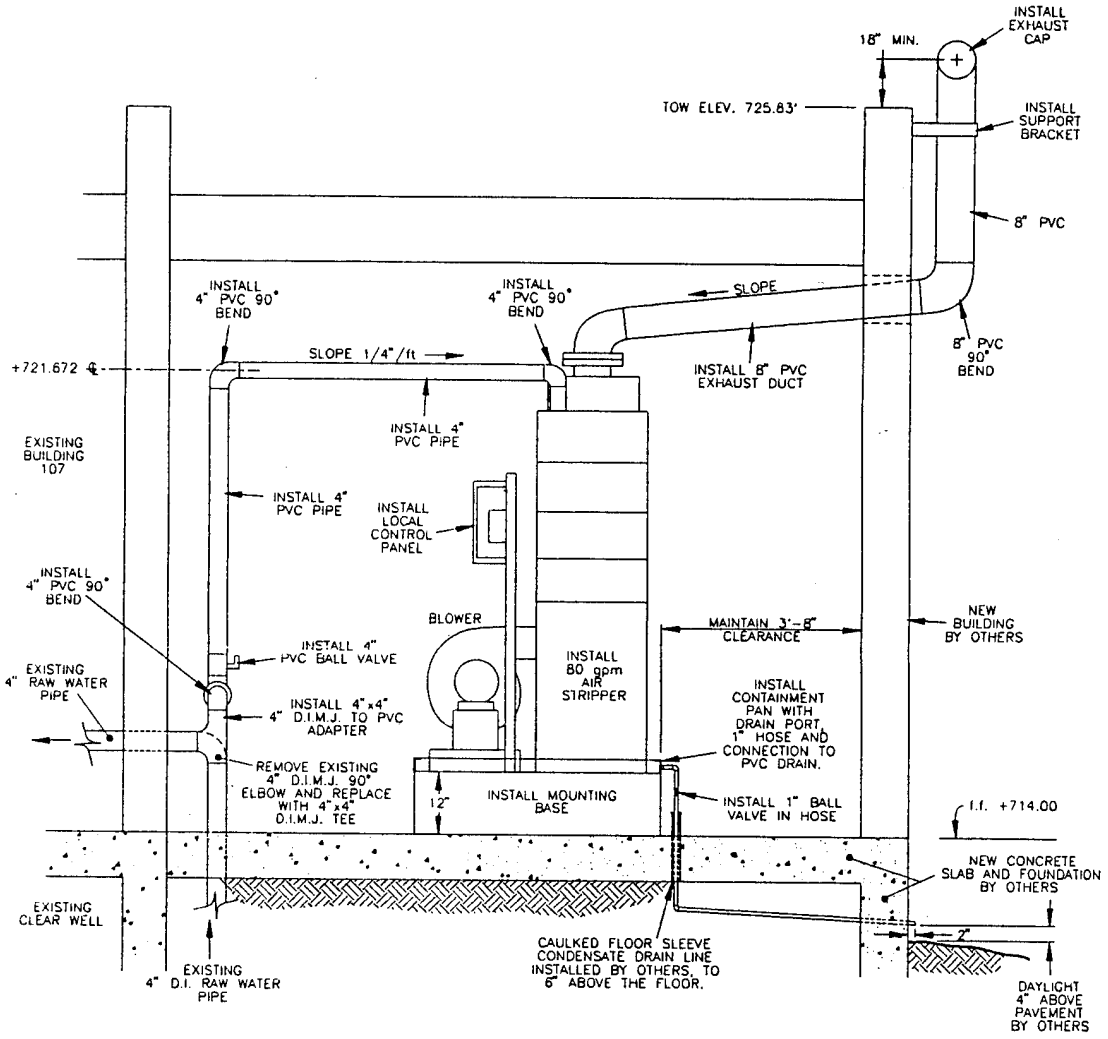
DESCRIPTION: SITE PLAN

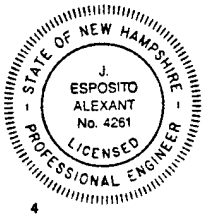
SCALE	DATE	SHEET NO.
AS SHOWN	4-17-95	C-1

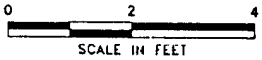
DRAWING NO. 392-9110G

NAME OF ENGINEER

SECTION A-A







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Environmental Science & Engineering, Inc.

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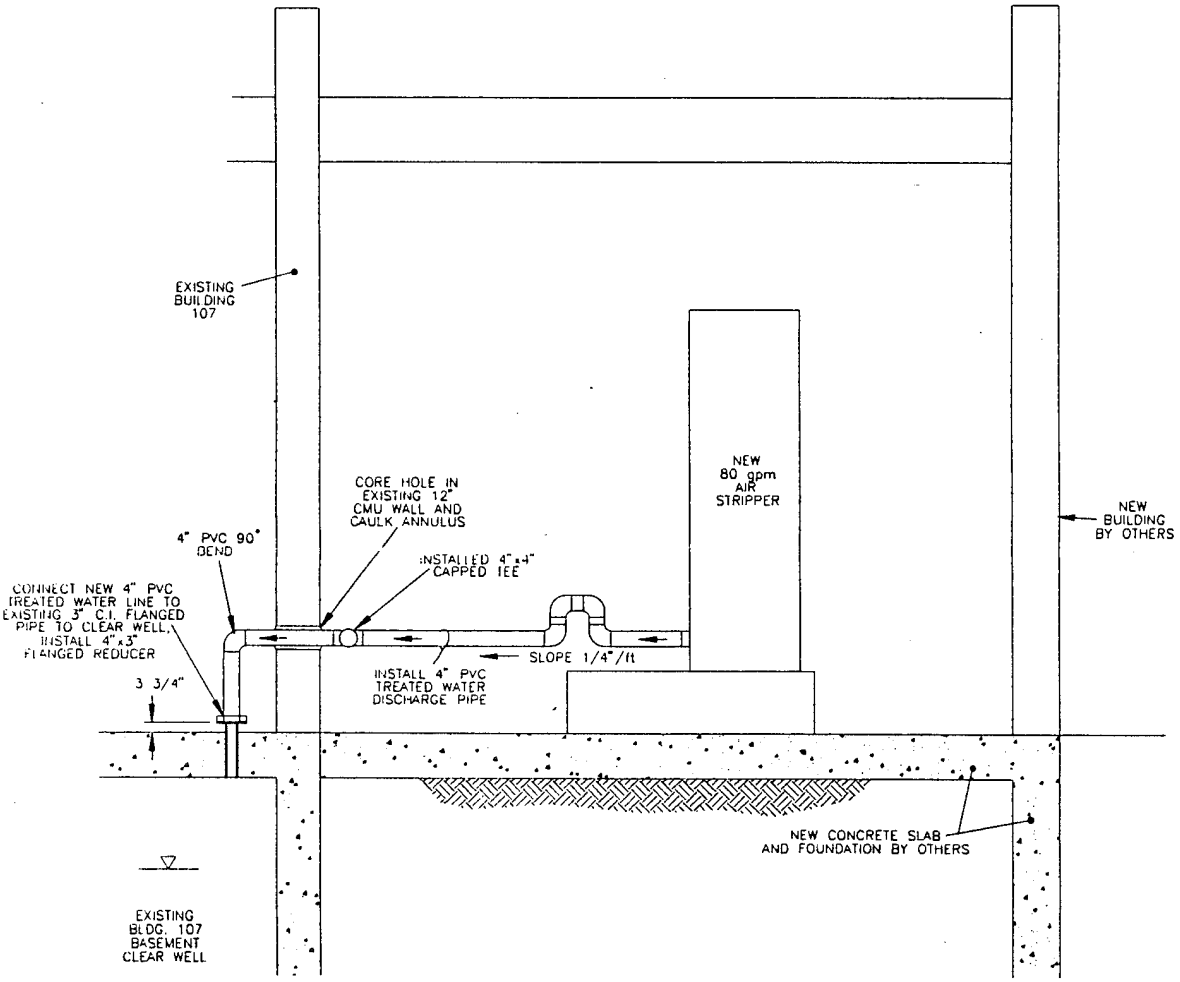
JEA		
DRAWN	CHECKED	
DJB		

DESCRIPTION: MECHANICAL SECTION A-A

NAME OF ENGINEER	AS SHOWN / 4-17-95	SHEET NO. M-2
	DRAWING NO. 392-9110G	

SECTION B-B



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Environmental Science & Engineering, Inc.

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DRAWN	CHECKED	
DJB		

DESCRIPTION: MECHANICAL SECTION B-B

STATE OF NEW HAMPSHIRE
J. ESPOSITO ALEXANT
No. 4261
LICENSED PROFESSIONAL ENGINEER

0 2 4
SCALE IN FEET

NAME OF ENGINEER	SCALE: AS SHOWN	DATE: 4-17-95
	DRAWING NO.: 392-9110G	SHEET NO.: M-3

B

Installation Specifications

CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

INSTALLATION OF
WATER TREATMENT SYSTEM
PILOT PROJECT
PHASE 2

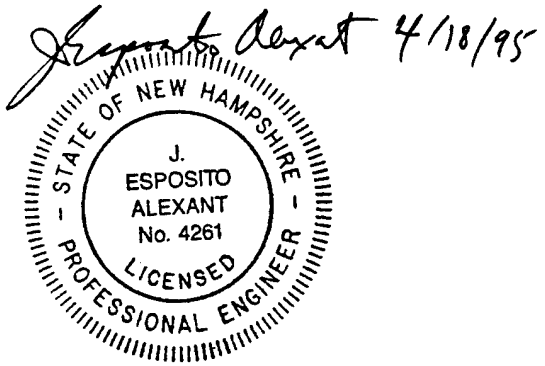
Prepared for:
New Boston Station
United States Air Force
Amherst, New Hampshire

Prepared by:
Environmental Science & Engineering, Inc.
Five Overlook Drive
Amherst, New Hampshire 03031

April 17, 1995

Reference No.: F33615-89-D-4001

Task Order: 0023



4/18/95

ESE
A CILCORP Company

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NEW BOSTON AIR FORCE STATION
Installation of Water Treatment System Pilot Project Phase 2
ESE project #392-9110G-1000

SUBCONTRACTOR WORK ORDER SERVICES AGREEMENT

EXHIBIT A: WORK ORDER: Contract Documents and Technical Specifications:

2.1 The aerator unit shall be a Shallow Tray low profile air stripper unit manufactured by North East Environmental Products, Inc., Model 2641, approved equal. The design "flow through" rate shall be 80 gallons per minute. The air stripper shall contain four (4) aeration trays. It shall be supplied and installed by an experienced firm, which shall perform start-up and initial operation tests to ensure that the unit will remove over 99.9 percent of the radon gas contained in the water, with a projected maximum inlet radon concentration of 76,000 piCu/l. Treated water concentrations shall not exceed 300 piCu/l.

The air stripper will draw inlet air from inside the new building addition.

2.2 Features of the aeration stripper shall include the following:

a. 304L stainless steel for major wetted parts including sump tank, trays, and tray latches;
b. steel frame;
c. tray cleanout ports;
d. Inlet screen and damper;
e. demister, 304L stainless steel;
f. air pressure gauge;
g. spray nozzle;
h. sight tube, cleanable;
i. gaskets;
j. air blower, 7.5 hp, 600 cfm at 22 inches W.C., 3 phase, 460 Volt, TEFC motor, 11 amps at normal load;
k. Standard NEMA 3R control panel and main disconnect, with alarm interlocks, motor starter, panel, adjustable ON delay relay for a chlorinator pump, two 110 volt single phase outlet receptacles, phase transformer, bypass switch;
l. low air pressure alarm switch;
m. high water level alarm switch;
n. alarm horn, mounted locally;
n. water pressure gauge on inlet piping;
o. blower air flow meter/indicator;
p. mounting skids shall be 12" high, and shall include supports of extruded fiberglas or other corrosion-proof material of suitable structural strength for the bottom 4".
q. two (2) sample taps, inlet and discharge;
r. washer wand.
s. weight of stripper system, without water:1,280 lbs.; loaded: 3,500 lbs.
t. all components and fabrication of the air stripper electrical items, motors, wiring, controls, and control panel shall meet appropriate requirements of the latest edition of the National Electrical Code.
u. stripper inlet nozzle shall have a pressure loss not greater than 15 psig at 80 gpm water flow.

SECTION 11400
AERATION STRIPPING EQUIPMENT

PART 1 - GENERAL

1.1 The CONTRACTOR shall provide and install one (1) air stripping unit for treatment of drinking water, with appurtenances, in a building addition to existing Building 107 at the United States Air Force (USAF) New Boston Station in New Hampshire. The building addition is being constructed by others. The air stripper shall have a nominal capacity of 80 gallons per minute (gpm).

1.2 Submit shop drawings showing all details of equipment, material related electrical and control devices and connections, and dimensions of floor layout, elevation, piping, vent connections, and weight.

1.3 Provide drawings and instructions for assembly, operation, maintenance, with numbered spare parts.

1.4. The USAF will separately construct the building addition, including a concrete slab on grade on which the air stripper equipment shall be installed. The USAF will also separately install buried raw water piping to a point above the new concrete slab.

1.5. The USAF will separately extend electrical power lines and control lines from panel inside existing Building 107 to a panel mounted on the interior wall for the new building addition, within 10 feet of the 80 gpm air stripper.

The CONTRACTOR shall make connection to the USAF wall panel mounted inside the new building addition, and shall provide and install electrical power lines and control lines from that wall panel to a local control panel at the 80 gpm air stripper.

The CONTRACTOR is advised that the USAF, under separate projects, is in the process of making modifications to the existing Building 107 equipment, some of which involve existing water treatment power controls. The power controls for this 80 gpm air stripper will be extended by the USAF from the control contacts being used for the existing 25 gpm air stripper currently operating in Building 107.

The CONTRACTOR shall closely coordinate the timing and manner of final wiring connections and startup through the ENGINEER and the USAF, such that drinking water service to the USAF facility is not unduly interrupted.

PART 2 - PRODUCTS

2.3 The aeration stripper shall discharge treated water in piping which shall be installed through the existing building wall to connect to an existing floor pipe flange in Building 107.

2.4 The aeration stripper manufacturer, North East Environmental Products, Inc., is located at 17 Technology Drive, West Lebanon, New Hampshire, 03784; telephone (603) 298-7061; fax (603) 298-7063.

2.5 Liquid level sensors and alarm contacts shall be provided on the aeration equipment; interlocks for the transfer pump and equipment control operating switches, as well as starter for the blower motor shall be mounted in the separate motor control center in Building 107.

2.6 The aerator will be connected to a vent, to be supplied by the Contractor, which will be vertical for a short distance, then run horizontally to the side wall of Building 107 and penetrate the existing block wall. On the outside of the building it will run vertically to point at least 18" above the existing roof. The horizontal run of the vent will be slightly sloped so that any condensation will flow back to the aerator. The vent will be suspended from the underside of the roof (ceiling) and attached to the exterior wall with hangers suitable for such service. The opening in the side wall shall be properly sealed.

2.7 The wet loaded weight of the aeration stripper units with blower, shall not exceed 3,500 lbs.

PART 3 - EXECUTION

3.1 The aerator shall be installed in an addition to the existing Building 107. The Contractor shall install 460 volt, 3-phase electric power from an electrical junction box mounted by others on the inside wall of the building addition, to the stripper, a connection point to the incoming water line, a discharge water, and a PVC pipe vent for the air discharge to the atmosphere.

3.2 The aeration stripping unit shall be installed plumb and level, with axes parallel to the building walls. Install permanent shims as necessary to level the unit. The system shall be capable of being dismantled into components weighing no more than 200 lbs each, by use of hand tools (e.g. wrenches).

3.3 The aeration stripping equipment shall be fabricated and installed to prevent significant dripping or spray, of either supply water or surface condensate to the existing concrete floor upon which the unit will be mounted. The CONTRACTOR shall install a corrosion-proof containment pan with side walls at least 4" high, with a drain port and hose valve as shown on the drawings.

3.4 Following installation and mechanical testing, the ENGINEER will conduct performance testing of the aerator stripping equipment. If the equipment does not perform according to specifications, the CONTRACTOR shall make modifications as necessary and as approved by the ENGINEER to bring the equipment into compliance, at no cost.

3.5 Prior to putting the stripper into service for drinking water, the CONTRACTOR shall disinfect the stripper equipment and associated piping with sodium hypochlorite solution following New Hampshire Water Supply and Pollution Control Commission regulations and AWWA standards. The US Air Force New Boston personnel will supply the chlorine solution and hypochlorite solution feed pump.

C

Operation and Maintenance Manual


1994
Shallowray
low profile air stripper

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

ShallowTray Aeration System

Prepared by:
North East Environmental Products, Inc.

Model # 2641

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ShallowTray low profile air strippers

Special Cautions!

Connect the Interlock Switches.

Connect the High Water Level Interlock and the Low Air Pressure Interlock prior to start-up.

It is important that a qualified, licensed electrician perform these installations.

Please see Equipment Set-up in the Operating Instructions section of this manual.

Fill the Sump Tank and Aeration Tray Inlet Chamber.

Fill the sump tank and aeration tray inlet chamber with clean water prior to start-up.

Please see Equipment Set-up in the Operating Instructions section of this manual.

North East Environmental Products, Inc.
17 Technology Drive
West Lebanon, NH 03784
603-298-7061 Fax: 603-298-7063

Section 1: Components List

ShallowTray® Low Profile Air Stripper Specification Sheet

Serial #: 2641-04-4430 Customer: ESE 012197 Ship date: 6/6/95

Engineered By: RC Order Date: 5-18-95

Design Review: Engineering RC 5-25-95 Sales [signature] 5/25/95

I. Design Criteria

Design Water Flow Rate: 80 gpm

Maximum Water Flow Rate (Based on Blower Model Selection): 90 gpm

Weir Height: Inlet, 4", Outlet, 2"

Power Requirements: 3 ø, 460 volts, 60 Hz

Motors ✓ TEFC or ____ EXP (CUSTOMER TO PROTECT EXP MOTORS FROM RAIN)

ENGINEERED BY
Robert W. Clarke
Design Engineer
North East Environmental Products, Inc.

II. Basic System Components

✓ Sump Tank, Cover, Latches	304L stainless steel
4 Aeration Trays	304L stainless steel
✓ Air Blower (w/ inlet screen and damper)	AMERICAN Fan # AVD-2-06-183
Minimum Required Blower Performance	600 cfm @ 22" wc
Maximum Blower Performance	____ cfm @ ____" wc
	7.5 hp, 3 ø, 460 volts,
	60 Hz, ✓ TEFC or ____ EXP
	Blower Inlet Size 6", Blower Outlet Size 6"

Blower Sized For:
____ Low Water Flow, or ✓ High Water Flow
22 "wc required for ShallowTray Air Stripper
0 "wc additional available for airstream equipment

100-00337
150-00150

✓ Demister Pad	Koch style 4310, 4" thick, 304 ss
✓ Air Pressure Gauge (0 - 30 "wc)	Dwyer Magnehelic 2000 series
✓ Spray Nozzle	Hollow cone, 90° pattern, sized for 15 psi
✓ Sight Tube	Brass, Nalgene tubing
✓ Aeration Tray Gaskets	High density nitrile sponge rubber
✓ Piping	Schedule 80 PVC, Brass
✓ Frame	3 in. and 4 in. welded steel C-Channel
✓ Blower and Vent Line Connections	Flexible rubber couplings

III. Optional Equipment

___ Feed Pump

_____ pump #_____

____ hp, ____ ø, _____ volts, 60 Hz, ____ TEFC or ____ EXP

Port Sizes: _____ inch inlet, _____ inch outlet. Impellor Size _____ inches

Required performance ____ gpm @ ____' TDH

___ Discharge Pump

_____ pump #_____

____ hp, ____ ø, _____ volts, 60 Hz, ____ TEFC or ____ EXP

Port Sizes: _____ inch inlet, _____ inch outlet. Impellor Size _____ inches

Required performance ____ gpm @ ____' TDH

___ Additional Blower

_____ Fan #_____

____ hp, ____ ø, _____ volts, 60 Hz, ____ TEFC or ____ EXP

inlet size ____", outlet size ____"

(with inlet screen and damper)

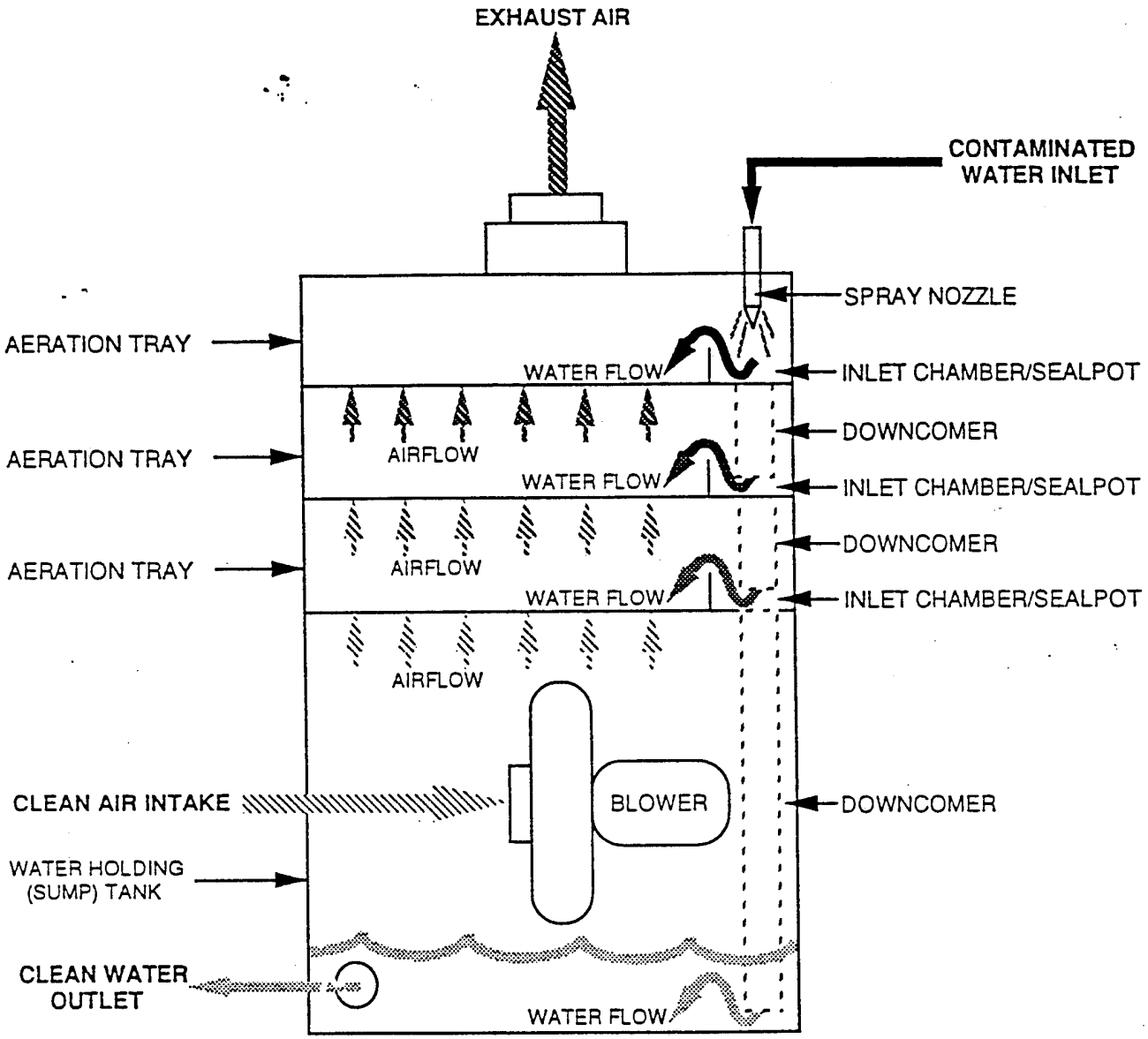
Required Performance ____ cfm @ ____" wc

___ Main Disconnect Switch	Integral with electrical enclosure, rotary style
✓ Control Panel	motor starters, high sump level alarm interlock circuits, low air pressure alarm interlock circuits, NEMA 3R enclosure
___ Control Panel w/ Pump Level Control	motor starters, high sump level alarm interlock circuits, low air pressure alarm interlock circuits, pump level control cicuit NEMA ____ enclosure
✓ Control Circuit Transformer 460 :120V	Acme
___ Intrinsically-Safe Components (inside control panel)	Pepperl+Fuchs, WE77/Ex2-UL repeater relay Dual Channel, SPDT relay output **AND/OR** Warrick 27A1E0 latching relay Single Channel, SPDT relay output
✓ Intermittent Operation	Blower time-delay circuit added to panel design
___ Auto Operation	# of wells ___
___ Well Probes	Warrick, series 3Y
✓ Low Air Pressure Switch	Dwyer 1950-1, 0.3-1.6" wc
✓ High Level Alarm Switch	SJ Electro
___ Discharge Pump Float Switch	SJ Electro
✓ Water Pressure Gauge	Dial gauge, liquid-filled INLET PIPING
___ Water Flow Meter	Halliburton, MCII digital readout
✓ Air Flow Meter	Dwyer 2000-0 meter, pitot tube, mounting kit
___ Temperature Gauge	Dial gauge
2 Line Sampling Port	Schedule 80 PVC
___ Air Blower Silencer	Clevaflex, CSA series
✓ Washer Wand	Nozzle, Elbow, 1/4" steel pipe
___ Autodialer	Sensaphone 4100
___ PurgePanel ™	Nema 4/7 Disconnect, Nema 4/7 Box, air press. gauge, Low air press. switch, Blower (100 cfm @ 2" w.c.)
✓ Other ALARM HORN WITH ON-OFF SWITCH	
___ Other_____	_____
___ Other_____	_____
___ Other_____	_____
___ Other_____	_____
___ Other_____	_____

IV. Special Requests / Comments / Additional information

SPECIAL CONTROL PANEL
SPECIAL FRAME 3" HIGH - CORROSION RESISTANT LEGS MADE OF ALUMINUM 4" CHANNEL
BLOWER HOA SWITCH TO BE 3 POSITION ROTARY MAINTAINED
TRANSFORMER AND DUPLEX OUTLET FOR CHLORINE PUMP CONTROLS

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:

TYPICAL VENT LINE INSTALLATION

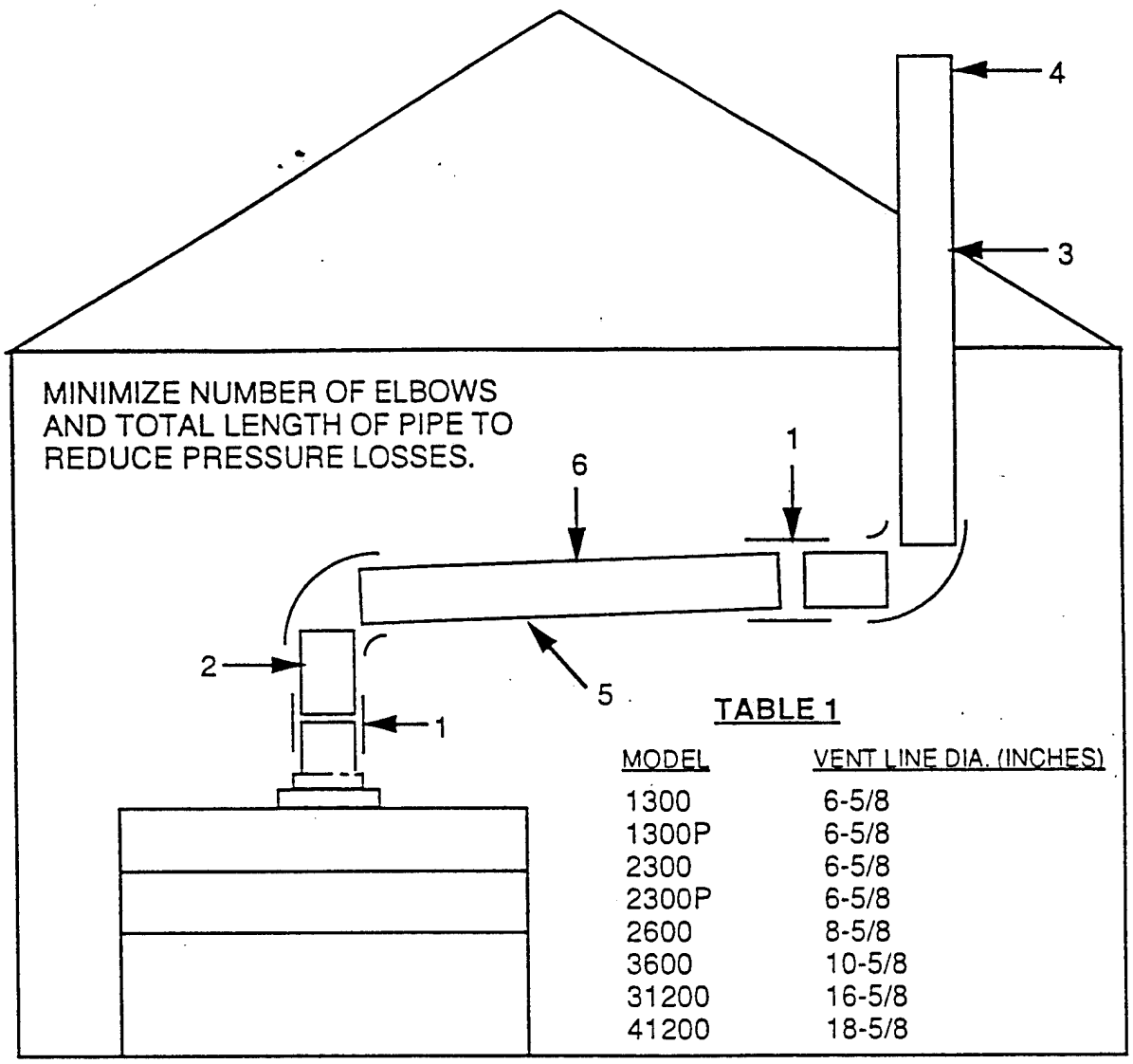


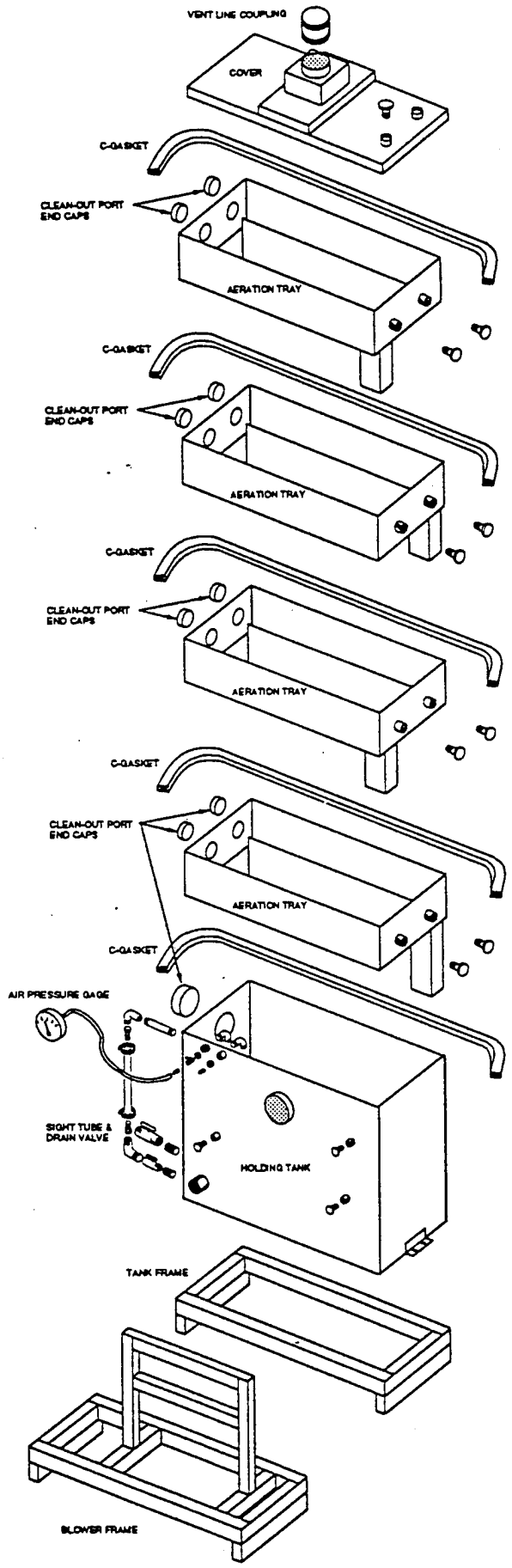
TABLE 1

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 ROOM TO REMOVE SECTION OF VENT LINE FOR EASY ACCESS TO AERATION TRAYS.
6. PITCH VENT LINE TOWARD SHALLOW TRAY UNIT.

2641 BASE SUBASSEMBLY



1 - (200-160-00040), COVER ASSEMBLY
4 - (200-160-00050), AERATION TRAY ASSEMBLY
1 - (200-160-00060), HOLDING TANK ASSEMBLY
1 - (200-140-00010), SIGHT TUBE ASSEMBLY
1 - (200-140-00142), DRAIN VALVE ASSEMBLY
1 - (500-160-01210), DOWNCOMER, 33"
3 - (500-160-01200), DOWNCOMER, 12"
4 - (500-160-01220), SEALPOT
4 - (500-160-01170), WEIR, 2"
4 - (500-160-01190), WEIR, 4"
8 - (500-150-00290), GASKET, SEALPOT & DC
1 - (500-160-00060), DEMISTER PAD, 2600
5 - (500-140-02000), 1/2" PLUG, PVC40
1 - (500-130-00065), GAGE, AIR PRESSURE (0-30" WC)
1 - (500-170-00051), TANK FRAME, 2600
1 - (500-170-00061), BLOWER FRAME, 2600
1 - (500-170-00045), PANEL MOUNT
1 - (500-150-00160), FERNCO RUB. COUPLING 1056-88
8 - (500-150-00220), CAP, RUBBER 4"
1 - (500-150-00200), CAP, RUBBER 8"
9 - (500-140-02020), 1" PLUG M T
1 - (500-140-02050), 2" PLUG, MT, PVC40
2 - (500-140-02880), 1/8" HOSE BARB
2 - (500-140-02520), 1/2"Mx1/2"F STREET EL, BRASS
2 - (500-140-02205), 1/2"Mx1/8"F BUSHING, BRASS
1 - (500-140-02735), 1/8"Mx1/8"F VALVE, BRASS
80 ft. - (500-150-00230), C-SHAPED GASKET
4 ft. - (500-200-00145), 3/16" ID, NALGENE TUBING

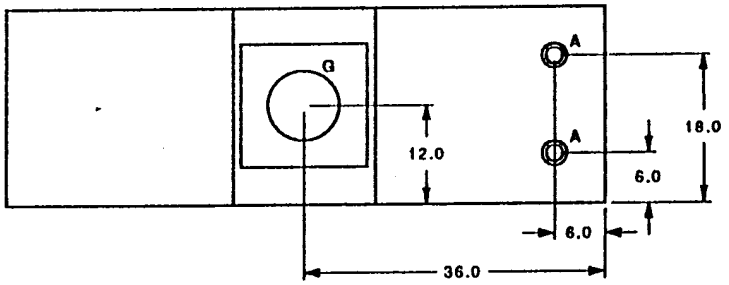
NORTH EAST ENVIRONMENTAL PRODUCTS, INC. 17 TECHNOLOGY DRIVE WEST LEBANON, NH 03784 (603) 298-7061	
TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 IN.	DRAWING NAME: 2641 BASE SUBASSEMBLY
	DRAWING #: 200-160-00512
DRAWN: MS	CUSTOMER:
DATE: 1/29/93	SCALE: / SIZE: A / SHEET 1 OF 1

2600 COUPLING LAYOUT

	PORT DESCRIPTION	SIZE
A	WATER INLET PORTS	2.0" FEMALE NPT FULL COUPLING
B	WATER OUTLET PORT	3.0" FEMALE NPT FULL COUPLING
C	AIR INLET PORT	0.0" SLIP FIT RING FOR RUBBER COUPLING
D	SUMP DRAIN PORT	1.0" FEMALE NPT HALF COUPLING
E	FLOAT SWITCH PORTS	0.5" FEMALE NPT FULL COUPLING
F	SIGHT TUBE PORTS	0.5" FEMALE NPT FULL COUPLING
G	AIR EXHAUST PORT	0.0" SLIP FIT RING FOR RUBBER COUPLING
H	SUMP TANK VIEW PORT	0.0" SLIP FIT RING FOR RUBBER CAP
J	AERATION TRAY VIEW PORT	4.0" SLIP FIT RING FOR RUBBER CAP
K	PRESSURE PORTS	0.5" FEMALE NPT FULL COUPLING

WATER INLET PORT IS LOCATED ON THE REAR RIGHT SIDE OF SYSTEM FOR 2, AND 4 TRAY SYSTEMS

TOP



DIMENSION CHART (INCHES)

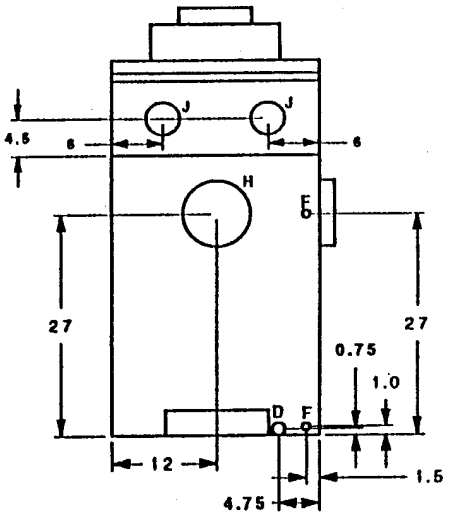
	X	Y	Z
2611	44.25	43.25	52.5
2621	53.5	52.5	61.75
2631	62.75	61.75	71.0
2641	72.0	71.0	80.25
2651	81.25	80.25	89.5

NOTE:

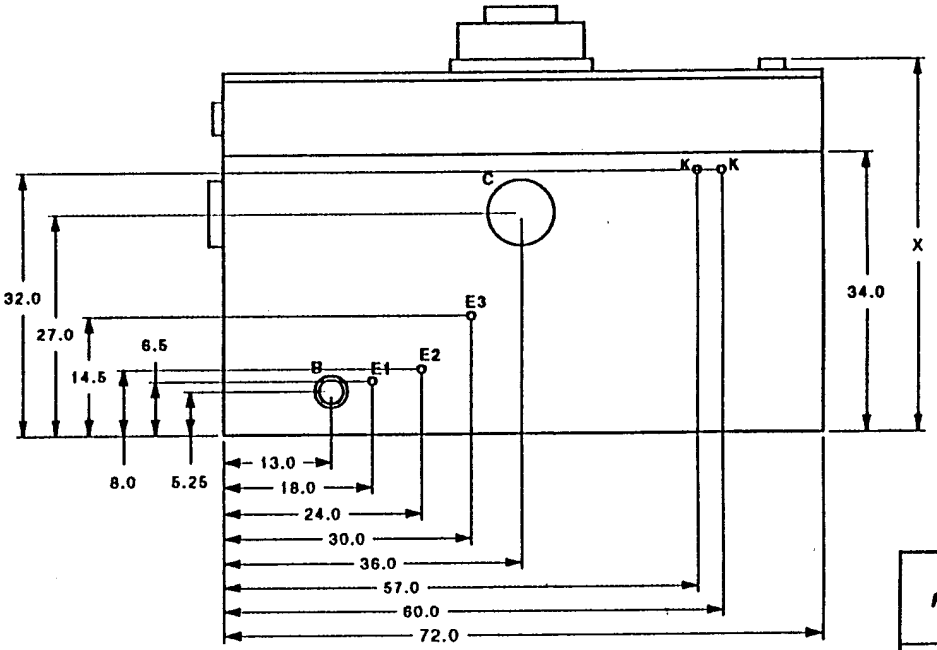
INCLUDES ADDITIONAL HEIGHT OF GASKET BETWEEN TRAYS AND COVER.

WATER INLET PORT IS LOCATED ON THE FRONT RIGHT SIDE OF SYSTEM FOR 1, 3, AND 5 TRAY SYSTEMS

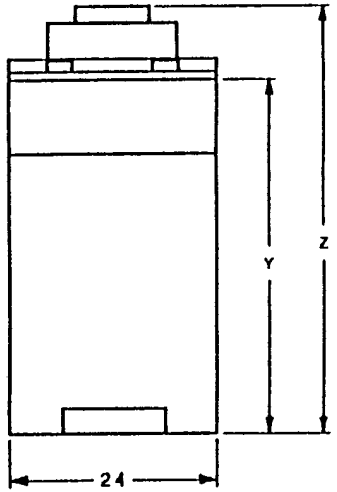
LEFT



FRONT



RIGHT



SWITCH LOCATION

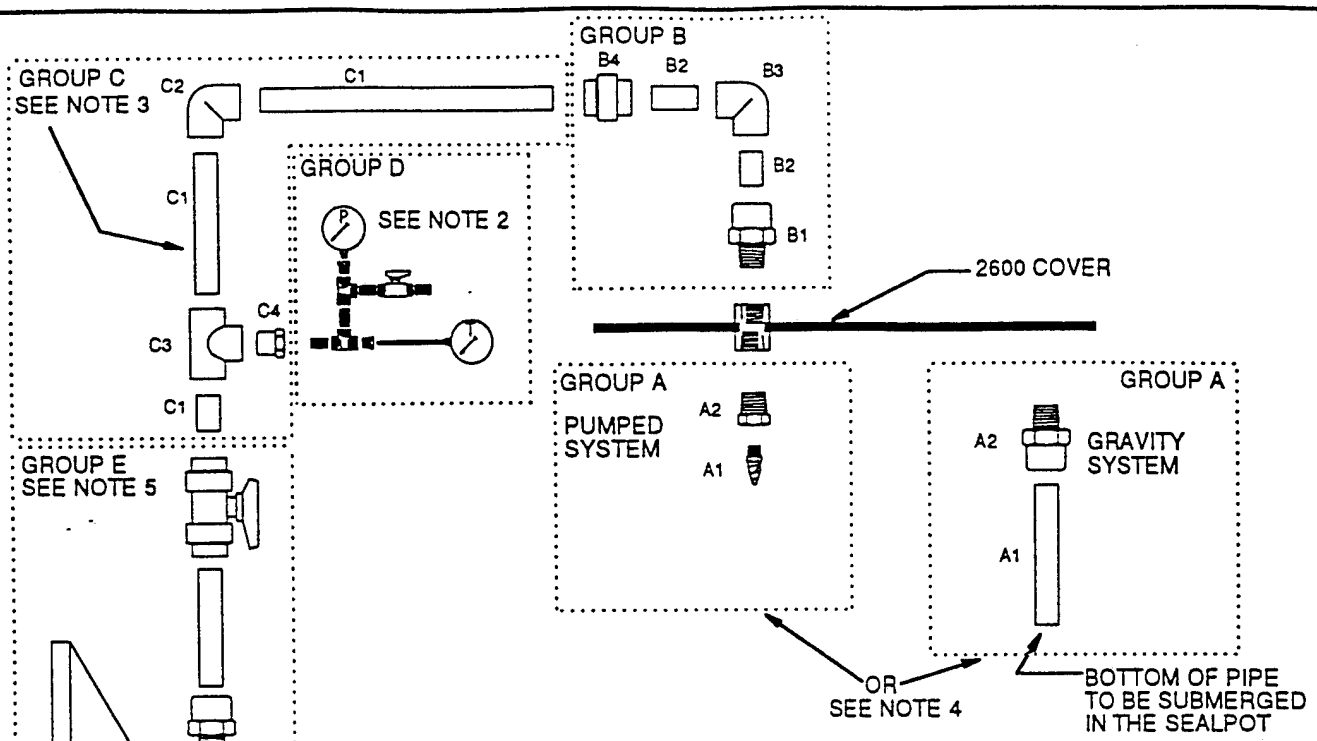
E1	E2	E3	
			FLOAT SWITCH, NORMALLY OPEN
		X	FLOAT SWITCH, NORMALLY CLOSED
X	X		0.5" NPT PLUG

✔ CHECK INDICATES ITEM INSTALLED ON PORT

*HEYCO FITTINGS TO BE INSTALLED ON THE INSIDE WALL OF SUMP TANK FOR EXP UNITS.

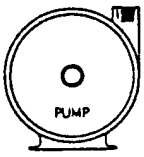
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603)-298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ±.000 in.	DRAWING NAME: COUPLING LAYOUT, 2600-9"
DRAWN BY: MS	DRAWING #: 900-160-00072
DATE: 6/3/94	SHEET: 1 OF: 1 / SIZE: A
	DRAWING SCALE: 2 TO 1



NOTES

1. DRAWING SHOWS MAXIMUM CONFIGURATION. ACTUAL PLUMBING SYSTEM MAY NOT CONTAIN ALL PARTS. SEE GROUP SELECTIONS ON SHEET 2 FOR ACTUAL SYSTEM.
2. SEE DRAWING 900-140-00009 FOR GROUP D DETAILS.
3. PIPE LENGTH VARIES WITH NUMBER OF TRAYS.
   - 1 TRAY PIPE LENGTH ___ INCHES
   - 2 TRAY PIPE LENGTH ___ INCHES
   - 3 TRAY PIPE LENGTH ___ INCHES
   - 4 TRAY PIPE LENGTH ___ INCHES
   - 5 TRAY PIPE LENGTH ___ INCHES
4. GRAVITY SYSTEMS HAVE STRAIGHT TUBE INSTALLED. PUMPED SYSTEMS HAVE NOZZLE OPTION INSTALLED.
5. PIPE LENGTH BEFORE AND AFTER FLOWMETER MUST BE FIVE DIAMETERS IN LENGTH. SEE DRAWING NUMBER 900-140-00024 FOR GROUP E SELECTION DETAILS.



PUMP PORTS	
INLET	
OUTLET	

DESIGN FLOW RATE
80 GPM

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

TITLE
2600 INLET PLUMBING SYSTEM
PVC 80

SIZE	DWG NO.	SHEET	REV
A	900-140-00023	1 OF 2	Ø

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	9-1-94

PLUMBING SYSTEM SELECTION

SELECT ONE FROM EACH APPLICABLE GROUP

GROUP A

☐ **200-140-01160 NOZZLE 2 TO 14 GPM**
A1 1 500-140-00170 Nozzle,14.5gpm@15psi,.5,Brass
A2 1 500-140-00500 Bushing,2.0Mx.5F,TxT,PVC80

☐ **200-140-01161 NOZZLE 14 TO 50 GPM**
A1 1 500-140-00210 Nozzle,57.0gpm@15psi,1.0,Brass
A2 1 500-140-00530 Bushing,2.0Mx1.0F,TxT,PVC 80

☒ **200-140-01162 NOZZLE 50 TO 90 GPM**
A1 1 500-140-00230 Nozzle,102.0gpm@15psi,1.5,Bras
A2 1 500-140-00570 Bushing,2.0Mx1.5F,TxT,PVC80

☐ **200-140-01163 GRAVITY (2" TUBE)**
A1 10" 500-140-01690 Pipe,2.0",PVC 80
A2 1 500-140-01120 Adapter,2.0Mx2.0F,TxS,PVC80

GROUP B

☒ **200-140-01164 ENTRY ELBOW**
B1 1 500-140-01120 Adapter,2.0Mx2.0F,TxS,PVC80
B2 12" 500-140-01690 Pipe,2.0",PVC 80
B3 1 500-140-00880 Elbow,90,2.0Fx2.0F,SxS,PVC80
B4 1 500-140-01250 Union,2.0,SxS,PVC80

GROUP F

☐ **200-140-01174 PUMP (1.25" PORT)**
F1 12" 500-140-01690 Pipe,2.0",PVC 80
F2 1 500-140-01120 Adapter,2.0Mx2.0F,TxS,PVC80
F3 1 500-140-02410 Coupling,Reducer,2.0Fx1.5F,TxT
F4 1 500-140-03170 Nipple,1.5xClose,TxT,Brass

☐ **200-140-01175 PUMP (1.5" PORT)**
F1 12" 500-140-01690 Pipe,2.0",PVC 80
F2 1 500-140-01120 Adapter,2.0Mx2.0F,TxS,PVC80
F3 1 500-140-02410 Coupling,Reducer,2.0Fx1.5F,TxT
F4 1 500-140-03170 Nipple,1.5xClose,TxT,Brass

GROUP D

☒ SEE DRAWING N° 900-140-00009
FOR GROUP D SELECTION

GROUP E

☐ SEE DRAWING N° 900-140-00024
FOR GROUP E SELECTION

GROUP C

☐ **200-140-01165 TRAY EXTENDER (1 TRAY)**
C1 30" 500-140-01690 Pipe,2.0",PVC 80
C2 1 500-140-00880 Elbow,90,2.0Fx2.0F,SxS,PVC80
C3 1 500-140-01000 Tee,2.0",S,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80

☐ **200-140-01166 TRAY EXTENDER (2 TRAY)**
C1 40" 500-140-01690 Pipe,2.0",PVC 80
C2 1 500-140-00880 Elbow,90,2.0Fx2.0F,SxS,PVC80
C3 1 500-140-01000 Tee,2.0",S,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80

☐ **200-140-01167 TRAY EXTENDER (3 TRAY)**
C1 50" 500-140-01690 Pipe,2.0",PVC 80
C2 1 500-140-00880 Elbow,90,2.0Fx2.0F,SxS,PVC80
C3 1 500-140-01000 Tee,2.0",S,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80

☒ **200-140-01168 TRAY EXTENDER (4 TRAY)**
C1 60" 500-140-01690 Pipe,2.0",PVC 80
C2 1 500-140-00880 Elbow,90,2.0Fx2.0F,SxS,PVC80
C3 1 500-140-01000 Tee,2.0",S,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80

☐ **200-140-01169 TRAY EXTENDER (5 TRAY)**
C1 70" 500-140-01690 Pipe,2.0",PVC 80
C2 1 500-140-00880 Elbow,90,2.0Fx2.0F,SxS,PVC80
C3 1 500-140-01000 Tee,2.0",S,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80

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

TITLE: **2600 INLET PLUMBING SYSTEM PVC 80**

SIZE	DWG NO.	SHEET	REV
A	900-140-00023	2 OF 2	Ø

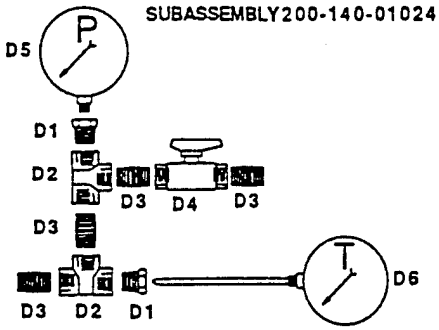
SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	9-1-94

GROUP D PARTS LIST

D1 500-140-00250 Bushing,.5Mx.25F,TxT,PVC80
D2 500-140-00940 Tee,.5",T,PVC80
D3 500-140-01380 Nipple,.5xClose,T,PVC80
D4 500-140-01300 Valve,Ball,.5,T,PVC80
D5 500-130-00150 Gauge,Water Pressure, 0-60PSI
D6 500-130-00190 Gauge,WaterTemp,(0-140),4.0"
D7 500-140-00795 Elbow,90,.5Fx.5F,TxT,PVC 80
D8 500-140-00690 Coupling,.5Fx.5F,TxT,PVC8 0
D9 500-140-02000 Plug, .5M, T, PVC 40

SAMPLE PORT, PRESSURE GAGE, TEMPERATURE GAGE

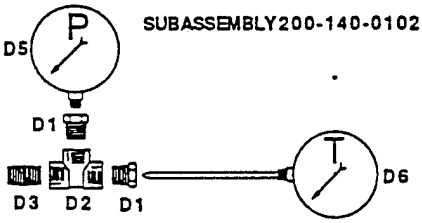
SUBASSEMBLY200-140-01024



☐

PRESSURE GAGE, TEMPERATURE GAGE

SUBASSEMBLY200-140-01023



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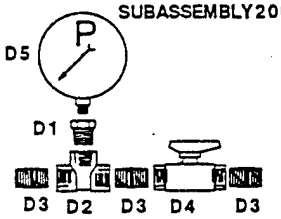
SAMPLE PORT, PRESSURE GAGE

SUBASSEMBLY200-140-01021



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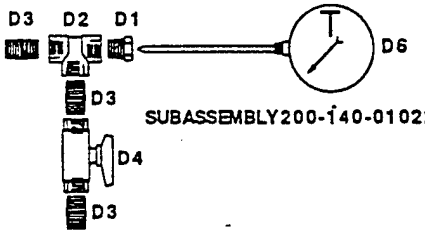
SAMPLE PORT, TEMPERATURE GAGE



SUBASSEMBLY200-140-01022

☐

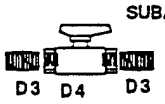
NO OPTIONS (1/2" NPT PLUG)

SUBASSEMBLY200-140-01025

☐

SAMPLE PORT

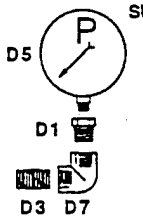
SUBASSEMBLY200-140-01018



☐

PRESSURE GAGE

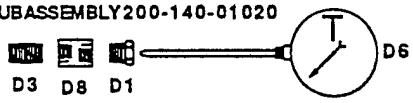
SUBASSEMBLY200-140-01019



☐

TEMPERATURE GAGE

SUBASSEMBLY200-140-01020



☐

THIS GROUP D SELECTION TO BE MOUNTED ONTO:	
INLET PLUMBING SYSTEM	X
OUTLET PLUMBING SYSTEM	

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

TITLE

GROUP D PLUMBING CONFIGURATIONS - PVC 80
SAMPLE PORT, PRESSURE GAGE, TEMPERATURE GAGE

SIZE	DWG NO.	SHEET	REV
A	900-140-00009	1 OF 1	Ø

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	6-8-94

PLUMBING SYSTEM SELECTION

SELECT ONE FROM EACH APPLICABLE GROUP

GROUP A

☒ **200-140-01340 INTERNAL SUCTION ELBOW**
A1 1 500-140-00890 Elbow,90,3.0Fx3.0F,SxS,PVC 80
A2 3.25" 500-140-01700 Pipe,3.0",PVC 80
A3 1 500-140-01130 Adapter,3.0Mx3.0F,TxS, PVC 80

GROUP B

☒ **200-140-01350 OUTER EXTENSION**
B1 1 500-140-01130 Adapter,3.0Mx3.0F,TxS, PVC 80
B2 4" 500-140-01700 Pipe,3.0",PVC 80
B3 1 500-140-01020 Tee,3.0",S,PVC80
B4 1 500-140-00630 Bushing,3.0Mx2.0F,SxS,PVC80
B5 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80

GROUP C

☐ **200-140-01351 RISER - 1 TRAY**
C1 3" 500-140-01700 Pipe,3.0",PVC 80
C2 1 500-140-01020 Tee,3.0",S,PVC80
C3 1 500-140-00630 Bushing,3.0Mx2.0F,SxS,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80
C5 1 500-140-02520 Elbow,Street 90, .5Fx.5M,TxT,B
C6 1 500-140-00060 Valve,Vacuum Relief 1/2"

☐ **200-140-01352 RISER - 2 TRAY**
C1 6" 500-140-01700 Pipe,3.0",PVC 80
C2 1 500-140-01020 Tee,3.0",S,PVC80
C3 1 500-140-00630 Bushing,3.0Mx2.0F,SxS,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80
C5 1 500-140-02520 Elbow,Street 90, .5Fx.5M,TxT,B
C6 1 500-140-00060 Valve,Vacuum Relief 1/2"

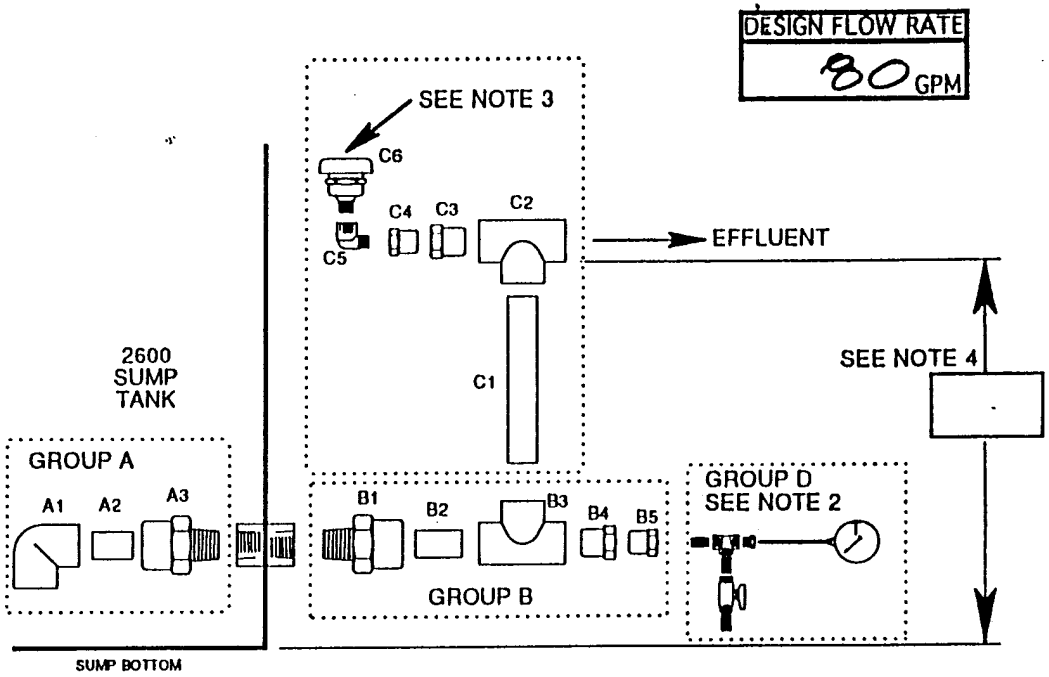
☐ **200-140-01353 RISER - 3 TRAY**
C1 12" 500-140-01700 Pipe,3.0",PVC 80
C2 1 500-140-01020 Tee,3.0",S,PVC80
C3 1 500-140-00630 Bushing,3.0Mx2.0F,SxS,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80
C5 1 500-140-02520 Elbow,Street 90, .5Fx.5M,TxT,B
C6 1 500-140-00060 Valve,Vacuum Relief 1/2"

☒ **200-140-01354 RISER - 4 TRAY**
C1 14" 500-140-01700 Pipe,3.0",PVC 80
C2 1 500-140-01020 Tee,3.0",S,PVC80
C3 1 500-140-00630 Bushing,3.0Mx2.0F,SxS,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80
C5 1 500-140-02520 Elbow,Street 90, .5Fx.5M,TxT,B
C6 1 500-140-00060 Valve,Vacuum Relief 1/2"

☐ **200-140-01355 RISER - 5 TRAY**
C1 16" 500-140-01700 Pipe,3.0",PVC 80
C2 1 500-140-01020 Tee,3.0",S,PVC80
C3 1 500-140-00630 Bushing,3.0Mx2.0F,SxS,PVC80
C4 1 500-140-00480 Bushing,2.0Mx.5F,SxT,PVC80
C5 1 500-140-02520 Elbow,Street 90, .5Fx.5M,TxT,B
C6 1 500-140-00060 Valve,Vacuum Relief 1/2"

GROUP D

☒ SEE DRAWING NUMBER 900-140-00009 FOR GROUP D SELECTION



NOTES

1. DRAWING SHOWS MAXIMUM CONFIGURATION. SEE GROUP SELECTION FOR ACTUAL PLUMBING SYSTEM. PLUMBING ORIENTAION MAY VARY FROM THIS DIAGRAM.
2. SEE DRAWING NUMBER 900-140-00009 FOR GROUP D DETAILS.
3. MOUNT VACUUM RELEIF VALVE IN UPRIGHT.
4. SET TRAP HEIGHT TO THIS DIMENSION.

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

TITLE: 2600 OUTLET PLUMBING (GRAVITY) PVC 80

SIZE	DWG NO.	SHEET	REV
A	900-140-00031	1 OF 1	Ø

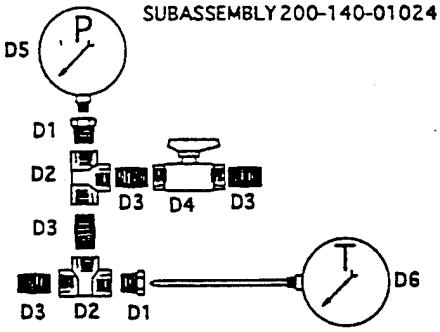
SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	12-23-94

GROUP D PARTS LIST

D1 500-140-00250 Bushing,.5Mx.25F,TxT,PVC80
D2 500-140-00940 Tee,.5",T,PVC80
D3 500-140-01380 Nipple,.5xClose,T,PVC80
D4 500-140-01300 Valve,Ball,.5,T,PVC80
D5 500-130-00150 Gauge, Water Pressure, 0-60PSI
D6 500-130-00190 Gauge,Water Temp,(0-140),4.0"
D7 500-140-00795 Elbow,90,.5Fx.5F,TxT,PVC 80
D8 500-140-00690 Coupling,.5Fx.5F,TxT,PVC80
D9 500-140-02000 Plug, .5M, T, PVC 40

SAMPLE PORT, PRESSURE GAGE, TEMPERATURE GAGE

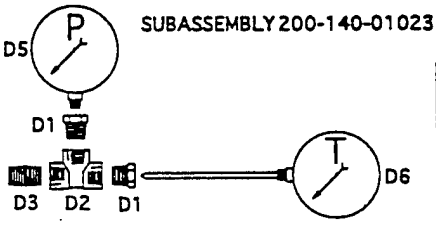
SUBASSEMBLY 200-140-01024



☐

PRESSURE GAGE, TEMPERATURE GAGE

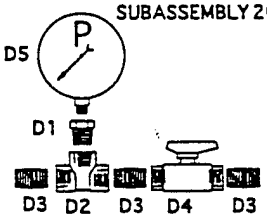
SUBASSEMBLY 200-140-01023



☐

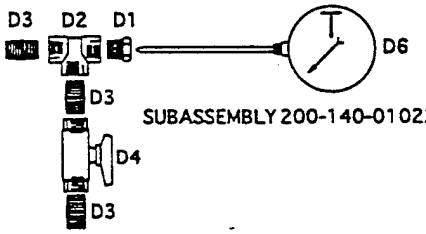
SAMPLE PORT, PRESSURE GAGE

SUBASSEMBLY 200-140-01021



☐

SAMPLE PORT, TEMPERATURE GAGE



SUBASSEMBLY 200-140-01022

☐

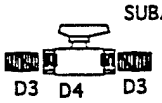
NO OPTIONS (1/2" NPT PLUG)

SUBASSEMBLY 200-140-01025

☐

SAMPLE PORT

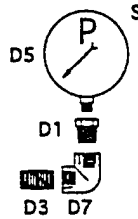
SUBASSEMBLY 200-140-01018



☒

PRESSURE GAGE

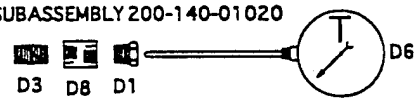
SUBASSEMBLY 200-140-01019



☐

TEMPERATURE GAGE

SUBASSEMBLY 200-140-01020



☐

THIS GROUP D SELECTION TO BE MOUNTED ONTO:	
INLET PLUMBING SYSTEM	
OUTLET PLUMBING SYSTEM	X

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

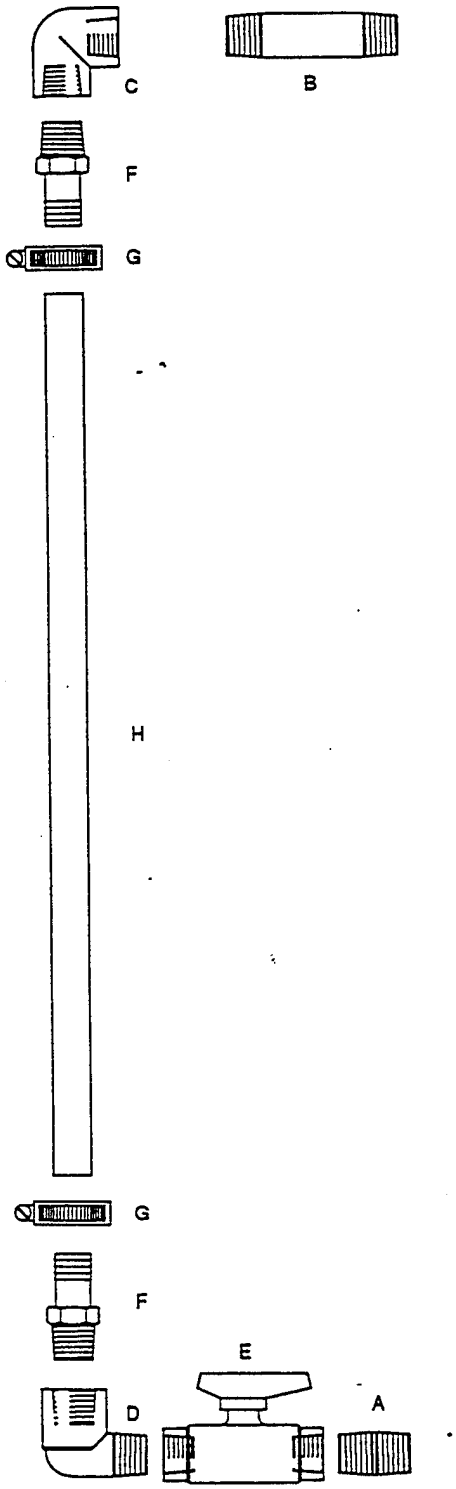
TITLE: GROUP D PLUMBING CONFIGURATIONS - PVC 80
SAMPLE PORT, PRESSURE GAGE, TEMPERATURE GAGE

SIZE	DWG NO.	SHEET	REV
A	900-140-00009	1 OF 1	Ø

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	6-8-94

CHOOSE ONE SIGHT TUBE.

(NOTE THAT BRASS SIGHT TUBES ARE ALREADY PART OF THE BASE SUBASSEMBLY, AND THE STAINLESS SIGHT TUBE SUBS ARE AN OPTION).



BRASS
(STANDARD)

☒ 200-140-00010
SIGHT TUBE, BRASS, FOR 13P/23P/13/23/26/36

1	A	500-140-02980, NIPPLE, .5XCLOSE, TXT, BRASS
1	B	500-140-03030, NIPPLE, .5X3.5L, TXT, BRASS
1	C	500-140-02510, ELBOW, 90°, .5FX.5F, TXT, BRASS
1	D	500-140-02520, ELBOW, STREET, 90°, .5FX.5M, TXT, BRASS
1	E	500-140-02740, VALVE, BALL, .5FX.5F, TXT, BRASS
2	F	500-140-02890, HOSE BARB, .5MX.5M, TXB, BRASS
2	G	500-140-00030, HOSE CLAMP, .41-.88, SS
21"	H	500-200-00150, TUBE, CLEAR, .5 ID, TYGON

☐ 200-140-00020
SIGHT TUBE, BRASS, FOR 312/412

1	A	500-140-02980, NIPPLE, .5XCLOSE, TXT, BRASS
1	B	500-140-03030, NIPPLE, .5X3.5L, TXT, BRASS
1	C	500-140-02510, ELBOW, 90°, .5FX.5F, TXT, BRASS
1	D	500-140-02520, ELBOW, STREET, 90°, .5FX.5M, TXT, BRASS
1	E	500-140-02740, VALVE, BALL, .5FX.5F, TXT, BRASS
2	F	500-140-02890, HOSE BARB, .5MX.5M, TXB, BRASS
2	G	500-140-00030, HOSE CLAMP, .41-.88, SS
29"	H	500-200-00150, TUBE, CLEAR, .5 ID, TYGON

STAINLESS STEEL
(OPTIONAL)

☐ 200-140-00011
SIGHT TUBE, 316 ST. STEEL, FOR 13P/23P/13/23/26/36

1	A	500-140-04010, NIPPLE, .5XCLOSE, TXT, 316SS
1	B	500-140-04012, NIPPLE, .5X3.5L, TXT, 316SS
1	C	500-140-03995, ELBOW, 90°, .5FX.5F, TXT, 316SS
1	D	500-140-03996, ELBOW, STREET, 90°, .5FX.5M, TXT, 316SS
1	E	500-140-04030, VALVE, BALL, .5FX.5F, TXT, 316SS
2	F	500-140-04000, HOSE BARB, .5MX.5M, TXB, 316SS
2	G	500-140-00030, HOSE CLAMP, .41-.88, SS
21"	H	500-200-00150, TUBE, CLEAR, .5 ID, TYGON

☐ 200-140-00021
SIGHT TUBE, 316 ST. STEEL, FOR 312/412

1	A	500-140-04010, NIPPLE, .5XCLOSE, TXT, 316SS
1	B	500-140-04012, NIPPLE, .5X3.5L, TXT, 316SS
1	C	500-140-03995, ELBOW, 90°, .5FX.5F, TXT, 316SS
1	D	500-140-03996, ELBOW, STREET, 90°, .5FX.5M, TXT, 316SS
1	E	500-140-04030, VALVE, BALL, .5FX.5F, TXT, 316SS
2	F	500-140-04000, HOSE BARB, .5MX.5M, TXB, 316SS
2	G	500-140-00030, HOSE CLAMP, .41-.88, SS
29"	H	500-200-00150, TUBE, CLEAR, .5 ID, TYGON

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

TITLE: SIGHT TUBE SUBASSEMBY

A	900-140-00044	1 = 1	-
NONE	DO NOT SCALE DRAWING	KM	2/20/95

CHOOSE ONE DRAIN VALVE.

(NOTE THAT BRASS DRAIN VALVES ARE ALREADY PART OF THE BASE SUBASSEMBLY, AND THE STAINLESS DRAIN VALVE SUBS ARE AN OPTION).

BRASS
(STANDARD)

☐ **200-140-00143**
DRAIN VALVE, BRASS, 1/2", FOR 1300P

1 A 500-140-02980, NIPPLE, .5XCLOSE, TXT, BRASS
1 B 500-140-02740, VALVE, BALL, .5FX.5F, TXT, BRASS

☐ **200-140-00146**
DRAIN VALVE, BRASS, 3/4", FOR 2300P

1 A 500-140-03050, NIPPLE, .75XCLOSE, TXT, BRASS
1 B 500-140-02750, VALVE, BALL, .75FX.75F, TXT, BRASS

☒ **200-140-00142**
DRAIN VALVE, BRASS, 1", FOR 13/23/26/36

1 A 500-140-03060, NIPPLE, 1.0XCLOSE, TXT, BRASS
1 B 500-140-02780, VALVE, BALL,1.0FX1.0F, TXT, BRASS

☐ **200-140-00141**
DRAIN VALVE, BRASS, 2", FOR 312/412

1 A 500-140-03250, NIPPLE, 2.0XCLOSE, TXT, BRASS
1 B 500-140-02760, VALVE, BALL,2.0FX2.0F, TXT, BRASS

316 STAINLESS STEEL
(OPTIONAL)

☐ **200-140-00145**
DRAIN VALVE, 316 ST. STEEL, 1/2", FOR 1300P

1 A 500-140-04010, NIPPLE, .5XCLOSE, TXT, 316SS
1 B 500-140-04030, VALVE, BALL, .5FX.5F, TXT, 316SS

☐ **200-140-00148**
DRAIN VALVE, 316 ST. STEEL, 3/4", FOR 2300P

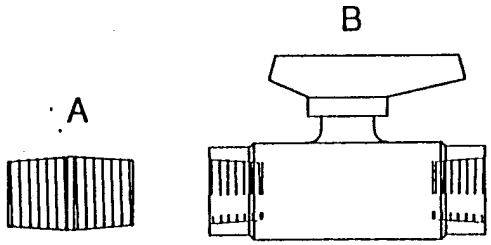
1 A 500-140-04011, NIPPLE, .75XCLOSE, TXT, 316SS
1 B 500-140-04031, VALVE, BALL, .75FX.75F, TXT, 316SS

☐ **200-140-00140**
DRAIN VALVE, 316 ST. STEEL, 1", FOR 13/23/26/36

1 A 500-140-04014, NIPPLE, 1.0XCLOSE, TXT, 316SS
1 B 500-140-04032, VALVE, BALL,1.0FX1.0F, TXT, 316SS

☐ **200-140-00147**
DRAIN VALVE, 316 ST. STEEL, 2", FOR 312/412

1 A 500-140-04022, NIPPLE, 2.0XCLOSE, TXT, 316SS
1 B 500-140-04035, VALVE, BALL,2.0FX2.0F, TXT, 316SS

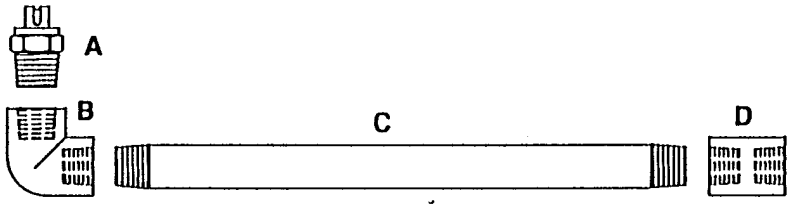


NORTH EAST ENVIRONMENTAL PRODUCTS, INC. 17 TECHNOLOGY DRIVE WEST LEBANON, NEW HAMPSHIRE 03784			
DRAIN VALVE SUBASSEMBY			
SIZE A	900-140-00045	SHEET 1 of 1	REV -
SCALE NONE	DO NOT SCALE DRAWING	DRAWN KM	DATE 2/20/95

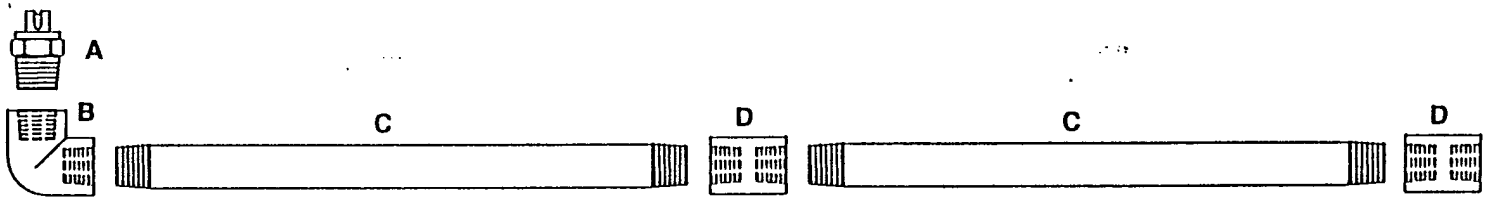
WASHER WAND ASSEMBLY

SELECT ONE

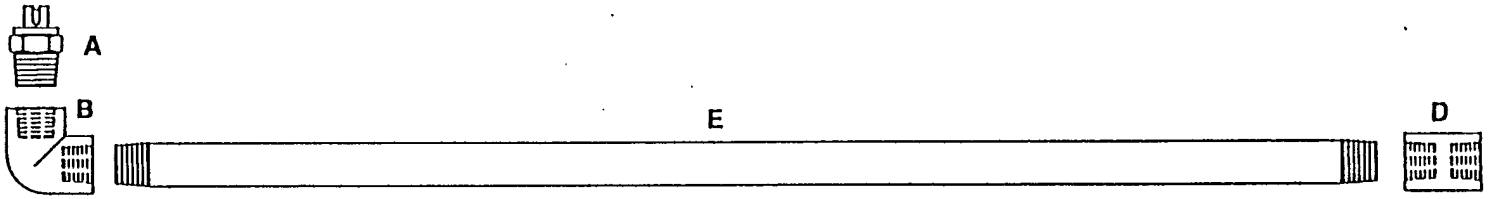
☐ 200-140-000030
3 FEET



☒ 200-140-00034
6 FEET (2 SECTIONS)



☐ 200-140-00032
6 FEET



PARTS LIST

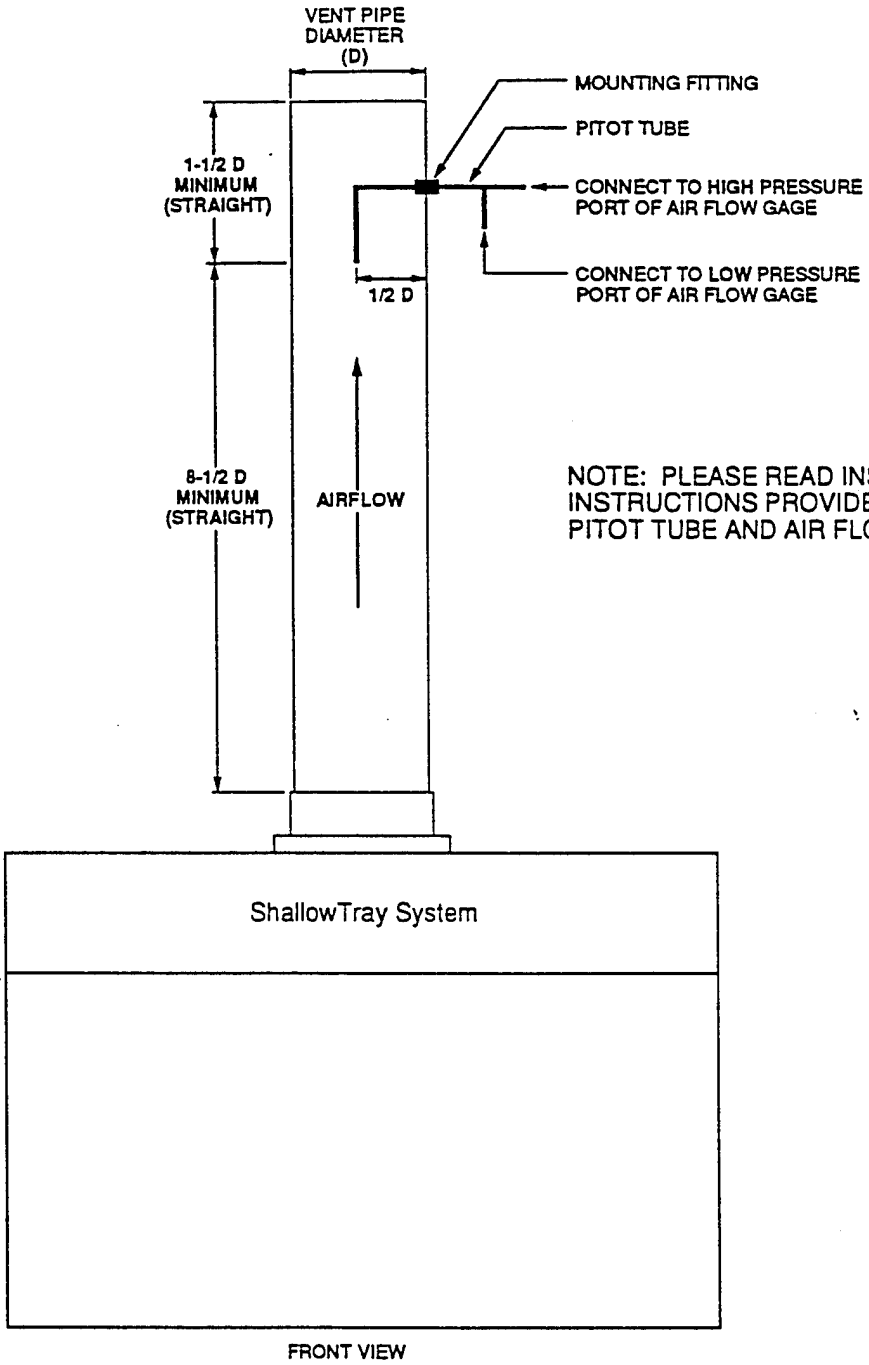
A	500-140-00110 Nozzle,MEG,1/4",25,05
B	500-140-00075 Elbow,90,.25Fx.25F,90,TxT,galv
C	500-140-00085 Wand Washer Extension,36"
D	500-140-00115 Coupling,.25fx.25f,,txt,galv
E	500-140-00086 Wand Washer Extension,72"

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

TITLE: WASHER WAND ASSEMBLY			
SIZE: A	DWG NO.: 900-140-00110	SHEET: 1 of 1	REV: Ø
SCALE: NONE	DO NOT SCALE DRAWING	DRAWN: RC	DATE: 4-11-95

PROPER PITOT TUBE INSTALLATION / LOCATION

(FOR SINGLE-POINT PITOT TUBE MOUNTED IN AIR EXHAUST DUCT)



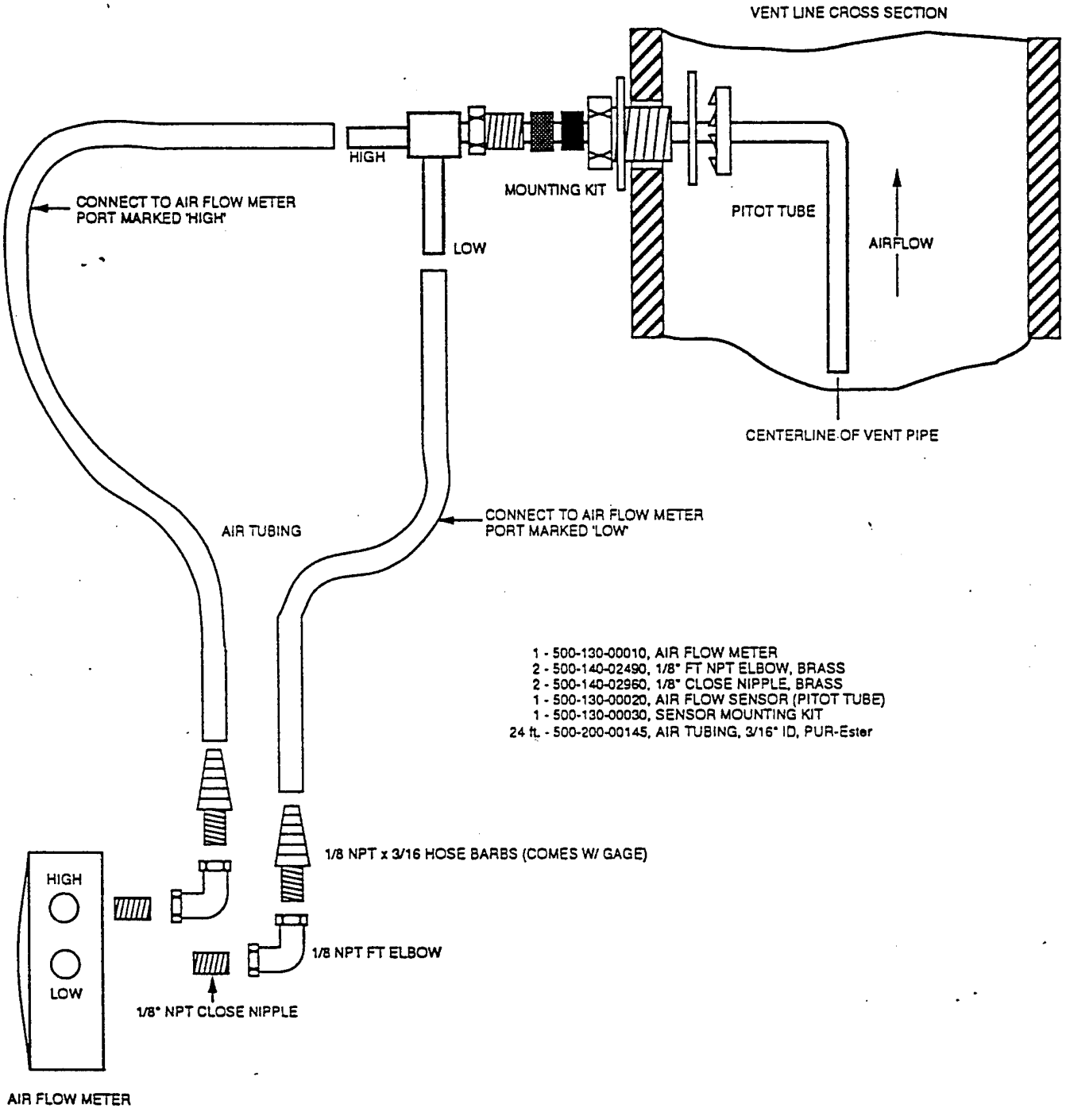
FRONT VIEW

NOTE: PLEASE READ 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: PITOT TUBE INSTALLATION/LOCATION		
	DRAWING #: 900-130-00003		
DRAWN: KM	CUSTOMER:		
DATE: 12/14/94	SCALE:	SIZE: A	SHEET: OF:

AIR FLOW METER ASSEMBLY



NOTE:

WHEN USING PVC VENT LINE, IT MAY BE EASIER TO DRILL AND TAP A 1/2" HOLE IN THE PVC PIPE AND SCREW IN THE 1/2" CRIMP HOUSING INSTEAD OF USING THE LOCK WASHER.

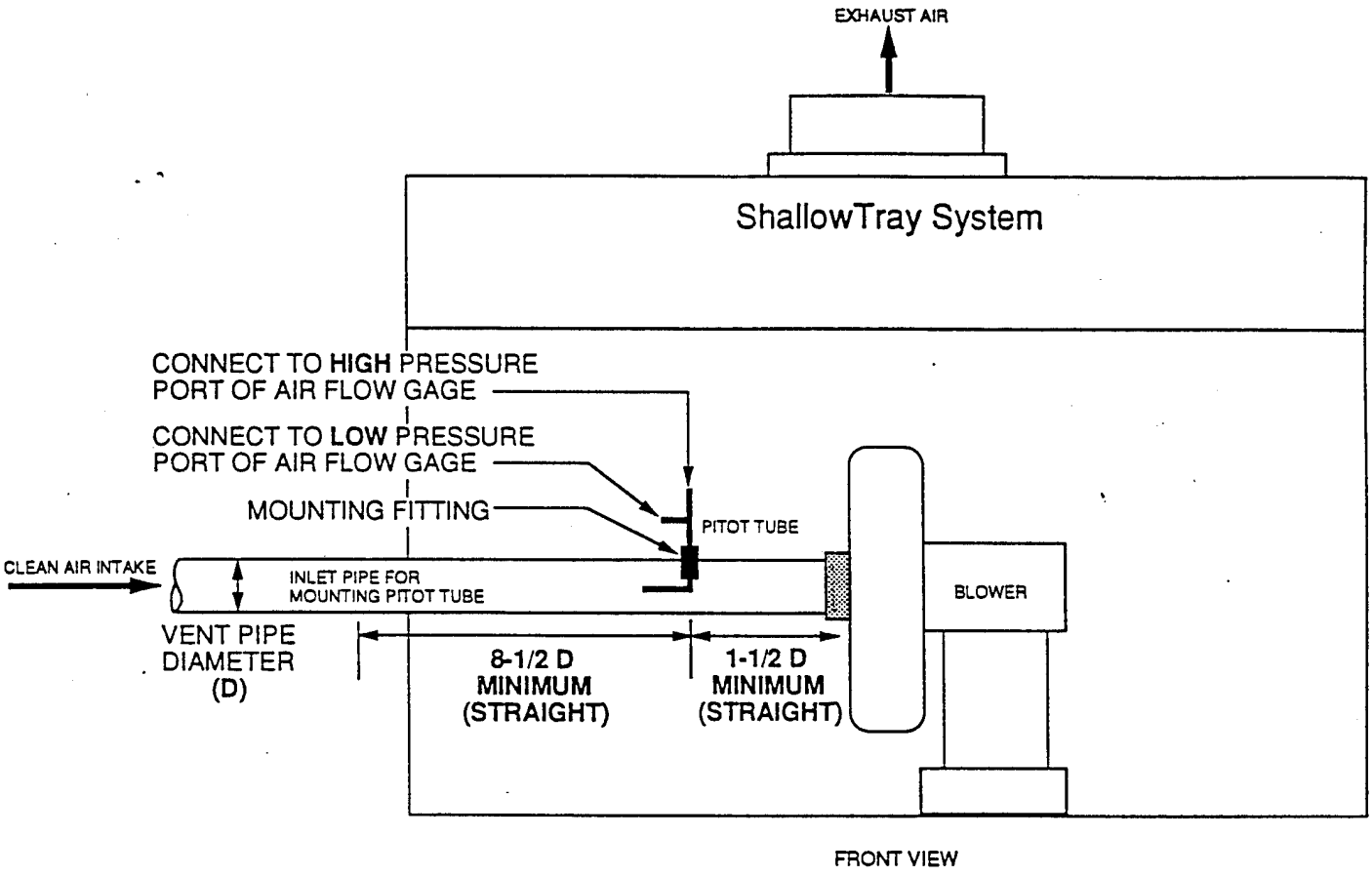
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED ±1 in.	DRAWING NAME: AIR FLOW METER ASSEMBLY		
	DRAWING #: 200-130-00010		
DRAWN: KM	CUSTOMER:		
DATE: 12/14/94	SCALE:	SIZE: A	SHEET: OF:

PROPER PITOT TUBE INSTALLATION / LOCATION

(FOR SINGLE-POINT PITOT TUBE MOUNTED IN AIR INTAKE DUCT)

NOTE: PLEASE READ INSTALLATION INSTRUCTIONS PROVIDED WITH THE PITOT TUBE AND AIR FLOW METER.

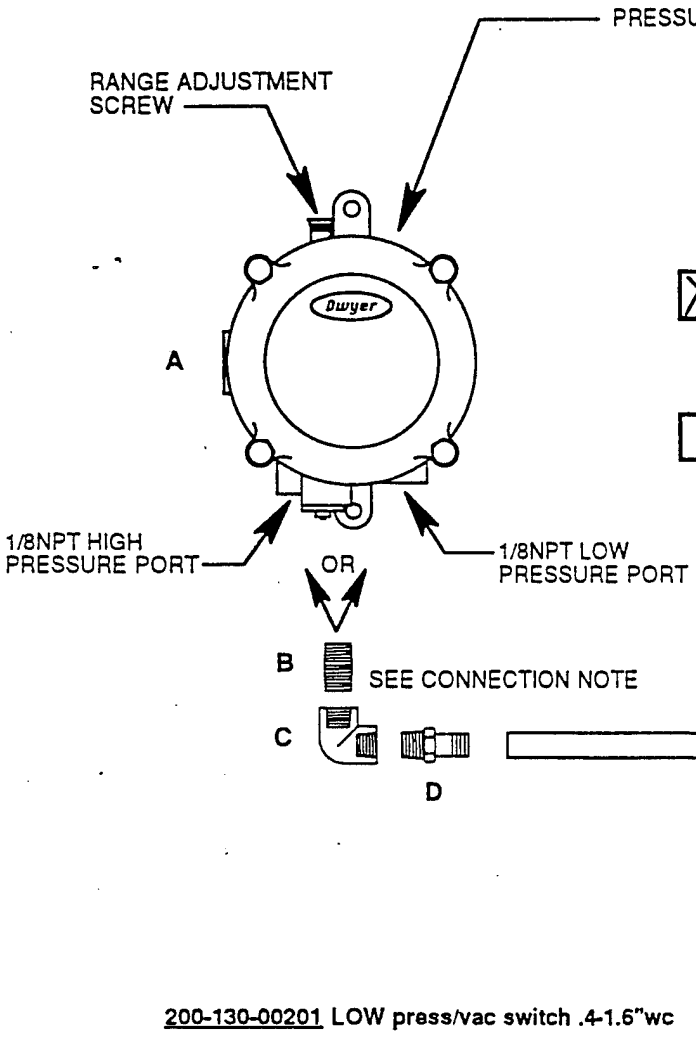


FRONT VIEW

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

TOLERANCES UNLESS OTHERWISE SPECIFIED ±1 in.	DRAWING NAME: PITOT TUBE INSTALLATION/LOCATION		
	DRAWING #: 900-130-00009		
DRAWN: KM	CUSTOMER:		
DATE: 12/14/94	SCALE: NTS	SIZE: A	SHEET :1 OF :1

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

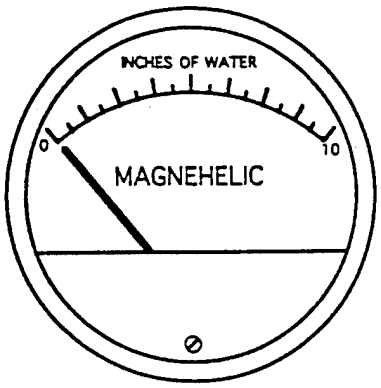
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NEW HAMPSHIRE 03784

TITLE: LOW AIR PRESSURE/VACUUM SWITCH

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

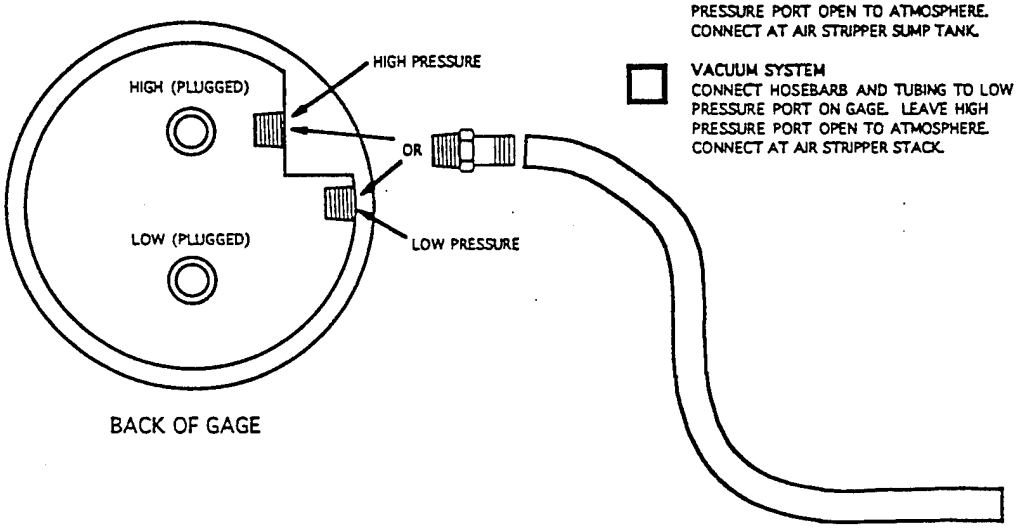
SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC/MS	9-22-94

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.



BACK OF 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.

☐ 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 Air3/16IDx5/16OD

☐ 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 Air3/16IDx5/16OD

☐ 200-130-00211 Air pressure gauge SUB 0-15"wc
•1 500-130-00050 Gauge Air Pressure0-15"WC
•4' 500-200-00145 Tubing Air3/16IDx5/16OD

☐ 200-130-00212 Air pressure gauge SUB 0-20"wc
•1 500-130-00060 Gauge Air Pressure0-20"WC
•4' 500-200-00145 Tubing Air3/16IDx5/16OD

☒ 200-130-00213 Air pressure gauge SUB 0-30"wc
•1 500-130-00065 Gauge Air Pressure o-30"
•4' 500-200-00145 Tubing Air3/16IDx5/16OD

☐ 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 Air3/16IDx5/16OD

☐ 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.
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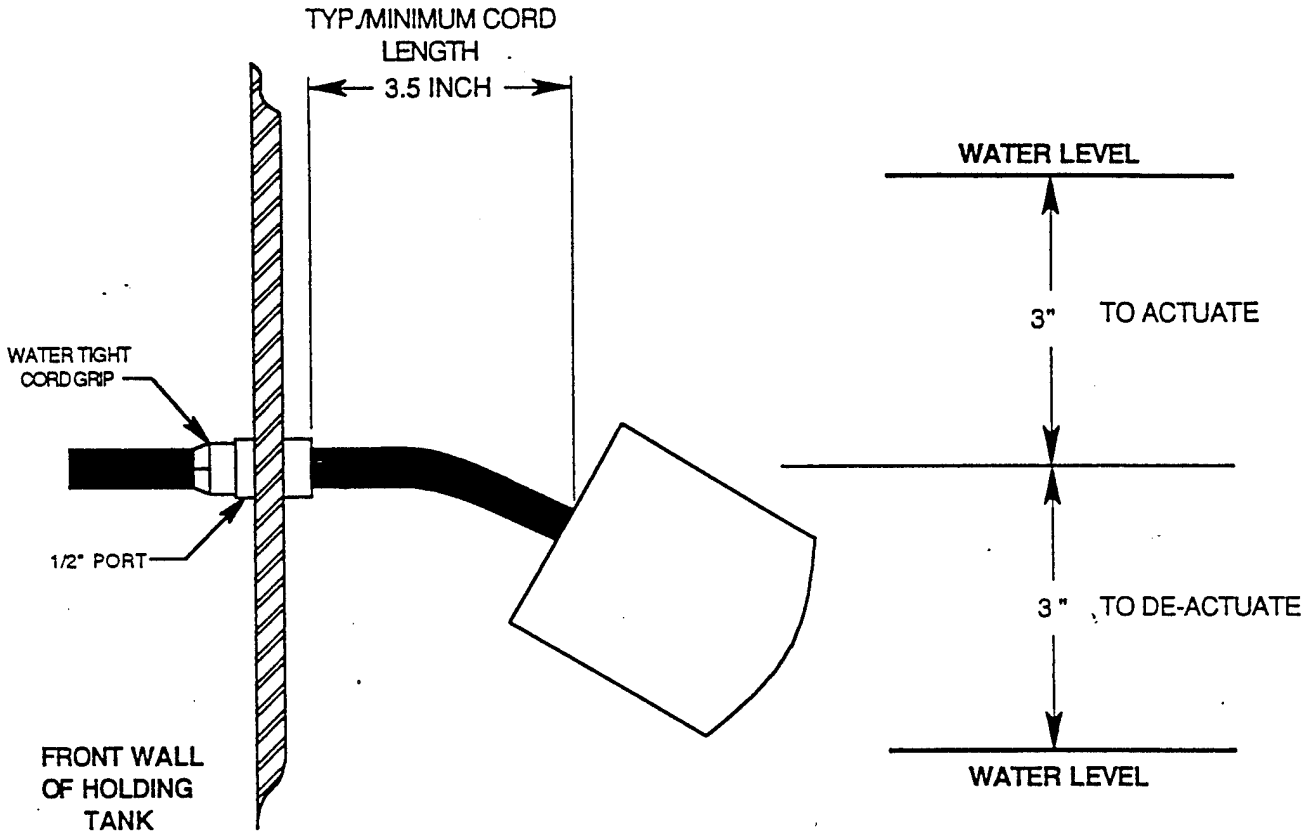
AIR PRESSURE GAGE

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

FLOAT SWITCH

MECHANICAL



☐ 200-120-00310 FLOAT SWITCH, N.O., 10' CORD
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
1 500-120-02522 Switch,float,N.C.,mech,10ft cord
1 500-120-02490 Cord,Watertight,1/2",Bulkhead

NOTE:
WATER TIGHT CORD GRIP TO BE MOUNTED INSIDE THE TANK FOR EXP UNITS.

	EXP MOUNT CORD GRIP INSIDE TANK
✓	TEFC MOUNT CORD GRIP OUTSIDE TANK

SEE COUPLING LAYOUT FOR SWITCH LOCATION.

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TOLERANCES UNLESS OTHERWISE SPECIFIED ±.060 In.	DRAWING NAME: FLOAT SWITCH (MECHANICAL)		
DRAWN BY: MS	DRAWING #: 900-120-00029		
DATE: 8/31/94	SHEET: 1 OF: 1	SIZE: A	
FC - 3/14/95	DRAWING SCALE: 20 TO 1		

2600 FRAME
PART NUMBERS FOR SPECIFYING

OPTION #1- High pressure blower

Quanitity	Description	New Part Number
1	Control Panel Mount	500-170-00045
1	2600 Holding Tank Frame	500-170-00051
1	2600/3600Blower ~~Tank~~ Frame	500-170-00061

OPTION #2- AF-15 Blower

Quanitity	Description	New Part Number
1	Control Panel Mount	500-170-00045
1	2600 Holding Tank Frame	500-170-00051
1	2600/3600Blower ~~Tank~~ Frame	500-170-00061
1	3 7/8 x 20 x 13 Blower riser	500-170-00156

OPTION #3- AF-12 Blower

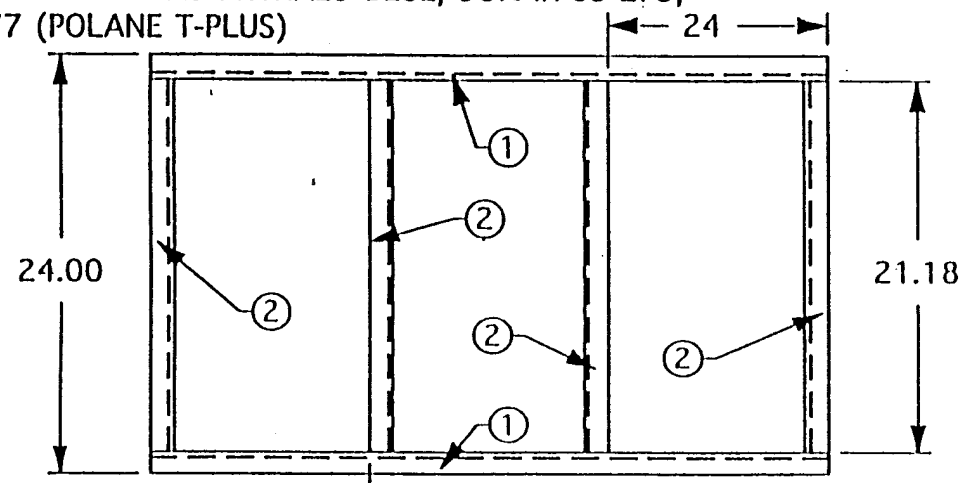
Quanitity	Description	New Part Number
1	Control Panel Mount	500-170-00045
1	2600 Holding Tank Frame	500-170-00051
1	2600/3600Blower ~~Tank~~ Frame	500-170-00061
1	7 3/4 x 20 x 13 Blower riser	500-170-00171

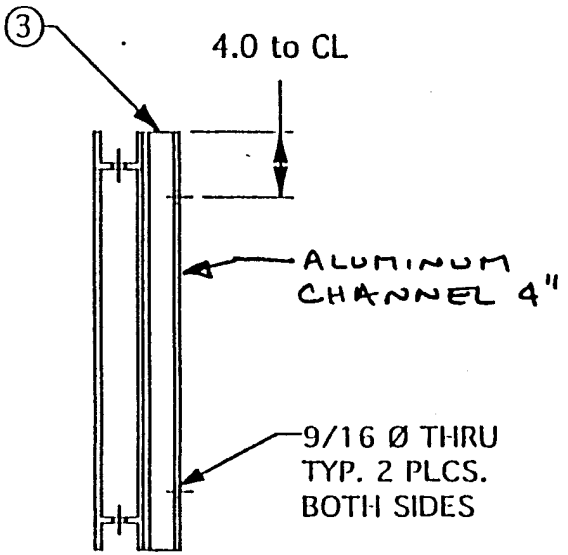
Note: The 2600 Frame is Sub-Assembly #'s: 200-170-00080 & 200-170-00060

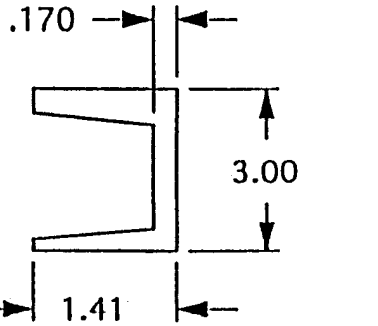
NOTES

DATE	REV.	ENG.	DESCRIPTION	ECN #

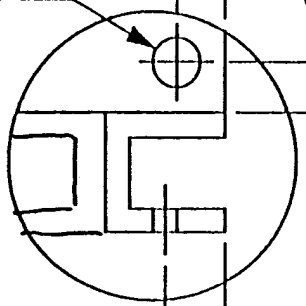
1. MATERIAL: 1018 C-CHANNEL
2. SURFACE: STANDARD MILL FINISH
3. CONTINUOUS WELD ALL CONTACT POINTS ON INSIDE AND OUTSIDE OF THE "C"
4. DEBURR ALL EDGES
5. ALL DIMENSIONS ARE IN INCHES
6. FINAL FINISH: PRIMER, SHERWIN WILLIAMS GRAY #E65A4;
   PAINT, SHERWIN WILLIAMS PHTHALO BLUE, 90% #F63-L73,
   10% F63-W77 (POLANE T-PLUS)







CROSS SECTION OF C-CHANNEL
(Not To Scale)



DETAL A

PARTS LIST		
ITEM	QTY.	TANK FRAME
1	2	CHANNEL 3.0" x 4.1 lb/ft x74.00"
2	4	CHANNEL 3.0" x 4.1 lb/ft x 21.18"
3	2	CHANNEL 4.0" x [illegible]b/ft x 24.00"

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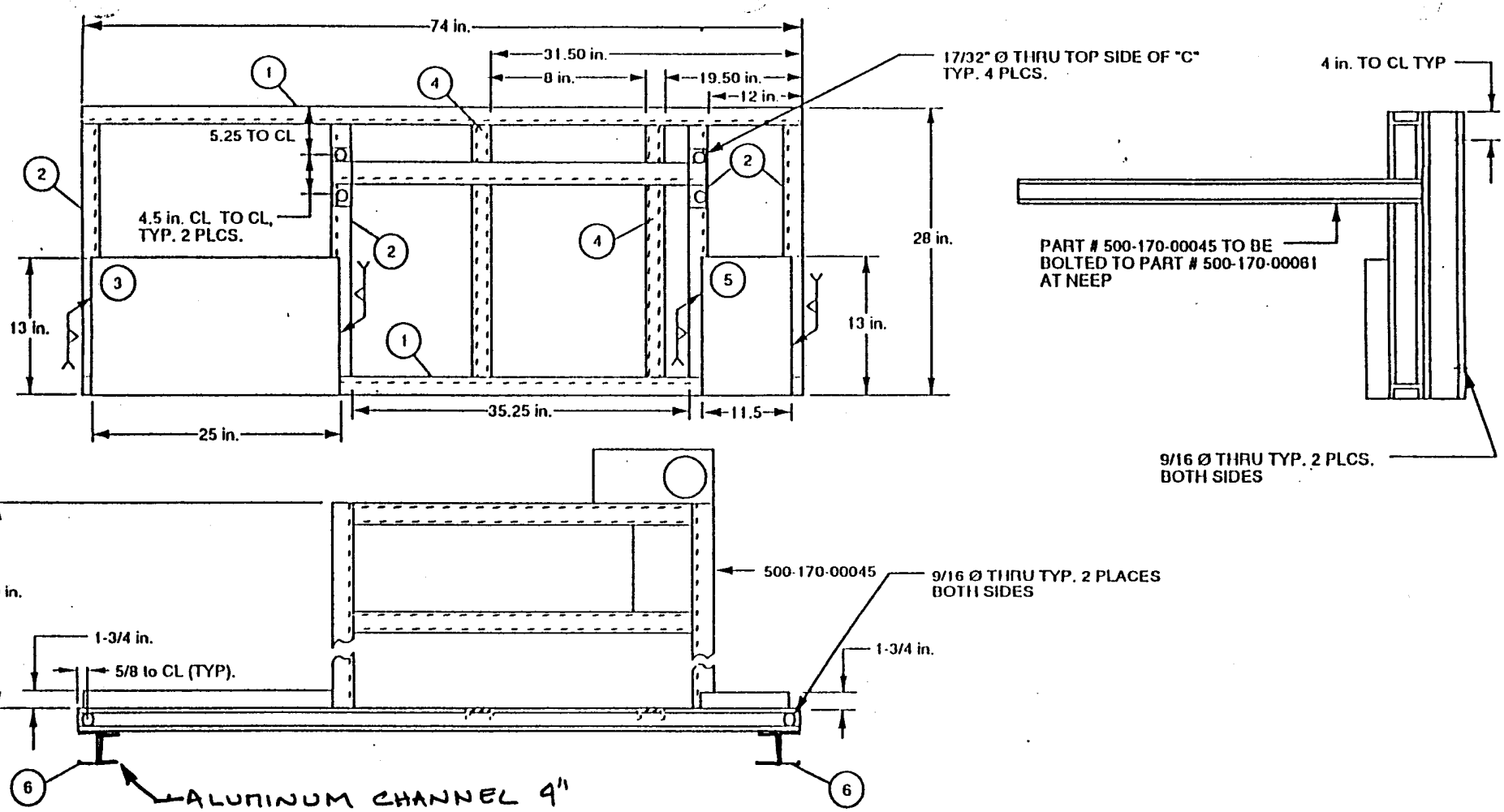
TOLERANCES UNLESS OTHERWISE SPECIFIED: ± .030 in.	DRAWING NAME: 2600 HOLDING TANK FRAME
DRAWN: ERIC B.	DRAWING #: 500-170-00051
DATE: 1/7/93	SCALE: NONE | SIZE: A | SHEET 1 OF 1
	DO NOT SCALE DRAWING



47

ITEM	QTY	DESCRIPTION
1	2	CHANNEL 3.0"x 4.1 lb/ft x 74" long
2	4	CHANNEL 3.0"x 4.1 lb/ft x 25.18" long
3	1	PUMP MOUNT 3/16 MILD STEEL
4	2	CHANNEL 4.0"x 5.4 lb/ft x 25.18" long
5	1	PUMP MOUNT 3/16 MILD STEEL
6	2	CHANNEL 4.0"x [illegible] x 28" long

NOTES:

1. MATERIAL: 1018
2. SURFACE: STANDARD MILL FINISH
3. CONTINUOUS WELD ALL CONTACT POINTS INSIDE AND OUTSIDE OF THE "C"
4. DEBURR ALL EDGES
5. ALL DIMENSIONS ARE IN INCHES
6. FINAL FINISH: PRIMER, SHERWIN WILLIAMS GRAY #E65A4;
   PAINT, SHERWIN WILLIAMS PHTHALO BLUE, 90% #F63-L73,10% #F63-W77

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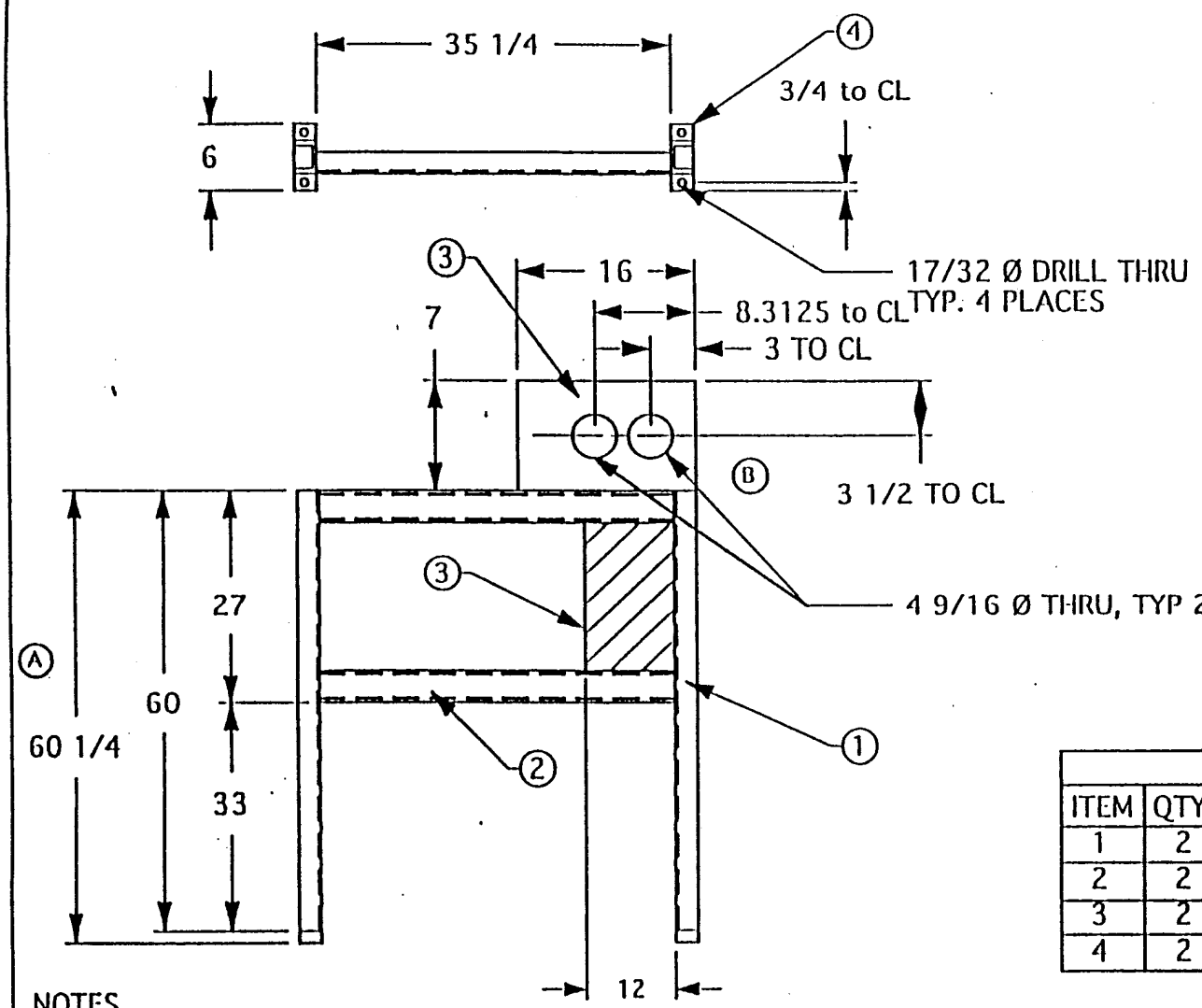
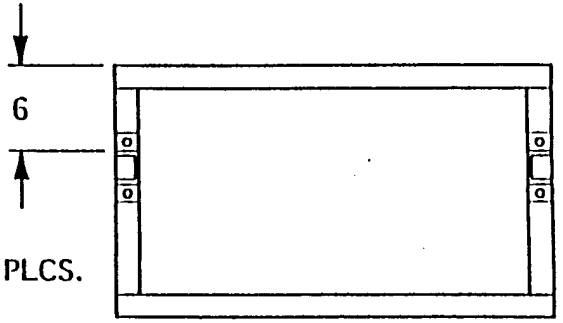
TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 in.	DRAWING NAME: 2600/3600 BLOWER FRAME SUB.
DRAWN: EB	DRAWING #: 200-170-00000
REV.: B	CUSTOMER:
DATE: 11/9/93	SCALE: / SIZE: A / SHEET : OF :

DATE	REV.	ENG.	DESCRIPTION	ECN #
1/26/93	A	EB	ADDED DIMENSION 60 WAS 61	
11/9/93	B	EB	ADDED 4 9/16Ø HOLE	





TYPICAL LOCATION OF PANEL MOUNT

PARTS LIST		
ITEM	QTY.	TANK FRAME
1	2	CHANNEL 3.0" x 4.1 lb/ft x 60"
2	2	CHANNEL 4.0" x 4.1 lb/ft x 35 1/4"
3	2	14 GA. SHEET METAL
4	2	1 1/4 x 1/4 x 6 BAR STOCK

(A)

NOTES

1. MATERIAL: 1018 C-CHANNEL, UNLESS OTHERWISE SPECIFIED
2. SURFACE: STANDARD MILL FINISH
3. CONTINUOUS WELD ALL CONTACT POINTS ON INSIDE AND OUTSIDE OF THE "C"
4. DEBURR ALL EDGES.
5. ALL DIMENSIONS ARE IN INCHES
6. FINAL FINISH: PRIMER, SHERWIN WILLIAMS GRAY #E65A4; PAINT, SHERWIN WILLIAMS PHTHALO BLUE, 90% #F63-L73, 10% F63-W77 (POLANE T-PLUS)

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TOLERANCES UNLESS OTHERWISE SPECIFIED: ±.030 in.

DRAWING NAME: CONTROL PANEL MOUNT FOR BLOWER FRAME

DRAWN: ERIC B.

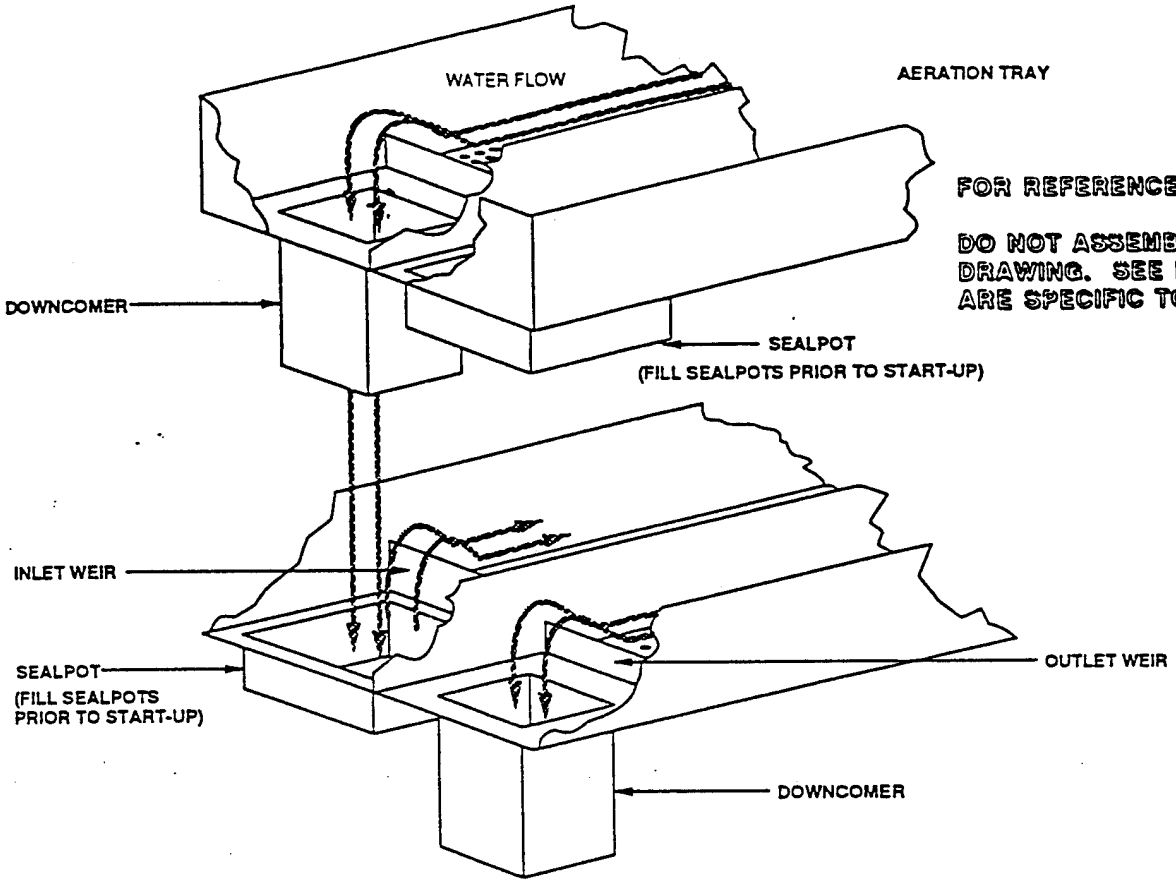
DRAWING #: 500-170-00045

DATE: 8/25/92

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

DO NOT SCALE DRAWING

SEALPOT FUNCTION - WATER SEAL

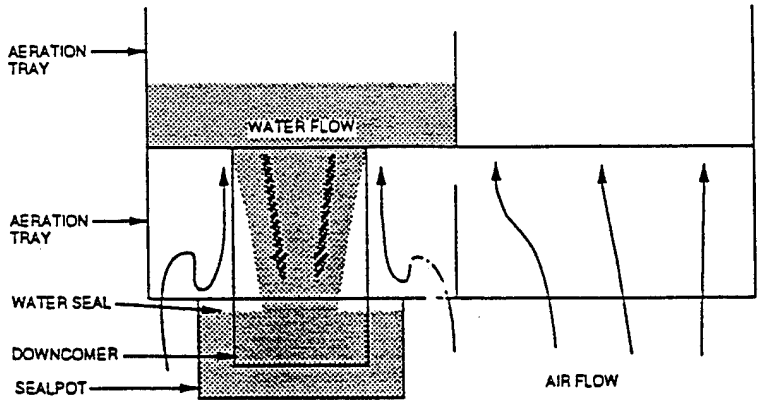


FOR REFERENCE ONLY !

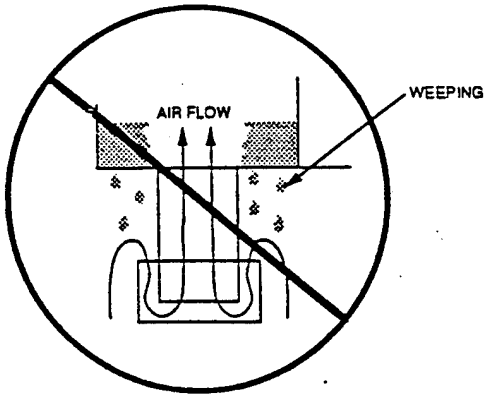
DO NOT ASSEMBLE PER THIS DRAWING. SEE DRAWINGS THAT ARE SPECIFIC TO THIS UNIT.

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.

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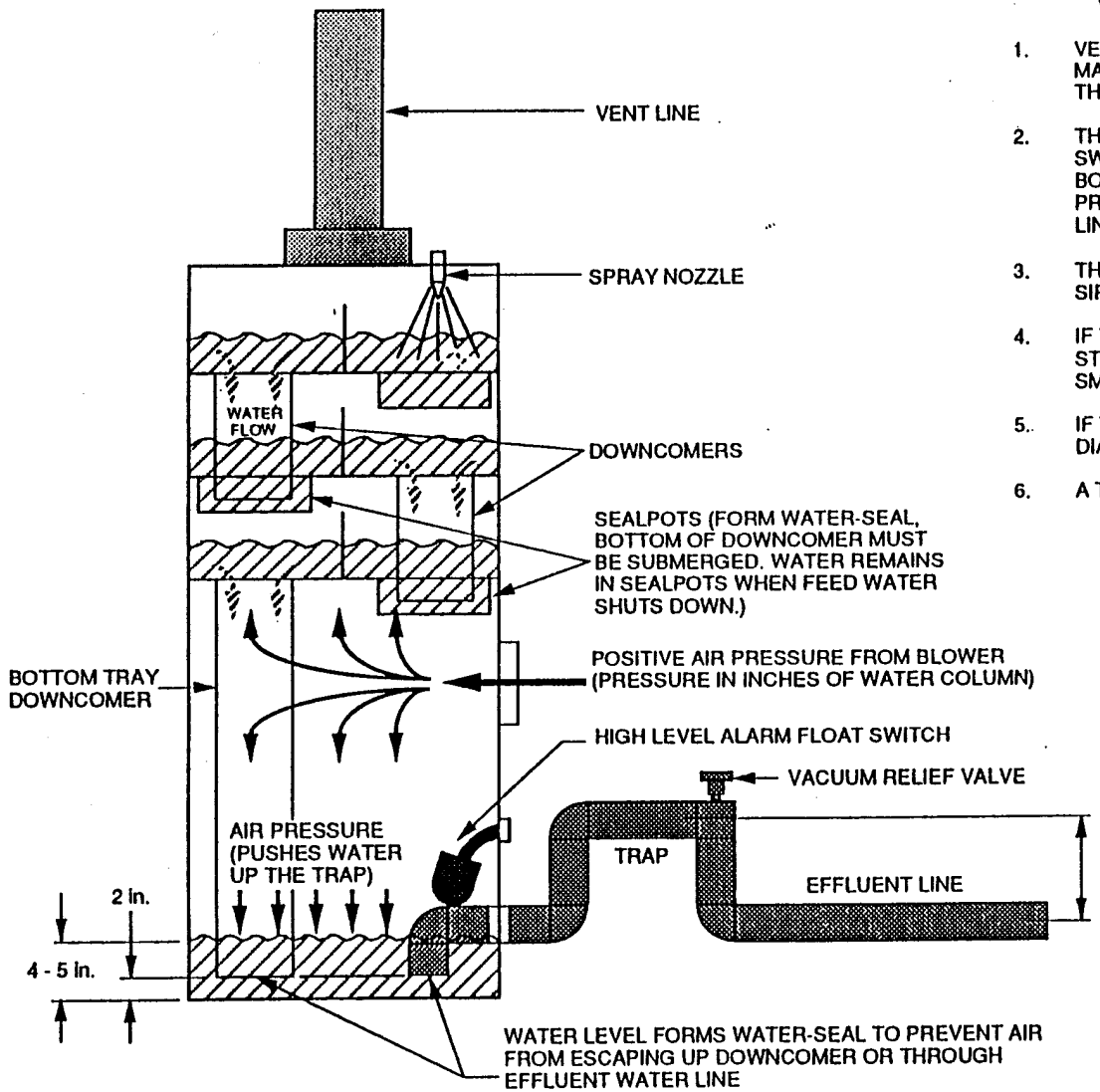
TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 in.	DRAWING NAME: SEALPOTS		
	DRAWING #: 900-160-00061		
DRAWN: MS DATE: 11/19/92	CUSTOMER:		
REV: A 3/9/94	SCALE:	SIZE: A	SHEET: OF:



SIDE VIEW

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 SUMR 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

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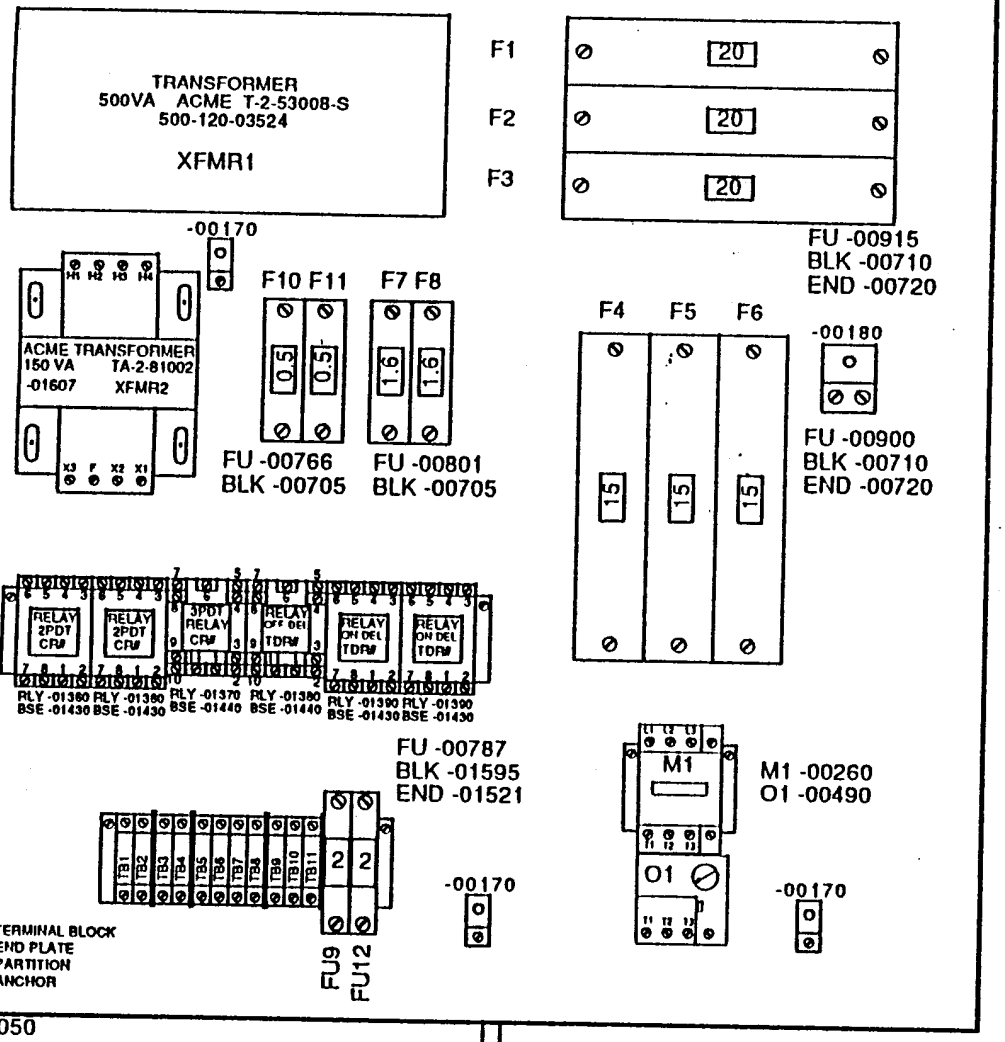
TOLERANCES UNLESS OTHERWISE SPECIFIED ± 1 in.	DRAWING NAME: GRAVITY DISCHARGE TRAP HEIGHT		
	DRAWING #: 900-140-00001		
DRAWN: MS	CUSTOMER:		
DATE: 11/8/93	SCALE:	SIZE: A	SHEET: OF:



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TITLE

ELECTRICAL ASSEMBLY

ENVIRONMENTAL SCIENCE AND ENGINEERING

SIZE	DWG NO	SHEET	REV
A	2641/4330	1 OF 1	Ø

SCALE		DRAWN	DATE
NONE	DO NOT SCALE DRAWING	RC	5-26-95

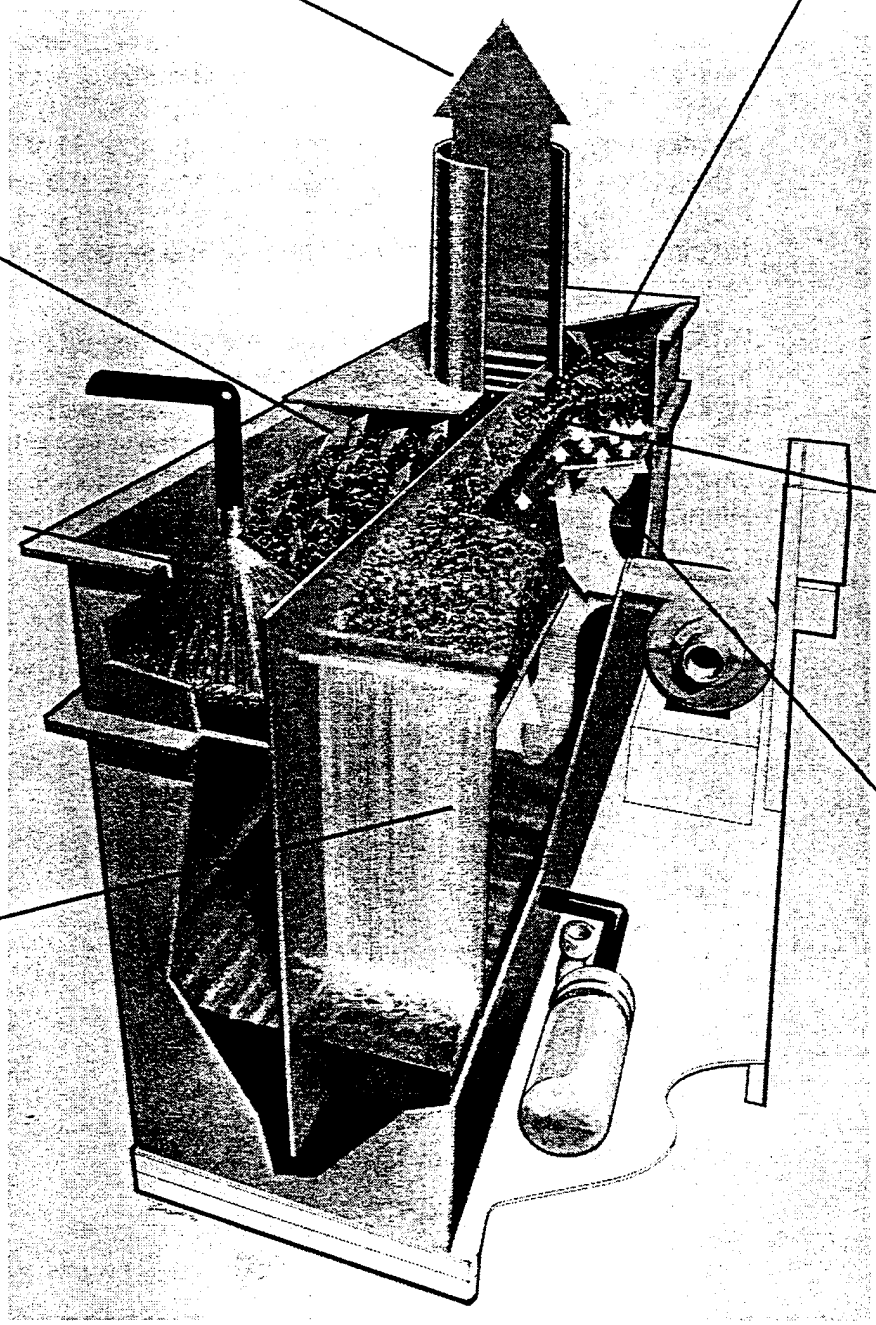
Section 2: ShallowTray System

The ShallowTray Process

Air is vented to the atmosphere or to vapor phase treatment of choice.

Water travels around the full length of the baffled tray, becoming progressively cleaner.

Turbulent frothing maximizes volatilization and scours the aeration tray.



Contaminated water inlet.

3/16" holes resist fouling.

Fan blows air up through hundreds of holes into the water.

Treated water falls into holding tank.

SHALLOWTRAY PROCESS

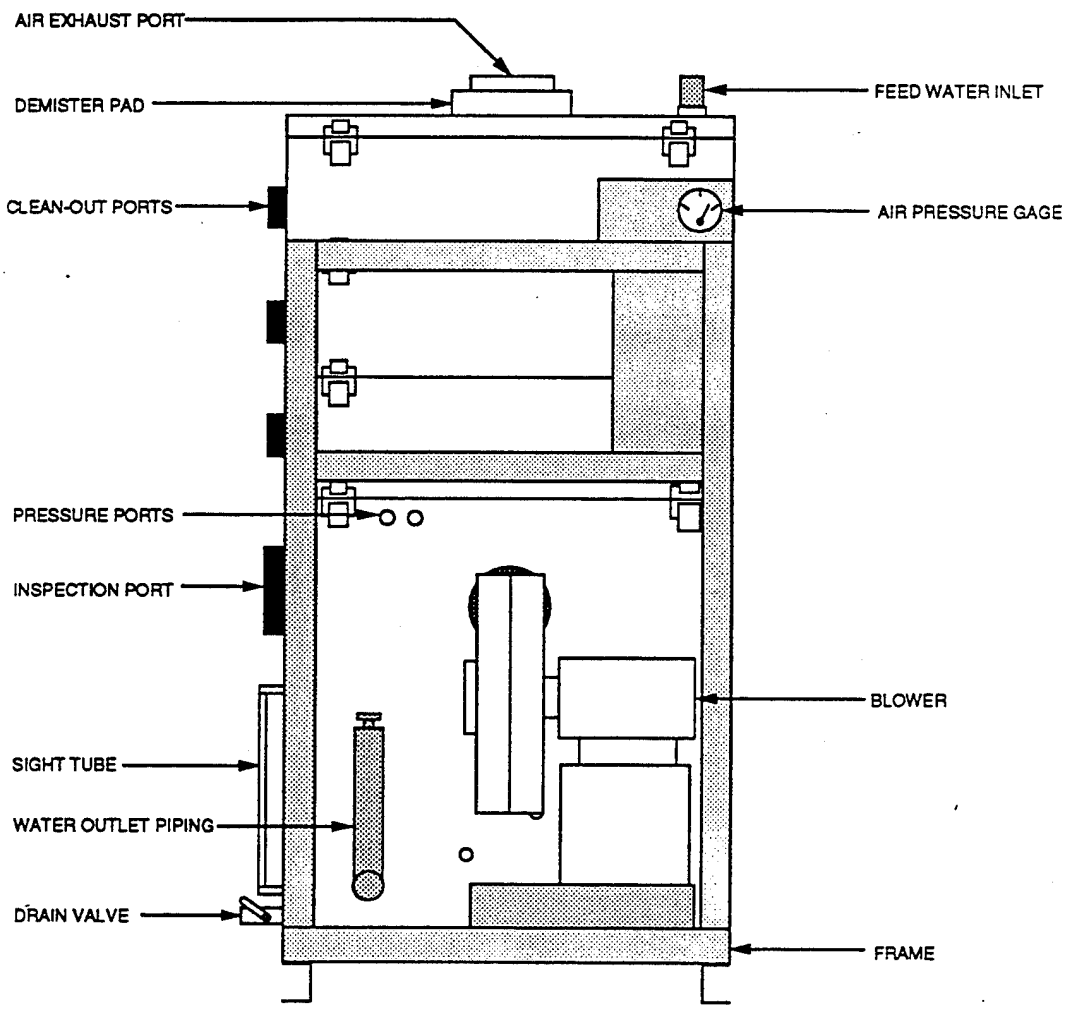
The Treatment Process

The purpose of air stripping is to treat contaminated groundwater for the removal of certain volatile organic chemicals (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 baffled sieve tray type aeration trays (The ShallowTray process is protected under U.S. Patent #5,045,215; Other U.S. and international patents pending). Air is blown up through hundreds of 3/16" diameter holes in the aeration tray. The air forms a froth of bubbles approximately six inches deep on the aeration 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 type 304L corrosion resistant stainless steel, or polyethylene, the tray unit utilizes counter current air and water flow through an array of baffled aeration 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



BASIC SYSTEM

ShallowTray systems are fabricated from rugged 304L stainless steel or molded polyethylene. Each system is pre-assembled and factory tested before shipment to your site.

Basic System Components

Information from manufacturers of the components on your system are included in the Components Information Section at the back of this manual.

Air Pressure Gage

The pressure gage reads the pressure drop of the system in inches of water column. The gage is connected to the system via an air hose that is attached to a pressure port on the sump tank. This air hose is connected to the "high" pressure port on the gage. The "low" pressure port is open to the atmosphere.

At initial start-up the pressure gage can be used to make adjustments to the damper, located on the blower inlet. Adjustments should be made according to the table:

# of trays	Minimum Pressure
1 tray system	4" wc
2 tray system	7" wc
3 tray system	11" wc
4 tray system	15" wc

As stated below in the Damper section, beware when making damper adjustments after initial start-up. Fouling may occur in the system which would affect the air flow rate. A system that was fouled would produce a lower air flow at the same pressure reading than the system did at initial start up. A system that was severely fouled might not produce the minimum air flow requirements that the system needs. If the pressure reading rises at a steady rate over a period of time, and there have been no changes in the damper location and water flow rate, chances are the system is fouling. If this occurs shut down the system. Remove the inspection ports and visually inspect for signs of fouling. Occasionally inspect the air hose for water build up. Water trapped in the air hose could produce an erroneous reading. A shut-off valve is now provided on the pressure port. The valve should be closed when no one is at the site. This will help prevent condensation building up inside the pressure gage. Condensation build up will ruin the pressure gage.

Blower

The blowers on the ShallowTray low profile air stripper units are typically cast aluminum type B spark resistant, direct drive @ 3450 rpm, with motor options of TEFC or EXP. Each blower is selected by our engineering staff to exceed the minimum air flow requirements (cfm) at the nominal working pressure (inches of water column) of each system.

It is critical that the blower damper be opened wide enough to provide the unit with the designated minimum 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.

A small 3/8" drain hole is drilled on the bottom side of the blower housing to provide a means of discharging any water that might splash in when the blower is not in operation. When starting the unit for the first time, check that the blower wheel is rotating in the direction of the arrow on the blower housing. If you hear the blower wheel rubbing or any odd sounds shut down the system immediately and call North East Environmental Products.

Damper

There is a damper on the intake side of the blower. The damper is used to make adjustments to the air flow rate (cubic feet per minute) of your system. The air flow rate is increased (higher cfm's) by opening the damper wider.

Since the blower is pre-selected to exceed the minimum air flow requirements of your system, you can adjust your damper, at initial start-up, using the pressure reading on the pressure gage.

Follow the table below and adjust your damper to obtain the given value on your pressure gage.

# of trays	Minimum Pressure
1 tray system	4" wc
2 tray system	7" wc
3 tray system	11" wc
4 tray system	15" wc

Beware when making damper adjustments after initial start-up. Fouling may occur in the system which would effect the air flow rate. A system that has fouled would produce a lower air flow rate at the same pressure reading than the system did at initial start up. A system that was severely fouled might not produce the minimum air flow requirements that the system needs. For this reason it is recommended that an air flow meter and an air pressure gage both be used when adjusting the damper after initial start-up. It is also recommended that you keep a log book of pressure readings so you can determine when the system is fouling.

Demister

A wire mesh demisting pad is installed beneath the air exhaust nozzle located on the top cover of the unit. The purpose of the demisting pad is to remove water droplets that would have blown through the vent line. It is possible, though unlikely, that the demisting pad may become plugged or fouled. If this occurs the demisting pad is easily removed. Disconnect the vent line, take off the top cover, and remove the retaining screws on the bottom side of the cover. The demisting pad can be cleaned with a pressure washer or replaced with a new one.

Gasket

A black nitrile sponge gasket, of firm density, is used to form an airtight seal around the sump tank and aeration trays. If there are any problems with the gaskets contact North East Environmental Products as soon as possible. A replacement gasket can be glued to the sealing flange using an industrial neoprene 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.

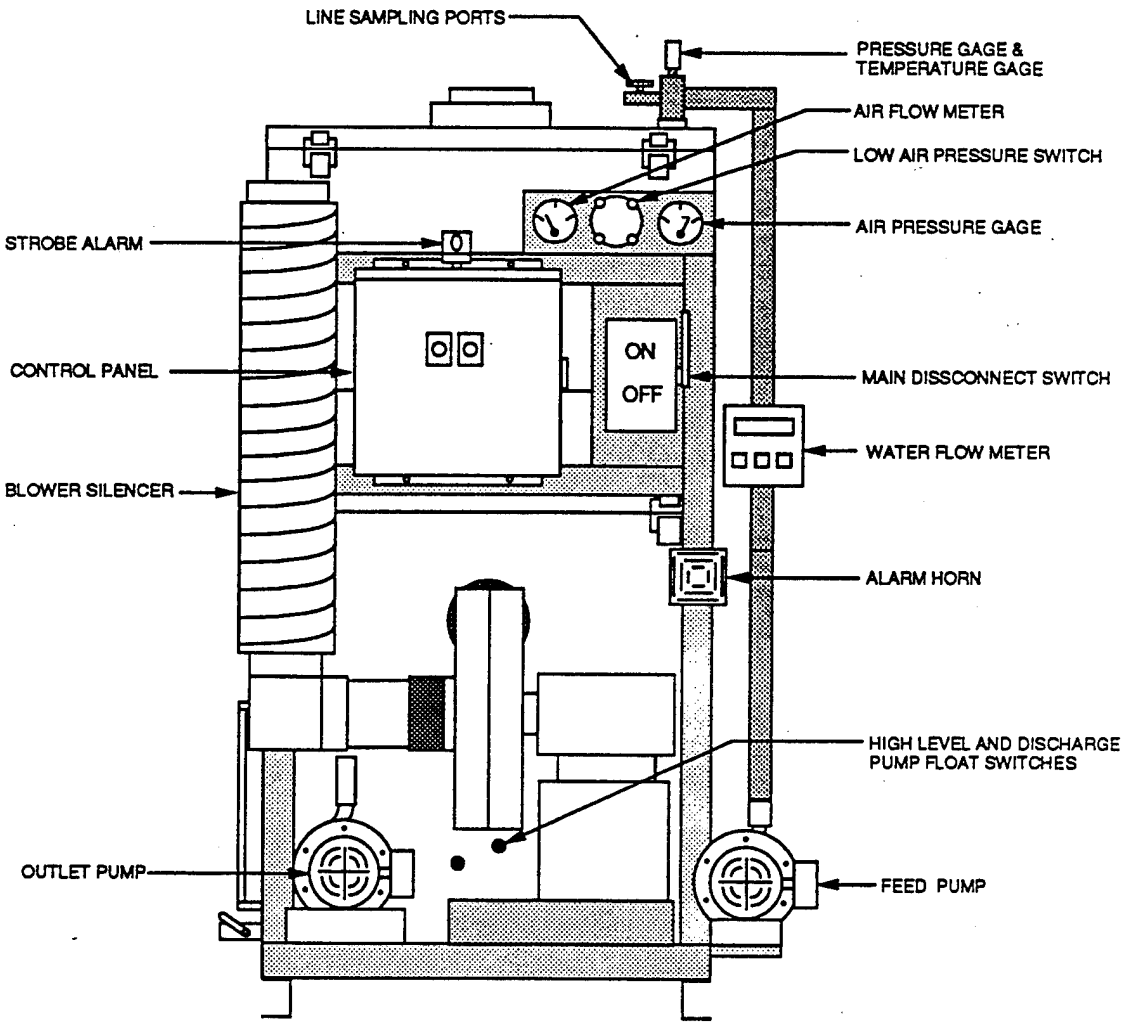
Spray Nozzle

A spray nozzle is installed in all units except ones with gravity feed. The nozzle directs the contaminated water to the inlet chamber and begins the volatilization process. The nozzle is rated for 15 psi at the systems maximum water flow rate.

It is recommended that a strainer be installed somewhere in the inlet process water line, especially at 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 to 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 an air lock.

ShallowTray System Options



SHALLOWTRAY OPTIONS

ShallowTray System Options

ShallowTray low profile air strippers are built to meet site and project specifications. The following options may have been selected for your system. Please refer to your System Drawing, in the Drawing section at the back of this manual. Information from manufacturers of the components on your system are included in the Component section 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 it is dictated by the size of the blower and the choice of options. The silencer can be mounted either horizontally or vertically (through the use of an elbow). Silencers exposed to high wind velocities should be properly secured. Silencers mounted in the horizontal direction should be supported properly to avoid over-stressing.

Air Flow Meter

The air flow meter measures the amount of air flowing through the system. It is connected to the system via two air tubes and a pitot tube which is mounted in the exhaust air vent line. The pitot tube must be located at least 8½ pipe diameters of straight pipe from the exhaust nozzle or elbow and at least 1½ diameters of straight pipe from the end of the pipe or any elbow.

The air flow meter typically gives readings in feet per minute, which is then multiplied by the cross sectional area, square feet, of the vent line to give cubic feet per minute (cfm). As stated in the damper section, the air flow meter is needed to make damper adjustments, especially after initial start-up.

The table below lists area values in square feet for typical vent pipe diameters. Multiply the appropriate area value by the air flow reading, in feet per minute, from the air flow meter to get the air flow rate in cubic feet per minute.

Vent Pipe diameter (inches)	Area ($ft.^2$)
4	0.0873
6	0.1963
8	0.3491
10	0.5454
16	1.3962
18	1.7671

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 safety 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.

Control Panel Intrinsically Safe Components

ShallowTray low profile air stripper systems that process potentially explosive concentrations of vapors 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 placing the order for a system.

Digital Water Flow Indicator

The digital water flow indicator, typically installed in the incoming process water line, reads the rate of flow (gpm) and the totalized flow (gallons). The flow meters are 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. The mechanical component of the meter is the turbine styled rotor which spins around a shaft that is axial to the flow of water.

It is possible to plug the turbine rotor with particles and sediment. A coarse 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. Follow the manufacturers instructions that were sent with the ShallowTray unit when disassembling the water flow meter.

Feed and Discharge Pumps

The pumps on each system have been selected by our engineering staff to meet all flow and pressure requirements. The pumps are typically stainless steel with motor options of EXP or TEFC. The pumps are not self-priming, they must be primed by filling the outlet port with clean water until it has filled the entire pump chamber. This must be done prior to initial start-up. Throttle valves are installed on the discharge lines. The valve should be throttled back until the motor draws the nameplate current rating. If the pump is running wide open and it is not pumping against the required head, the pump will cavitate. This is the nature of centrifugal pumps, they must be throttled back if they are not pumping against the required head. If the pump is wired by someone other than North East Environmental Products please double check the rotation. A pump shaft rotating in the wrong direction could spin off the pump impeller and cause serious damage to the pump.

Systems using pumps should have the flow rates tuned so that the discharge is keeping up with the feed pump.

SHALLOWTRAY OPTIONS

High Water Level Alarm Switch

The high water level alarm switch is one of the two alarm interlocks that must be properly connected by a licensed electrician prior to the system's initial start-up. Please see the Special Cautions at the beginning of Operating Instructions section for more information. The purpose of the high water level alarm switch is to prevent water from flooding the blower by shutting off the incoming contaminated water once it has reached a designated level. The high water level switch will send an alarm signal when it is approximately 3.5 inches above the coupling its cord emerges from.

Line Sampling Ports

The line sampling ports provide a quick and easy means to take a water sample of both incoming contaminated water and outgoing clean water. The sampling ports are the 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 taking the sample. This purges the sample port of any stagnant water.

When purging the sample port on the contaminated water line, make sure you capture the contaminated water in some sort of storage container 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 Alarm Switch

The low air pressure alarm switch is one of the two alarm interlocks that must be properly connected by a licensed electrician prior to the system's initial start-up. Please see the Special Cautions at the beginning of Operating Instructions section for more information. The low air pressure alarm switch monitors the blower for continuous water treatment.

Should the blower fail, the low air pressure switch should be wired to shut off all incoming water. It, like the air pressure gage, is connected to the system via an air hose which is attached to a pressure port on the sump tank. The air hose is connected to the "high" pressure port on the switch. The "low" pressure port is open to the atmosphere. Periodically inspect the air hose for water build-up which will effect the switch's operation.

Test the switch, at initial start-up, by removing the air hose from the pressure port on the sump tank once the system is in full operation. This should set the system into an alarm condition and shut off the incoming contaminated water.

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. Some control panels, not supplied by North East Environmental Products, contain an internal disconnect or circuit breaker to remove power. Disconnects supplied by North East Environmental Products are external to the control panel, providing flexibility in situations where a site already contains a

disconnect for the air stripping system. Make sure a qualified licensed electrician installs the power line.

Temperature Gage

The temperature gages can be installed on both the inlet and outlet piping. The water temperature represents an important factor when estimating the system's performance since it directly effects removal efficiency. Temperature gages provided by North East Environmental Products typically have read-outs of 0-140 degrees Fahrenheit.

Water Pressure Gage

Water pressure gages can be installed on both the inlet and outlet water lines. The gages can be used to determine the water pressures entering and exiting the system. Excessively high readings could signal that something in your system is plugged. Large fluctuations in the pressure readings could be a sign that the water flow rate is varying.

SHALLOWTRAY OPTIONS

Section 3: Operating Instructions

Special Cautions!

The following operations must be carried out prior to start-up.

Connect the Interlock Switches.

To avoid damage to the blower and flooding of the equipment with contaminated feed water, install the high water level and low air pressure 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 will destroy the blower and void the warranty. The high water level interlock switch will shut off the feed water pump in an emergency situation.

Low Air Pressure Interlock

If the blower should fail, untreated water would flow directly into the discharge line. The low air pressure interlock switch will shut off the feed water pump and prevent this from occuring.

Fill the Sump Tank and Aeration Tray Inlet Chamber.

On initial start-up, the sump tank must be filled with clean water to a height of about one foot. Make sure the valve to the sight tube is open. The sump tank can be filled via the clean-out ports, on the left side of the unit, or through the inlet piping. (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.

EQUIPMENT SET-UP

Equipment Set-up

Drawings

Drawings referred to in the following sections are found in Section 6.

Please follow codes.

The plumbing and electrical installations must be performed by qualified personnel. All installations must be done in accordance with local, state and national codes.

Install adequate supports.

Since **none** of the external piping associated with the ShallowTray unit is designed to support process water lines, adequate supports must be installed.

Step 1

Bolt your unit together.

For shipping purposes, the ShallowTray unit may come in two sections; the blower frame assembly and the aeration tray assembly. Bolt the base frames together using the bolts provided. (This step is done at the factory for the 1300 and 2300 series).

Step 2

Install the rubber coupling.

Install the rubber coupling from the blower outlet to the air inlet nozzle on the sump tank (See coupling layout in Section 6 for air inlet nozzle location).

Step 3

Level the ShallowTray unit.

Level the ShallowTray unit. This is a critical step in the proper assembly of the equipment. The aeration trays must be as close to level as possible.

Step 4: **For a gravity discharge unit**

Install the outlet pipe.

For a gravity discharge unit (no discharge pump): Refer to the outlet piping drawing to assemble the inverted U-trap from components supplied in a separate carton.

It is essential that the U-trap be mounted in the vertical direction, and that it be properly supported.

Use proper pipe sealant and PVC cement when needed.

Caution: The vertical height of the trap should not be changed.

Step 4: **For a unit with a discharge pump**

Install the outlet pipe.

For a unit with a discharge pump: Refer to the outlet piping drawing to assemble the water line from the sump tank to the pump section from components supplied in a separate carton.

Install outlet piping from the pump's discharge port. Use proper pipe sealant and PVC cement when needed.

Prime the pump. Pour clean water in the pump's discharge nozzle until it has filled the entire pump chamber.

Step 5

Install the inlet piping manifold.

Install the inlet piping manifold, which was shipped in a separate box. Follow the inlet piping diagram for proper installation.

It is recommended that, during start-up, a strainer be installed in the water inlet line to prevent the spray nozzle and process water line components from plugging with sand and sediment.

Use proper pipe sealant and PVC cement when needed.

Step 6

Install the sump drain valve and the sight tube.

Refer to drawings to install the sump drain valve and the sight tube.

Step 7

Connect the water lines.

If you have not filled the seal pots per initial start-up, temporarily connect the clean water feed line to the inlet piping.

Connect the process water lines to the inlet and discharge piping.

Firmly support the process water lines to prevent stress on the piping. **The piping is not designed to support the weight of the process water lines.**

Use proper pipe sealant and PVC cement when needed.

Step 8

Connect the air hoses.

Connect the air hoses from the two 1/8" hose barbs, located on the sump tank, to the high pressure ports on both the air pressure gage and the air pressure switch. Keep the low pressure ports open to the atmosphere (remove plugs or caps).

Step 9

Connect a vent line.

Connect a vent line on the top of the unit.

Caution: Do not use a vent line with a smaller diameter than the air exhaust nozzle.

Connect the 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. (See drawing.)

Step 10

Wire the electrical components.

Have a qualified, licensed electrician wire up 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 wiring diagrams.)

Step 11

Install optional items.

Air flow meter

Mount the pitot tube on the vent line per Dwyer bulletin # H-11 (found in hardware box) using drill and tap, and hardware provided. (See pitot tube mounting diagram in Section 6.)

Air blower silencer

Install the rubber coupling 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 silencer diagram. (See Section 6.)

If the silencer is in the horizontal position, attach it directly to the rubber coupling previously installed on the blower.

Support the silencer in an appropriate manner.

Water flow meter

Install the water flow meter with the inlet piping.

Checkinlet piping diagram (See Section 6).

The flow meter owner's manual was sent with the unit, be sure to refer to it when installing the meter.

There should be a coarse strainer installed in the incoming process water line prior to the water flow meter.

START UP

Initial Start Up

Upon completion of the equipment set-up, mechanical and electrical installation, proceed with the following steps:

Step 1

Turn off electrical components and close drain and sample valves.

Check that all electrical components associated with the unit are turned off, and all drain and sample valves are closed. (Note: Be sure that the sight tube valve is open).

Step 2

Fill the sump tank with one foot of clean water.

Special Caution: Make sure the sump tank is filled with one foot of clean water.

On initial start-up, the sump tank must be filled with clean water to a height of about one foot. Make sure the valve to the sight tube is open. The sump tank can be filled via the clean-out ports, on the left side of the unit, or through the inlet piping.

Step 3

Fill the inlet chambers with clean water.

Special Caution: Make sure the inlet chambers are filled with clean water.

See Step 8 below for instructions.

Step 4

Turn 'ON' the master power disconnect switch.

Turn 'ON' the master power disconnect switch on the power disconnect panel.

Step 5

Check the blower rotation.

Check the blower rotation by momentarily switching on the blower switch and observing whether the blades turn in the direction of the arrow on the blower casing.

Step 6

Open the air inlet damper and turn the blower 'ON.'

If blower rotation is correct, fully open the air inlet damper and turn the blower switch to "ON". Otherwise correct wiring per manufacturer's instructions.

Step 7

Start the clean water flow to the unit.

Let the clean water and blower run for two minutes then shut off both.

Once the blower wheel stops rotating restart both the blower and the feed water flow.

This procedure should fill the inlet chambers as described below.

Step 8

Fill the inlet chambers with clean water.

Special Caution: Make sure the inlet chambers are filled with clean water.

To fill the inlet chambers (This is not necessary for a one tray system.), start the air blower and the water flow to the unit. Let both run for about two minutes then shut them off. When the wheel to the blower stops spinning restart both the blower and the water flow. This procedure allows the water to drip into the seal pots.

If the seal pots won't fill by this method you can fill them manually. First try spraying a stream of water through the clean-out ports, on the left side of the unit. The stream of water must be sprayed straight across the system and hit the opposite side. The splashing action should fill the seal pots. If the preceding methods don't work, remove the trays, fill the seal pots, and re-assemble. The new units provide inlet chamber filling ports.

Step 9

Connect contaminated feed water line.

Replace clean water feed line with contaminated feed line.

Step 10

Check the air pressure readings.

After the unit has been operating 5-10 minutes, the air pressure readings should be as follows:

# of trays	Minimum Pressure
1 tray system	4" wc
2 tray system	7" wc
3 tray system	11" wc
4 tray system	15" wc

Pressure readings may vary somewhat depending on your venting system.

The system is ready for operation.

The system is now ready for operation. It is not necessary to perform initial start up procedures each time the system is shut down. The system will already be primed from the last run.

Routine Operation

Inspect and record unit's operation.

Inspect the unit's operation at regular intervals and take pertinent instrument readings. Record readings and performance data in an operations log book.

The air pressure in the system is indicated on the pressure gage. The high pressure port is connected to the sump tank and the low pressure port is open to the atmosphere. The reading is given in inches of water column. At initial start-up, adjust the blower damper to obtain a pressure reading at least as high as that given below:

# of trays	Minimum Pressure
1 tray system	4" wc
2 tray system	7" wc
3 tray system	11" wc
4 tray system	15" wc

Set the throttle valve.

Units with a discharge pump are supplied with a throttle valve. The valve should be set so that the pump draws no more than the rated full load amps stamped on the pump motor.

Intermittent Operation

ShallowTray low profile air stripper systems can be designed to run intermittently when continuous blower operation is a concern. 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 too will shut down. When the feed water is restored, the blower will start up to treat the new batch of water. The benefits of intermittent operation are lower operating costs, better control of noise, and longer motor life.

SYSTEM SHUT DOWN

System Shut Down

Shut water off.

Shut off the water feed to the system.

Wait 5 minutes.

Wait 5 minutes to allow the water in the aeration trays to be completely treated, then shut off the blower.

Shut power off.

Shut off the power at the main disconnect switch if more than a temporary shut down is anticipated.

Caution

If proper shut down procedures are not followed contaminated water will drain into the sump. This will contaminate the water that has been collected in the sump. Allow the blower to run the additional 5 minutes after the feed water is shut-off.

Section 4: Cleaning Procedures

Equipment Maintenance Instructions

Cleaning Instructions

Minerals, dissolved in high concentrations, tend to precipitate out of groundwater during aeration 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** (Call Bill Comish, at Water Solutions, 508-758-6120 for information). The recommended cleaning procedure is pressure washing. Follow the instructions detailed below.

Equipment Required

Pressure Washer

2 gpm minimum flow at 900 psi max. 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 1/4" NPT.

Clean Water Supply

Clean water supply with a capacity of at least 2 gpm at 20 psi, connected to the pressure washer by means of an ordinary garden hose.

Cleaning the Unit

Step 1

Turn off equipment.

Turn off and disconnect the feed water supply and all associated electrical equipment.

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.

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 itself. Wear protective goggles while spraying.

Step 5

Insert wand and start water flow.

Insert the wand all the way into the 8" 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" 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

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 around the aeration holes.

Also check the water level in the sump tank periodically and drain it when necessary.

Step 8

Clean top side of tray.

When the surface appears clean, move the wand to the top side of the 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 the demister pad for fouling.

Clean the spray nozzle.

If the spray nozzle shows evidence of deposits it should be removed and scrubbed with a wire brush.

Check the demister pad.

Clean the demister pad.

Use the pressure sprayer to remove debris, deposits and gummy residues sometimes found on the demister pad.

Replace the demister pad.

Demister pads that are excessively plugged should be replaced. The old pad is removed by loosening the retainer screws on the hold-down brackets, and a new pad is installed in the same fashion.

Section 5: Troubleshooting

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 same size and rating.

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, bearings are bad.

Tubing to pressure switch plugged with water or debris.

Remove tubing from pressure switch and blow into it towards tank.

Clean or replace tubing if plugged or kinked.

Blower wheel jammed against side of housing.

TURN OFF ALL power to the system. Try to spin wheel by hand. Wheel should rotate freely.

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 and clean or replace as necessary.

Float switch in tank is stuck in down position.

Remove 8" 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.

Problem — Outlet Pump Won't Start Or Run

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 same size and rating.

Overload relay trips.

Locate reset button on pump overload relay.

Push reset button in. Reasons for tripping: incorrect line voltage, motor wires incorrectly, inadequate ventilation, bearings are bad.

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.

Impeller, seal or bearing damage.

TURN OFF POWER. Try to turn impeller by hand.

If impeller won't turn, remove housing and locate source of binding.

Problem **Low Air Pressure In Stripper Tank**

Blower damper closed.

Visually check position of damper on inlet of blower.

Open damper to get proper reading on pressure gage. Firmly tighten screw.

Motor rotation backwards.

Watch rotation of blower wheel at slow speed.

Reconnect 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 provided in appendix A.

Inlet chamber (sealpot) in each tray is not full of water.

Slide tray aside and look at water level in chamber.

Remove 4" rubber caps on end of trays. Fill up inlet chambers with a hose. Or, follow inlet chambers fill up procedure above in Initial Start Up.

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 gage plugged with water or debris.

Remove tubing from pressure gage 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" from cover surface.

Adjust length of inlet pipe on inside of cover until total length is about 10½".
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, blower will start, air pressure will rise to operational level.

No action necessary.

Problem **High Pressure In Stripper**

Air exhaust piping is restricted.

Check vent piping for bird nests or other obstructions. Check that vent pipe diameter does not decrease.

Vent piping diameter must be the same as the outlet vent diameter on the cover.

Air holes in bottom of trays are plugged.

Remove inspection and cleanout caps and visually inspect holes.

For iron fouling, clean out unit with a 1000 psi pressure washer. For scaling, scrape or bang scale from all surfaces, then use a pressure washer to open holes. Consider using sequestering agent to reduce scaling.

Demister pad is plugged.

Remove cover from ShallowTray and inspect the bottom of the demister pad in the cover.

Remove demister pad from cover and clean. Replace if necessary.

Problem Water Won't Flow Into Unit

Inlet/well pump functioning properly.

Allow water level to rise in well pump, which will turn on inlet pump to system.

No action necessary.

Tank air pressure is low. System is in alarm condition.

Read tank air pressure from pressure gage. System should be in alarm condition if pressure is below about 2 inches w.c.

Check that blower is operating properly. 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.

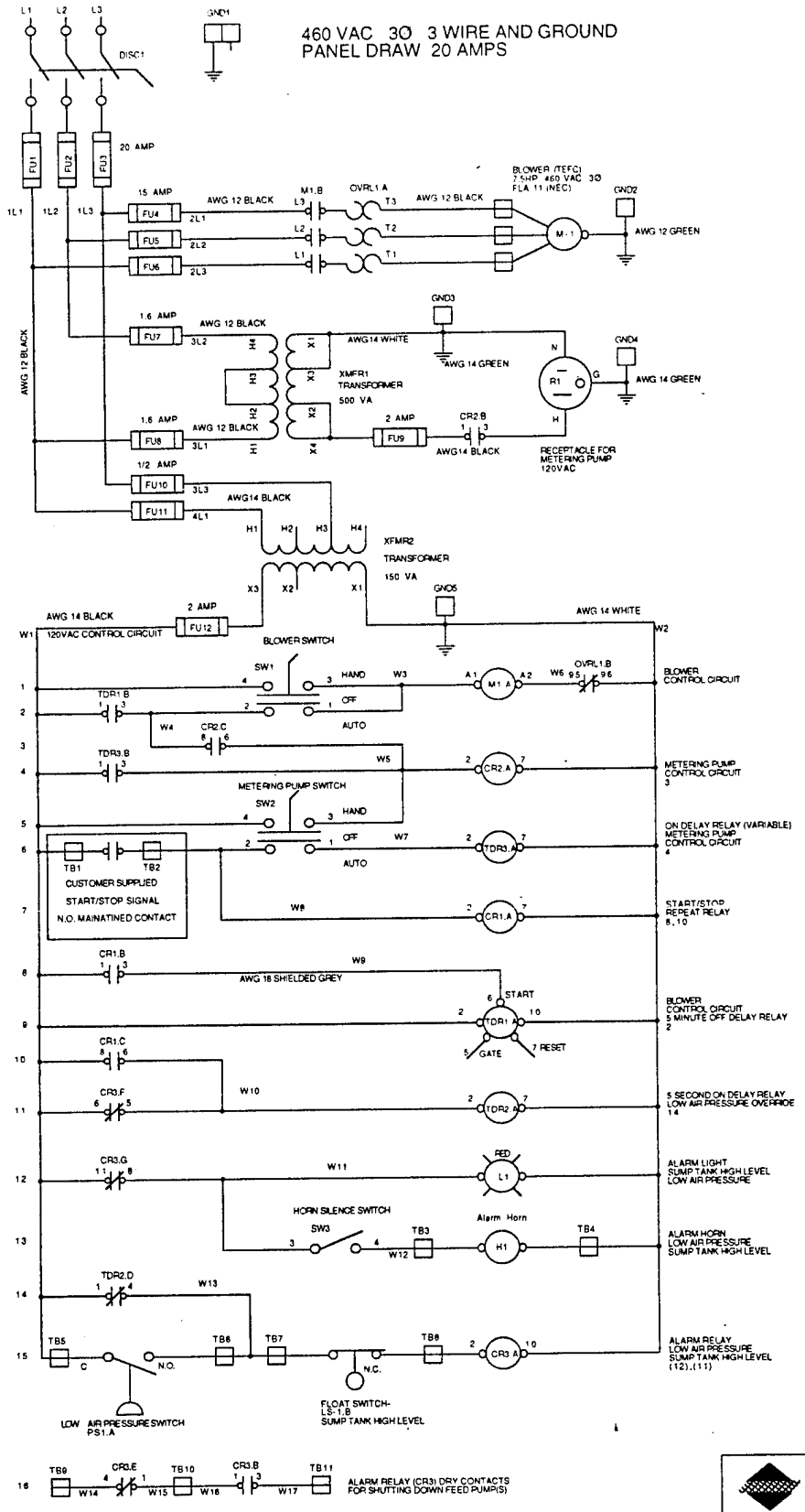
Problem ***Iron precipitates out of water when treated with an air stripper causing iron build up in unit.***

Iron Fouling Is A Problem

Remove cleanout caps and inspect inside of tray for buildup/fouling.

- Clean out unit with 1000 psi pressure washer on routine basis.
- Pretreat incoming water.
- Meter a sequestering agent into the inlet water.

Section 6: Drawings



NOTES

1 ALL WIRES ARE AWG 14 RED UNLESS OTHERWISE SPECIFIED

U L LISTED
FILE NUMBER
E151217

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

ELECTRICAL CIRCUIT SCHEMATIC

DRAWING NO. 2641/4430 SCH			
CUSTOMER ENVIROMENTAL SCIENCE AND ENGINEERING			
DRAWN: RC	SCALE: NONE	SIZE: B	SHEET 1 OF 1
DATE: 5-23-95	DO NOT SCALE DRAWING		

Section 7: Component Information

NOTE:

The following is a collection of the ShallowTray's components manufacturer's cut-sheets.
Not all of the following may pertain to your unit, depending on the options you have selected.
Refer to the Components list, found in section 1, for the options that are on your unit.

AMERICAN FAN COMPANY ®

2933 SYMMES ROAD, FAIRFIELD, OHIO 45014
PHONE: (513) 874-2400 FAX: (513) 870-5577

AMERICAN FAN CO. INSTALLATION, OPERATION, AND MAINTENANCE MANUAL SM 844

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.

INDEX

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 and space requirements.

Even though all equipment is carefully inspected and prepared for shipment at the factory, rough handling enroute may cause damage to fan and/or drive parts.

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 shipped to customer which 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. Larger units should also be lifted by the base or by lifting eyes, if provided. 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 be 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 a structural steel base and the isolation take 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.

SECTION II

BEFORE START-UP

1. Fasteners - all foundation bolts, wheel hub set screws, 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 reshimmed.
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 air flow.
2. Fan may now be brought up to speed. Watch for anything unusual such as vibration, overheating of bearings and motors, 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.

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 50°F and 120°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 operating 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 rate of temperature rise allowable 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 unbalance.
3. Hardware - check tightness of all bolts and set screws.
4. Lubrication - check fan and motor bearings and add lubricant if necessary. Be careful not to overgrease as this can damage bearing seals.
5. Air flow - make sure there are no obstructions to air flow 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.

   Ball pillow blocks can have total running temperatures of 165°F (74°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 be centered to prevent the blades from striking the housing. Make sure wheel is rotating in proper direction. Never run the fan at a higher speed than it was designed for unless you check with American Fan first.

FAN BEARING MAINTENANCE

For most applications, a lithium base grease 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.

Because oil lubricated bearings are usually used on high-speed or high-temperature applications, refer to American Fan 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, when 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 reaches the overflow point at the lower oil cup.

MOTOR MAINTENANCE

Lubricate motor bearings to the manufacturer's recommendations. Lubrication recommendations are printed on tags attached to the motor. Should these tags 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 relubrication. Then lubricate annually with electric motor oil or SAE 10 oil. Under continuous operation at higher temperatures (but not to exceed 104°F ambient) relubricate annually.

B. Fractional Horsepower Ball Bearing Motors:
Under normal conditions, ball bearing motors will operate for five years without relubrication. Under continuous operation at higher temperatures (but not to exceed 104°F ambient) relubricate after one year. To relubricate 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 Bearing Motors:
Motors having pipe plugs or grease fittings should be relubricated while warm and at stand-still. 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 relubricated by removing end shields, cleaning grease cavity and refilling three-fourths of circumference of cavity.

Recommended relubrication intervals-general guide only.

H.P. Range	Standard Duty 8 Hr./Day	Severe Duty 24 Hr./Day Dirty-Dusty	Extreme Duty Very Dirty High Ambients
1½-7½	5 Yrs.	3 Yrs.	9 Mos.
10-40	3 Yrs.	1 Yrs.	4 Mos.
50-150	1 Yrs.	9 Mos.	4 Mos.

These ball bearing greases or their equivalents are satisfactory for ambients from -15°F. For Motors:

Mobilplex EP#1—Socony Mobil Oil Company
Alvania Grease #2—Shell Oil Company
Andox B Grease—Esso Standard Oil Company
Prestige #42 Grease—Sun 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.

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 of 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 set screws.
   - 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

Contact the local American Fan representative or the factory 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 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 and the motor model 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 WARRANTY

1) "The Seller hereby warrants the equipment to be free from defects in materials and workmanship under normal use and service, the obligations hereunder being limited to making good at Seller's plant F.O.B. any part or parts thereof manufactured by Seller which shall within twelve (12) months from the date of shipment to the original purchaser be returned to Seller with transportation charges prepaid and which on examination by Seller shall disclose to Seller's satisfaction defects. This warranty shall be the only warranty by Seller covering this equipment or the parts thereof and shall be in lieu of all other warranties either expressed or implied. Buyer waives all claims for defects in material and workmanship unless said claim be made in writing and received by Seller within ten (10) days after the discovery thereof. This warranty shall cover only the cost of correcting defects in the equipment or parts thereof and Seller shall not be responsible for damages either proximate or consequential arising out of use, operation or possesion of said equipment or the parts thereof by Buyer or any other parties. The Seller shall not be responsible for work done, equipment or parts furnished or repairs made by others, for any loss or expense arising from such work, equipment parts or other repairs unless the same is done or furnished with the prior written consent and approval of the Seller. Seller shall under no circumstances be liable for the cost of raw materials used or lost in testing or experimental operations of any equipment sold or other such testing or experimentation to be done under the supervision of a representative of the Seller or of any employee or other representative of the Buyer."

2) Warranties on purchased material are limited to terms of warranty furnished by our suppliers.

3) We do not guarantee against abrasion, corrosion or erosion.

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.

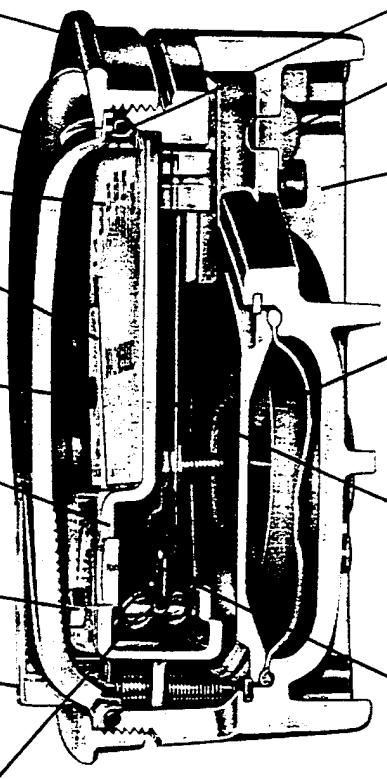
Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on helix shaft.

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

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

Sapphire 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.



"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 a flat leaf of Swedish spring steel in temperature compensated design. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

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

Helix is precision milled from an alloy of high magnetic permeability, deburred and annealed in a hydrogen atmosphere for best magnetic qualities. Mounted in jeweled bearings, it turns freely to align with magnetic field of magnet to transmit pressure indication to pointer.

SERIES 2000 MAGNEHELIC® – MODELS AND RANGES

The models below will fulfill most requirements. Page 5 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

Model Number	Range, Inches of Water	Minor Div.
2000-00†	0- .25	.005
2000-0†	0- .50	.01
2001	0-1.0	.02
2002	0-2.0	.05
2003	0-3.0	.10
2004	0-4.0	.10
2005	0-5.0	.10
2006	0-6.0	.20
2008	0-8.0	.20
2010	0-10	.20
2015	0-15	.50
2020	0-20	.50
2025	0-25	.50
2030	0-30	1.0
2040	0-40	1.0
2050	0-50	1.0
2060	0-60	2.0
2080	0-80	2.0
2100	0-100	2.0
2150	0-150	5.0

Model Number	Range, Zero Center Inches of Water	Minor Div.
2300-0†	.25-0-.25	.01
2301	.5-0-.5	.02
2302	1-0-1	.05
2304	2-0-2	.10
2310	5-0-5	.20
2320	10-0-10	.50
2330	15-0-15	1.0

Model Number	Range, PSI	Minor Div.
2201	0-1	.02
2202	0-2	.05
2203	0-3	.10
2204	0-4	.10
2205	0-5	.10
2210*	0-10	.20
2215*	0-15	.50
2220*	0-20	.50
2230**	0-30	1.0

*MP option standard
**HP option standard

Dual Scale Air Velocity Units

Model Number	Range, Inches of Water	Range, Air 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	Minor Div.
2000-6MM†	0-6	.20
2000-10MM†	0-10	.20
2000-25MM	0-25	.50
2000-50MM	0-50	1.0
2000-80MM	0-80	2.0
2000-100MM	0-100	2.0
Zero Center Range		
2300-20MM†	10-0-10	.50

Model Number	Range, CM of Water	Minor Div.
2000-15CM	0-15	.50
2000-20CM	0-20	.50
2000-25CM	0-25	.50
2000-50CM	0-50	1.0
2000-80CM	0-80	2.0
2000-100CM	0-100	2.0
2000-150CM	0-150	5.0
2000-200CM	0-200	5.0
2000-250CM	0-250	5.0
2000-300CM	0-300	10.0
Zero Center Ranges		
2300-4CM	2-0-2	.10
2300-10CM	5-0-5	.20
2300-30CM	15-0-15	1.0

†These ranges calibrated for vertical scale position.

Model Number	Range, Pascals	Minor Div.
2000-60 Pa†	0-60	2.0
2000-125 Pa†	0-125	5.0
2000-250 Pa	0-250	10.0
2000-500 Pa	0-500	10.0
2000-750 Pa	0-750	25.0
Zero Center Ranges		
2300-250 Pa	125-0-125	5.0
2300-500 Pa	250-0-250	10.0

Model Number	Range, Kilopascals	Minor Div.
2000-1 kPa	0-1	.02
2000-1.5 kPa	0-1.5	.05
2000-2 kPa	0-2	.05
2000-3 kPa	0-3	.10
2000-4 kPa	0-4	.20
2000-5 kPa	0-5	.20
2000-8 kPa	0-8	.20
2000-10 kPa	0-10	.20
2000-15 kPa	0-15	.50
2000-20 kPa	0-20	.50
2000-25 kPa	0-25	.50
2000-30 kPa	0-30	1.0
Zero Center Ranges		
2300-1 kPa	.5-0-.5	.02
2300-3 kPa	1.5-0-1.5	.10

Suggested Specifications

A differential pressure gage for measuring (state purpose) shall be installed. Gage shall be the diaphragm-actuated dial type 4¾" O.D., with white dial, black figures and graduations and pointer zero adjustment. Gage shall be Dwyer Instruments, Inc., Magnehelic®, Catalog No. _____ reading to _____" water column, in _____" divisions.

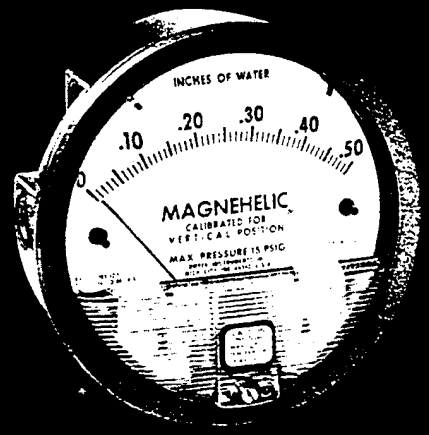
Special Purpose Ranges

Scale No. 2401 Square Root Specify Range

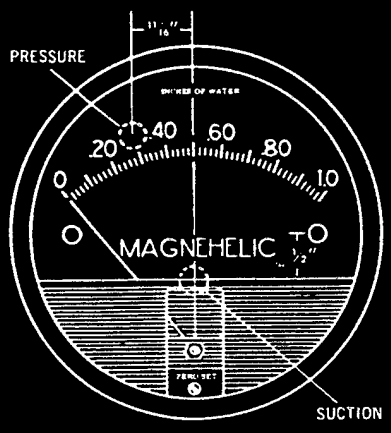
Scale No. 2402 Blank Scale Specify Range

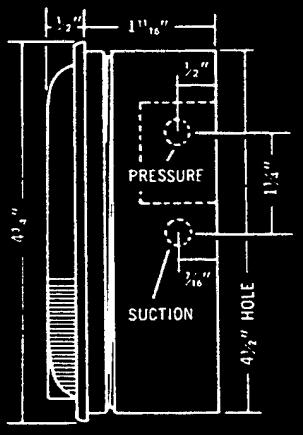
Model 2000-00N, Range – .05 to + .20" W.C. For room pressure monitoring.

Dwyer SERIES 2000 Magnehelic® Differential Pressure Gages



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





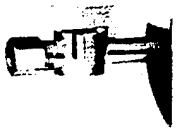
Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

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 inch 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 4½" 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 4¾" 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; see Bulletin S-101).

PHYSICAL DATA

Ambient temperature range: 20° to 140° F.*

Rated total pressure: –20" Hg. to 15 psig.†

Overpressure: Relief plug designed to open at 25 psig.

Connections: ⅛" NPT female 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 baked dark gray hammerloid.

Accuracy: Plus or minus 2% of full scale (3% on –0 and 4% on –00 ranges), throughout range at 70°F.

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.

*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; has external reset screw. Available for all ranges (not high pressure). Can be ordered with gage or separately.

Portable units

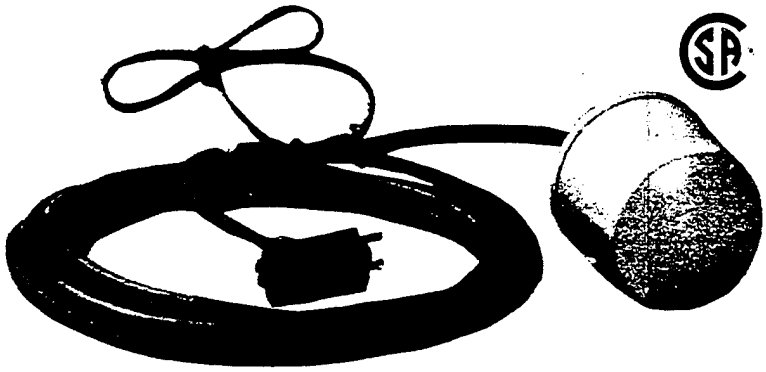
Combine carrying case with any Magnehelic gage of standard range (not high pressure). Includes 9 ft. of ¼" I.D. rubber tubing, stand-hang bracket, and terminal tube with holder.

Air filter gage accessory package

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

SUPER SINGLE® Pump Switch

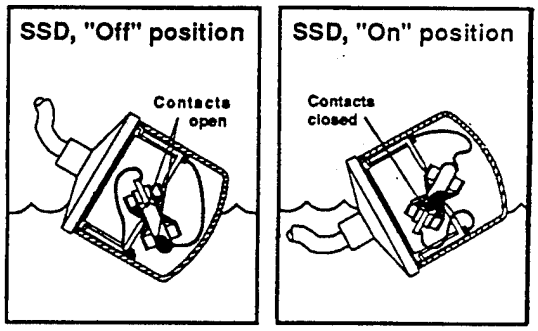
A dependable mercury float switch designed to provide automatic pump control.



Model SSD or SSU

ADVANTAGE

- Patented tumbler assembly gives positive pump on and off.
- Easy installation, no control panel needed.
- Special stranding insures flexible cable.
- ENTIRE unit UL Listed for water and sewage and CSA Certified.
- TWO-YEAR LIMITED WARRANTY.
- U.S. PATENT NO. 4,302,641



APPLICATIONS

The Super Single® pump switch will directly control pumps up to 1HP (120V) or 2HP (230V). This pump switch utilizes a heavy-duty, mercury-to-mercury tilt switch (two pools of mercury make and break electrical contact) positioned in a tumbler. This patented on-off tumbler is not sensitive to rotation.

The Super Single® pump switch provides automatic pump operation when controlling lift pumps, sump pumps, solenoids, relays, and alarms in water and sewage systems.

SPECIFICATIONS

CORD: Flexible 14 gauge, 2 conductor SJOW-A (UL), SJOW (CSA) water-resistant, special stranding, Neoprene.

FLOAT: 3.38 inch (8.57cm) diameter x 4.25 inch (10.80cm) long, thick-wall, high impact resistant, non-corrosive PVC plastic for use in liquids up to 140°F (60°C).

ELECTRICAL:

Voltage 60Hz, Single Phase	Maximum Pump Running Current	Maximum Pump Starting Current	Recommended Pump HP
120 VAC	15 amps	55	1 HP or less
230 VAC	15 amps	35	2 HP or less

NOTE: This pump switch should be used only with pumps equipped with integral thermal overload protection. One Super Single control may be wired to operate relay control panels for larger pump applications.

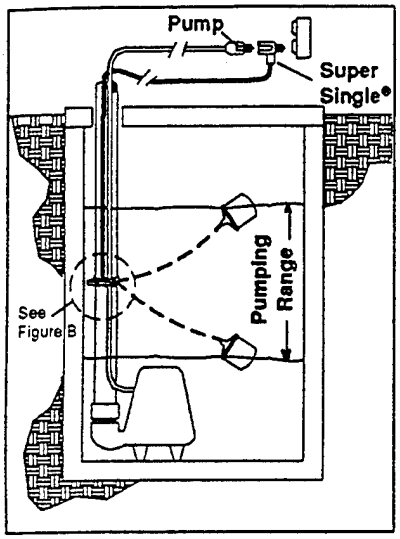
MODEL DEFINITION:

15	SS	D or U	1 or 2	WP or WOP
Cord Length (FT) Available 10, 15, 20, 30	SUPER SINGLE	Pump Down or Pump Up	120 Volt or 230 Volt	With or Without Piggy-Back Plug

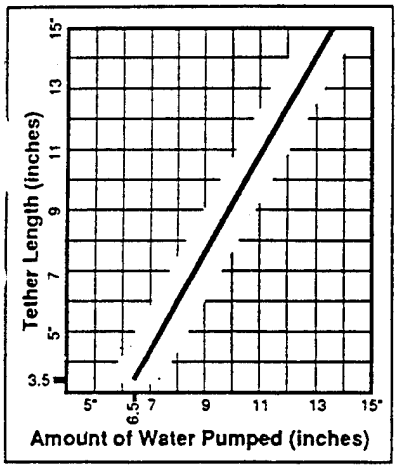
NOTE: Model WOP (for direct wiring) may be used in either 120V or 230V applications when within amp ratings.

SUPER SINGLE® Installation Instructions

Figure A



PUMPING RANGE GUIDE*



*The graph above is based on testing in non-turbulent conditions. USE ONLY AS A GUIDE. The black line represents average values; the gray area represents variance.

Figure B

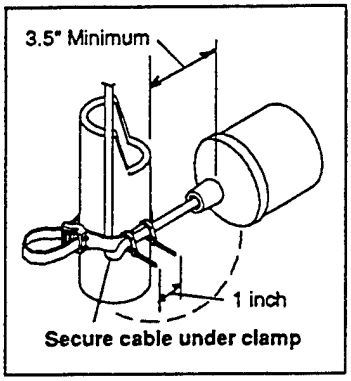


Figure C

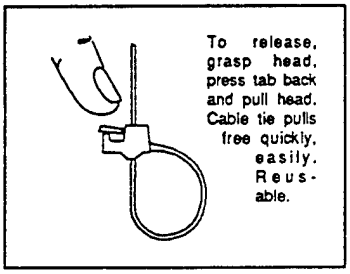


Figure D

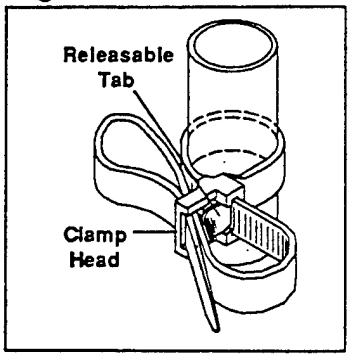
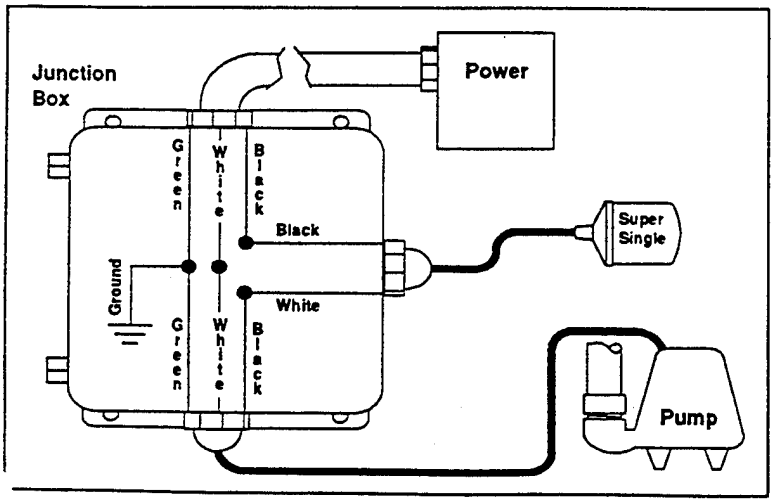


Figure E



WARNING: Turn off power source before installing or adjusting this device. Failure to turn off power could result in serious or fatal electrical shock.

1. Read these instructions carefully.
2. Check your local codes before installing. We recommend this product be installed in accordance with national and local electrical codes.
3. Do not connect this product while you are standing on a wet or damp surface.
4. Do not remove cord label from switch unit.
5. Retain these instructions with warranty card when installation is complete.

MODELS: SSD & SSU

MOUNTING FLOAT

1. Decide the pumping range for your installation See Figure A and Pumping Range Guide. Pumping range is determined by the cable length from the mounting strap to the float. See Figure B.
2. Tighten the pipe clamp around the discharge pipe keeping the float cable between the clamp and pipe to help prevent slippage. The distance from the discharge pipe to the float must be a minimum of 3.5 inches. Space the small clamps approximately one inch apart. See Figure B. All clamps are releasable which permits readjustment. See Figure C. Lock the releasable tab of the pipe clamp by running the remaining strap between the releasable tab and head, pulling tightly. Tuck the strap back through the head for a neat appearance. See Figure D.

PIGGY-BACK PLUG INSTALLATION

1. Insert 120V piggy-back plug into 120V outlet or 230V piggy-back plug into 230V outlet. To avoid electrical hazards, electrical outlet must not be located in pump chamber.
2. Plug pump into piggy-back plug.

DIRECT WIRE INSTALLATION

NOTE: Piggy-back plug may be removed for direct wire option. See Figure E.

Check your installation. Allow pump to cycle once to insure proper pump range.

WARNING

In a 230V pump installation, one side of the line going to the pump is always "hot". This condition exists regardless of whether the float switch is on or off.

WP INSTALLATIONS - Remove piggy-back plug from receptacle BEFORE installing or servicing pump and/or switch.

WOP INSTALLATIONS - To avoid hazards when installing or servicing, install a double pole disconnect near pump installation.

S.J. ELECTRO SYSTEMS, INC.

Built with Pride - Employee Owned

PO Box 1619 County Rd 6 Detroit Lakes, MN 56502

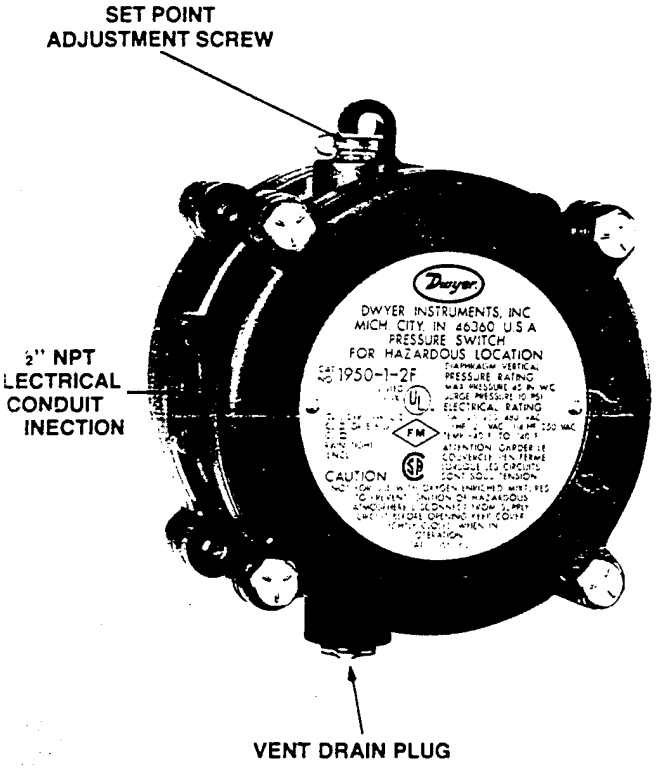
Telephone: 218-847-1317 FAX: 218-847-4617

Catalog Pg. 1001664B
Installation Instr. 1001540C
Printed in USA

SERIES 1950

INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES

Specifications - Installation and Operating Instructions



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

Model 1950 Switches: Operating ranges and dead bands.

To order specify Model Number	Operating Range Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-04	0.03 to 0.35	0.02	0.09
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	.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°F to 140°F. 0°F to 140°F for 1950P-8, 15, 25, and 50.
Rated Pressure: 1950 — 45 IN. W.C., 1950P — 35 PSI, 1950P-50 only — 70 PSI.
Maximum surge pressure: 1950 — 10 PSI, 1950P — 50 PSI, 1950P-50 only — 90 PSI.
Pressure Connections: 1/8" NPT.
Electrical Rating: 15 amps, 125, 250,480 volts, 60 Hz. A.C. Resistive 1/8 H.P. @ 125 volts, 1/4 H.P. @ 250 volts, 60 Hz. A.C.
Wiring connections: 3 screw type; common, norm. open and norm. closed.
Conduit connections: 1/2" NPT.
Set point adjustment: Screw type on top of housing. Field adjustable.
Housing: Anodized cast aluminum.
Diaphragm: Molded fluorosilicone rubber. 04 model, silicone on nylon.
Calibration Spring: Stainless Steel.
Installation: Mount with diaphragm in vertical position.
Weight: 3 1/4 lbs. 04 model, 4 lbs., 7 oz.

The New Model 1950 Explosion-Proof Switch combines the best features of the popular Dwyer Series 1900 Pressure Switch with a compact explosion-proof housing.

The unit is U.L. and CSA listed, FM approved for use in Class I, Groups C & D, Class II, Groups E, F, & G and Class III atmospheres. It is also totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches W.C. and from .5 to 50 PSI.

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

CAUTION: 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.

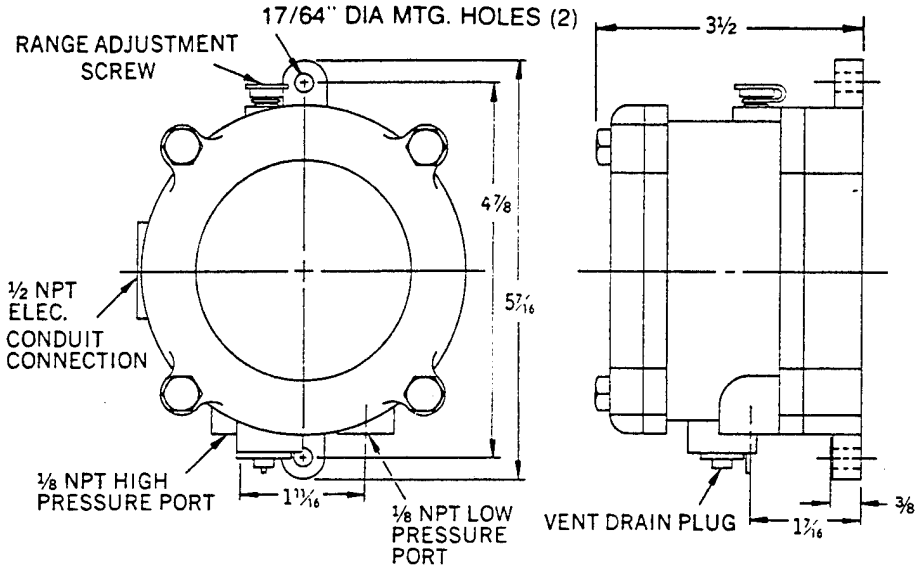
Response Time: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-15 seconds where applied pressures are near set point.

NOTE: The last number-letter combination in the 1950 model number identifies the switch electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In the case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC - 1/8 HP 125 VAC, 1/4 HP 250 VAC; and a number 5 or 6 rating is 1A 125 VAC. A letter B indicates a Buna-N diaphragm, N; Neoprene, S; Silicone, and V; Viton.

FR 26-440332-00

DWYER INSTRUMENTS, INC.
P. O. BOX 373 • MICHIGAN CITY, INDIANA 46360, U.S.A.
Telephone 219/879-8000
Fax 219/872-9057 Telex 25916

SERIES 1950
INTEGRAL EXPLOSION-PROOF PRESSURE SWITCHES
Installation and Operating Instructions



NOTE: For dimensions of Model 1950-04, request drawing 28-700175-00.

1950 SWITCH OUTLINE DIMENSIONS

INSTALLATION

Select a location that is free from excessive vibration, corrosive atmosphere and where the ambient temperature is between -40° and +140°F. Switch may be installed outdoors or in areas where the hazard of explosion exists. (See pg. 1 for specific types of hazardous service).

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical. (Special units can be furnished for other than vertical mounting arrangements if required.)

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with ¼" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two ⅛" NPT female pressure ports as noted below:

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

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

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

4. To make electrical connections, remove the three hex head screws from the cover and, after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of screw terminals marked "common", "norm open", and "norm closed". The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Remember that 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:

A. Remove the plastic cap and turn the slotted Adjustment Screw at the top of the housing clockwise to raise the set point pressure and counter-clockwise to lower the set point. After calibration, replace the plastic cap.

B. The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the 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.

C. For highly critical applications it is a good idea to check the set point adjustment and reset it as necessary once or twice in the first few months of operation. This will compensate for any change in initial tension which may occur in the spring and diaphragm. For most applications this change will not be significant and no resetting will be required.

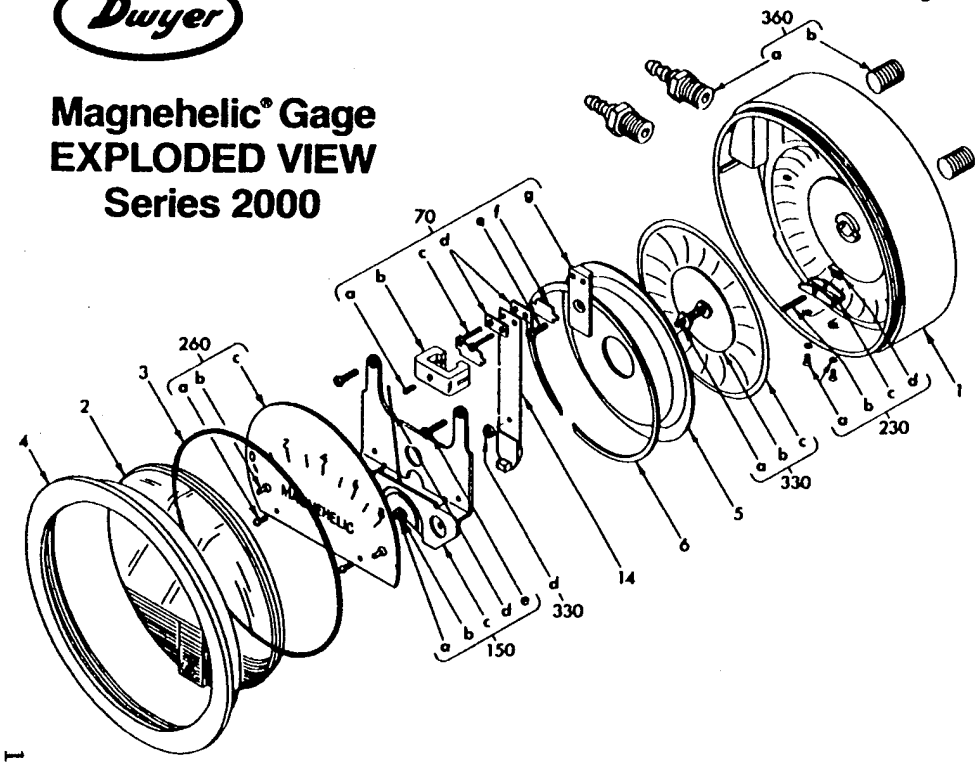
MAINTENANCE

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 one turn clockwise then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch.

Litho in U.S.A. 2/89

DWYER INSTRUMENTS, INC.
P.O. Box 373, Michigan City, Indiana 46360, U.S.A.
Phone: 219/879-8000 Telex: 25916 Fax: 219/872-9057

Magnehelic® Gage EXPLODED VIEW Series 2000



1. Case
2. Cover with zero adjust assy.
3. "O" ring seal
4. Bezel
5. Diaphragm sealing plate
6. Retaining ring
70. Range Spring assembly
    a. Clamp set screw
    b. Clamp
    c. Mounting screws (2 req'd)
    d. Clamping shoe (2 req'd)
    e. Clamp plate screw
    f. Spacer (2 req'd)
    g. Clamp plate
14. Range Spring with magnet
150. Wishbone Assembly – consists of:
    a. Front jewel
    b. Locking nut
    c. Wishbone
    d. Pointer
    e. Mounting screws (2 req'd)
    f. Helix assembly (not shown)
    g. Pivots (2 req'd) (not shown)
    h. Rear jewel (not shown)
230. Zero adjust assembly – consists of:
    a. Foot screws with washers (2 req'd)
    b. Adjust screw
    c. Foot
    d. Finger
260. Scale Assembly – consists of:
    a. Mounting screws (2 req'd)
    b. Bumper pointer stop (2 req'd)
    c. Scale
330. Diaphragm Assembly – consists of:
    (Arbor press needed to install)
    a. Linkage assy., complete
    b. Front plate
    c. Diaphragm
    d. Rear plate (not shown)
    e. Plate washer (not shown)
360. Mounting Hardware Kit
    a. Adapter – pipe plug ⅛" NPT to rubber tubing – (2 req'd)
    b. Pipe plug ⅛" NPT – (2 req'd)
    c. Mounting lug (3 req'd)
    d. Long screw (3 req'd)
    e. Short screw (3 req'd)

Ordering Instructions:

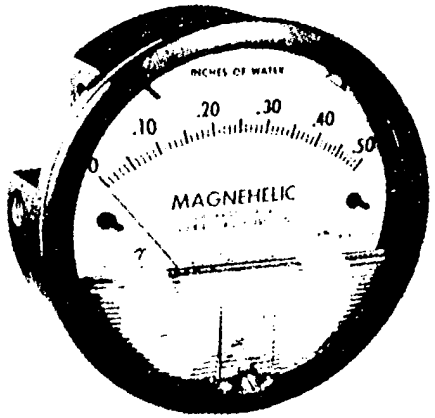
When corresponding with the factory regarding Magnehelic® gage problems, refer to the call-out numbers in this view. Be sure to include model number, pressure range, and any special options. Field repair is not recommended; contact the factory for repair service information.

Litho In U.S.A. 9/89

12-440212-04

OPERATING INSTRUCTIONS and PARTS LIST

Magnehelic® Differential Pressure Gage



SPECIFICATIONS

Dimensions: 4-3/4" dia. X 2-3/16" deep.

Weight: 1 lb. 2 oz.

Finish: Baked dark gray enamel.

Connections: 1/8 N.P.T. high and low pressure taps, duplicated, one pair side and one pair back.

Accuracy: Plus or minus 2% of full scale, at 70°F. (Model 2000-0, 3%; 2000-00, 4%).

Pressure Rating: 15 PSI.

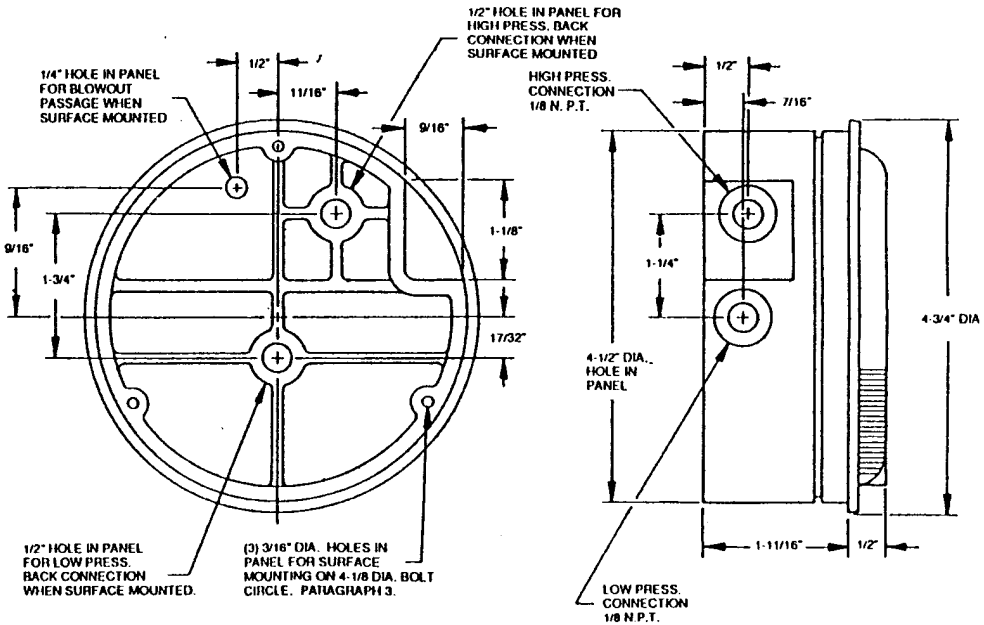
Ambient Temperature Range: 20° to 140°F.

Standard gage accessories include two 1/8" N.P.T. plugs for duplicate pressure taps, two 1/8" 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.

Hydrogen Gas Precautionary Note: The rectangular rare earth magnet used in the standard gage may not be suitable for use with hydrogen gas since a toxic and explosive gas may form. For hydrogen service, consult the factory for an alternate gage construction.



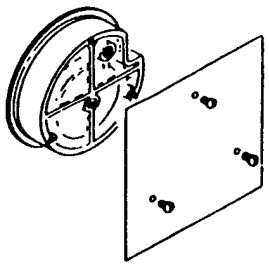
DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46360 U.S.A.
Telephone 219/879-8000
Fax 219/872-9057
Telex 25815

Overpressure Protection: Standard Magnehelic gages are rated for a maximum pressure of 15 psig and should not be used where that limit can be exceeded. Newer models employ a rubber plug on the rear which will unseat and vent the gage at approximately 25 psig. When surface mounting units with this feature, provide a vent hole, as indicated on the dimension drawing, or allow a minimum 1/8" clearance when flush mounting.

1. Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F. Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines may 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.

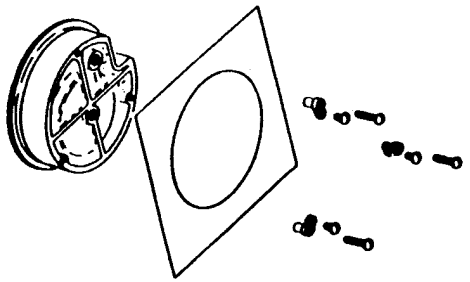
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions 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 4½" dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adaptors, Part No. 360c, firmly secured in place. To mount gage on 1¼"-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 gage is vented in a 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 or 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, P/N 1, held firmly, loosen bezel, P/N 4 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, P/N. 70-b. 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 0-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw, P/N 230-b.
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.

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

Warning: Attempted field repair may void your warranty. 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 Department
55 Ward Street
Wakarusa, IN 46573

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 sensors, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F, 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 P/N 230-b 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 or failure. Gages repaired at the factory are carefully calibrated and tested to assure "like-new" operation. After receipt and inspection, we will be happy to quote repair costs before proceeding.

Consult factory for assistance on unusual applications or conditions.

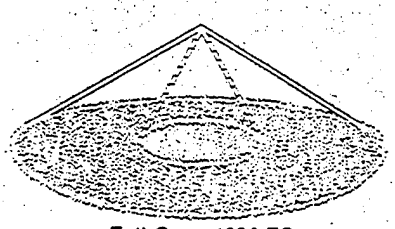
Use with air or compatible gases only.

Standard Line
Wide Range of Flows, Angles and Materials
Full and Hollow Cone

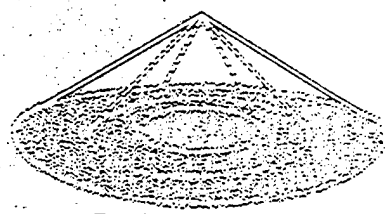
Full Cone 60° NN

Full Cone 90° FCN

Full Cone 90° FFCN



Full Cone 120° FC



Full Cone 120° FFC

DESIGN

Unique Bete spiral nozzles
solve many difficult spray problems
HIGH ENERGY EFFICIENCY
One piece - no internal parts
Clog-free performance
High discharge velocity

SPRAY CHARACTERISTICS

Wide range of flow rates and spray angles
Fine atomization
Spray patterns - full and hollow cone
Spray angles - 50° to 120°
Flow rates - .7 to 3350 gpm
Higher flow rates available

FULL CONE

60° Full Cone available in metals only.

Spray Angle	Male Pipe Size	Nozzle Number	Orifice Dia.	Free Passage Dia.	Overall Length	Hex. or Round Dia.	Weight Plastic Oz.	Weight Metal Oz.	GALLONS PER MINUTE @ PSI 10	20	30	40	50	60	80	100	200*	400*
60°	1/4	TF6NN	3/32	3/32	1 7/8	3/4		1	.7	1.0	1.2	1.4	1.6	1.7	2.0	2.2	3.1	4.4
		TF8NN	1/8	1/8	1 7/8	3/4		1	1.3	1.9	2.3	2.6	2.9	3.2	3.8	4.1	6.0	8.2
		TF10NN	5/32	1/8	1 7/8	3/4		1	2.0	2.9	3.5	4.0	4.5	5.0	5.9	6.5	9.2	13.0
	3/8	TF6NN	3/32	3/32	1 7/8	3/4		1	.7	1.0	1.2	1.4	1.6	1.7	2.0	2.2	3.1	4.4
		TF8NN	1/8	1/8	1 7/8	3/4		1	1.3	1.9	2.3	2.6	2.9	3.2	3.8	4.1	6.0	8.2
		TF10NN	5/32	1/8	1 7/8	3/4		1	2.0	2.9	3.5	4.0	4.5	5.0	5.9	6.5	9.2	13.0
		TF12NN	3/16	1/8	1 7/8	3/4		1 1/2	3.0	4.2	5.2	6.0	6.7	7.4	8.5	9.5	13.4	19
		TF14NN	7/32	1/8	1 7/8	3/4		1 1/2	4.0	5.7	7.0	8.1	9.0	10.0	11.4	12.5	18	25
		TF16NN	1/4	1/8	1 7/8	3/4		1 1/2	5.3	7.5	9.2	10.6	11.8	13.0	15.0	16.7	24	33
		TF20NN	5/16	1/8	1 7/8	3/4		1 1/2	8.2	11.7	14.3	16.5	18.4	20.0	23.3	26.1	36	52
	1/2	TF24NN	3/8	3/16	2 1/2	7/8		2 3/4	12.0	17.0	20.8	24.1	26.8	29.4	34	38	54	76
		TF28NN	7/16	3/16	2 1/2	7/8		2 3/4	16.4	23	28	33	37	40	46	52	74	104
	3/4	TF32NN	1/2	3/16	2 3/4 †	1 1/8		4 1/2	21	30	37	42	47	52	60	67	94	134
	1	TF40NN	5/8	1/4	3 5/8 ‡	1 3/8		7 1/2	34	48	57	67	74	81	94	105	148	210
		TF48NN	3/4	1/4	3 5/8 ‡	1 3/8		7 1/2	47	67	83	95	107	117	135	151	214	302
	1 1/2	TF56NN	7/8	5/16	4 3/8	2		21	64	93	112	129	145	159	184	205	290	410
		TF64NN	1	5/16	4 3/8	2		21	84	120	147	169	190	208	240	268	380	536
		TF72NN	1 1/8	5/16	4 3/8	2		21	96	137	165	192	213	235	270	302	426	604
90°	1/8	TF6FCN	3/32	3/32	1 11/16	3/4	1/2	1	.7	1.0	1.2	1.4	1.6	1.7	2.0	2.2	3.1	4.4
		TF8FCN	1/8	1/8	1 11/16	3/4	1/2	1	1.3	1.9	2.3	2.6	2.9	3.2	3.8	4.1	6.0	8.2
	1/4	TF6FCN	3/32	3/32	1 7/8	3/4	1/2	1	.7	1.0	1.2	1.4	1.6	1.7	2.0	2.2	3.1	4.4
		TF8FCN	1/8	1/8	1 7/8	3/4	1/2	1	1.3	1.9	2.3	2.6	2.9	3.2	3.8	4.1	6.0	8.2
		TF10FCN	5/32	1/8	1 7/8	3/4	1/2	1	2.0	2.9	3.5	4.0	4.5	5.0	5.9	6.5	9.2	13.0
	3/8	TF12FCN	3/16	1/8	1 7/8	3/4	3/4	1 1/2	3.0	4.2	5.2	6.0	6.7	7.4	8.5	9.5	13.4	19
		TF14FCN	7/32	1/8	1 7/8	3/4	3/4	1 1/2	4.0	5.7	7.0	8.1	9.0	10.0	11.4	12.5	18	25
		TF16FCN	1/4	1/8	1 7/8	3/4	3/4	1 1/2	5.3	7.5	9.2	10.6	11.8	13.0	15.0	16.7	24	33
		TF20FCN	5/16	1/8	1 7/8	3/4	3/4	1 1/2	8.2	11.7	14.3	16.5	18.4	20.0	23.3	26.1	36	52
	1/2	TF24FCN	3/8	3/16	2 1/2	7/8	1	2 3/4	12.0	17.0	20.8	24.1	26.8	29.4	34	38	54	76
		TF28FCN	7/16	3/16	2 1/2	7/8	1	2 3/4	16.4	23	28	33	37	40	46	52	74	104
	3/4	TF32FCN	1/2	3/16	2 3/4 †	1 1/8	1 1/2	4 1/2	21	30	37	42	47	52	60	67	94	134
	1	TF40FCN	5/8	1/4	3 5/8 ‡	1 3/8	2 1/2	7 1/2	34	48	57	67	74	81	94	105	148	210
		TF48FCN	3/4	1/4	3 5/8 ‡	1 3/8	2 1/2	7 1/2	47	67	83	95	107	117	135	151	214	302
	1 1/2	TF56FCN	7/8	5/16	4 3/8	2	5 1/2	21	64	93	112	129	145	159	184	205	290	410
		TF64FCN	1	5/16	4 3/8	2	5 1/2	21	84	120	147	169	190	208	240	268	380	536
		TF72FCN	1 1/8	5/16	4 3/8	2	5 1/2	21	96	137	165	192	213	235	270	302	426	604
	2	TF88FCN	1 3/8	7/16	5 7/8	2 1/2	6 1/2	26	140	198	240	280	310	340	395	438	620	876
		TF96FFCN	1 1/2	7/16	6 7/8	2 1/2	7 1/2	32	178	250	310	355	395	430	505	560	790	1120
	3	TF112FFCN	1 3/4	9/16	8	3 1/2	26	104	256	362	448	516	580	636	736	810	1160	1720
		TF128FFCN	2	9/16	8	3 1/2	26	104	336	480	588	676	760	832	960	1072	1520	2140
	4	TF160FFCN	2 1/2	5/8	9	4 1/2	40	160	525	750	920	1058	1188	1300	1500	1675	2370	3350

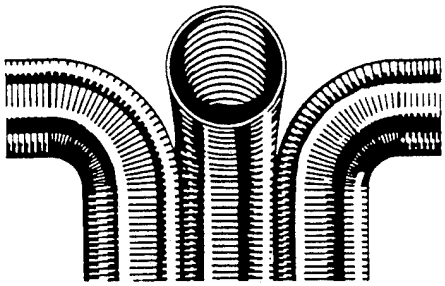
*High pressure operation recommended for metal nozzles only.

†Plastic length: 3 5/8" ‡Plastic length: 4 3/8"

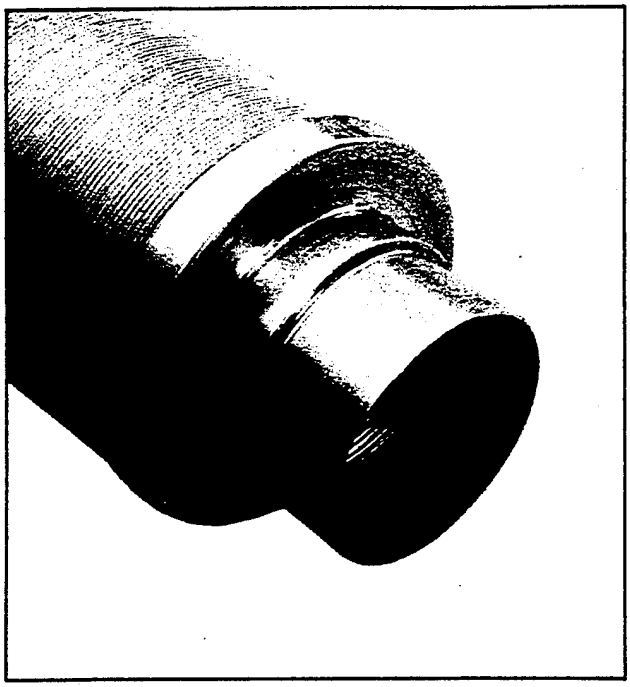
For adapters and bushings, refer to Accessories page

TO ORDER: Specify Spray Angle, Pipe Size, Nozzle Number and Material

CLEVAFLEX



HIGH VELOCITY ATTENUATOR



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$_1$. 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" ⌀ 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

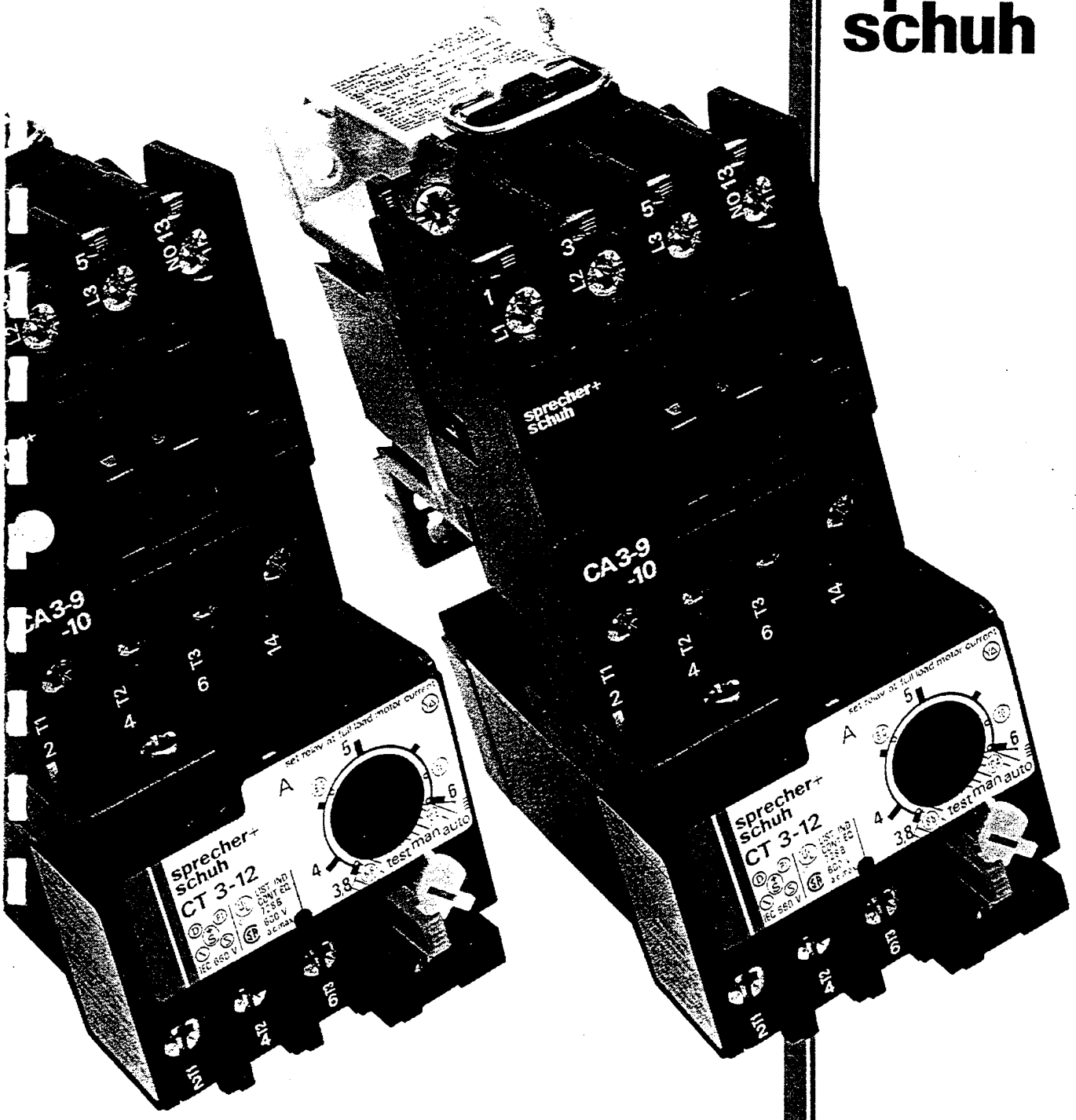
As tested by Kodaras Acoustical Laboratories, Division Electrical Testing Laboratories, Inc. Aug. 31-Sept. 2, 1979

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.

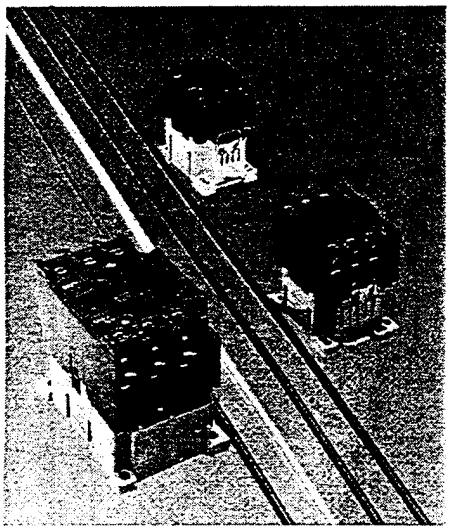
sprecher+
schuh



CA3 Contactor/Starter Series

Proven contactors and
motor protection for
applications up to 50HP

The powerful contactor system with decisive advantages



The CA3 series is Sprecher + Schuh's most popular line of contactors and starters. This versatile series was developed to meet the demand for smaller size devices without reducing reliability or performance. On average, every CA3 device is over 40% smaller than traditional contactors in this size class.

A perfect match

A wide selection of ten contactors is available in only three different frame sizes covering the range from 5 to 50 HP (@460V). This broad selection provides a contactor size for virtually every horsepower increment, allowing you to precisely match your motor with the appropriate CA3 starter.

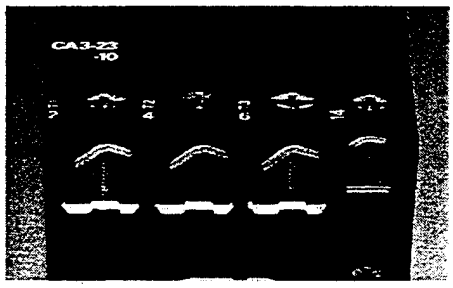
Rugged performance

Where traditional contactors rely on physical size, Sprecher + Schuh's CA3 series achieves rugged performance through a number of special design features. "Bounce free" contacts and high contact pressure allow the devices to handle high inrush currents with no effect on performance.

Due to their enclosed design, CA3 components are not affected by unfavorable climatic conditions. They also operate reliably under vibration and shock conditions such as those found in vehicles and ships.

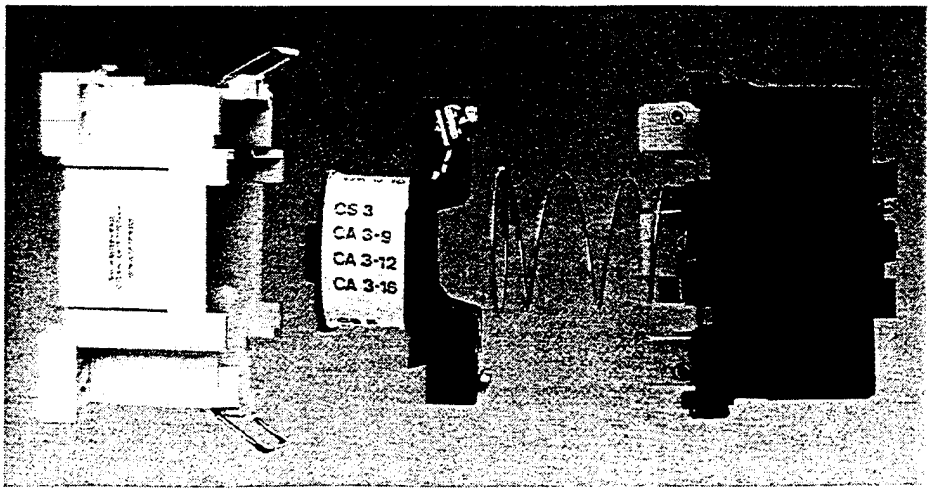
Maximum convenience

The CA3 line is completely modular for fast and trouble free installation and maintenance. Most contactors are DIN-rail mountable so they can be installed, moved or replaced quickly. All terminals are "captive" and are shipped in the raised position, saving you an operation. The universal terminal screws can be tightened with conventional, slot or posidrive screwdrivers and a limit stop prevents the conductor from being pushed into the contact chamber when wiring.



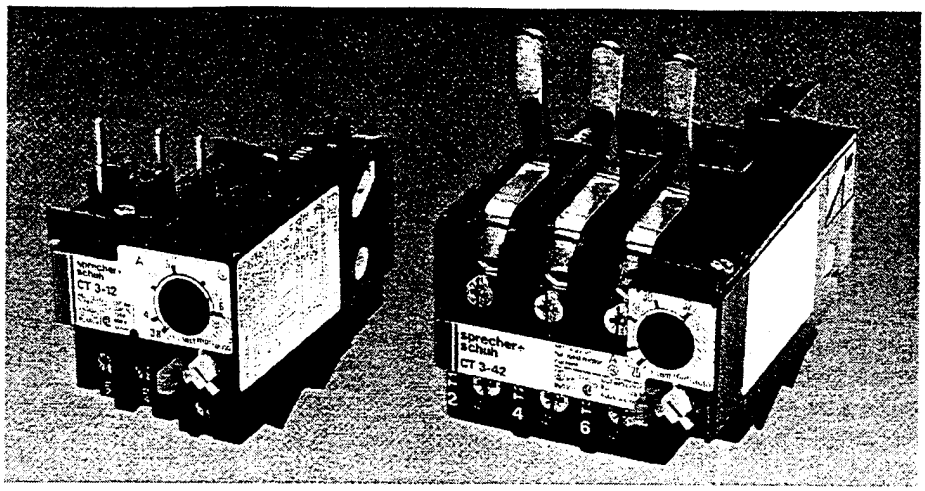
Easy coil changes

Simple and rapid coil changes are possible without tools on the CA3-9 through CA3-30, while only two screws must be loosened on the largest frame size. Reset solenoids and latch coils are also easily changed with no loose or small components to fumble with.



Exceptional motor protection is assured with CT3 overload relays

Sprecher + Schuh has always paid particular attention to the subject of motor protection. This concern is reflected in our CT3 line of thermal overload relays which include many standard features not available with traditional overload protection devices. Only two CT3 frame sizes cover the entire CA3 contactor range.



Superior "Class 10" characteristics

Today's T-Frame motors have less copper and iron than the old U-Frame motors that were popular when traditional "Class 20" overload relays were designed. For this reason, faster "Class 10" overloads like the CT3, have been recognized by many motor manufacturers as the ideal type to assure optimum motor protection.

Protection from single phase conditions

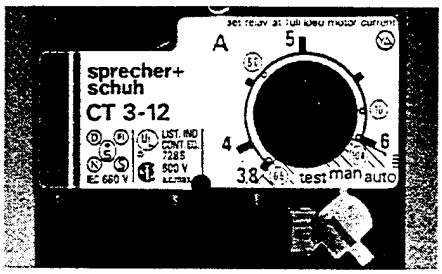
A unique feature not found in traditional thermal overload relays provides accelerated tripping under single phase conditions. This is accomplished with a special "differential tripping" mechanism built into every CT3 device (see diagram).

Ambient temperature compensation

Automatic ambient temperature compensation is another important feature standard with the CT3 series. The overload continually adjusts to surrounding temperatures between –25°C and +70°C so that trip times remain constant. This is especially important in cold climates where the trip times of uncompensated overloads can increase far beyond the safe limit for the motor.

Convenient dial adjustment of motor FLA

Rather than changing "heaters" to set the overload to the motor's FLA, CT3 relays have a dial adjustment on the faceplate. This convenience offers a wide range of FLA settings and allows you to accurately set or reset the overload in seconds.



Other standard features

CT3 overloads feature a fail-safe "trip free" design which prevents the device from being held closed during an overload. In addition, a selectable reset button permits any one of three reset options to be chosen: test, manual or automatic modes.

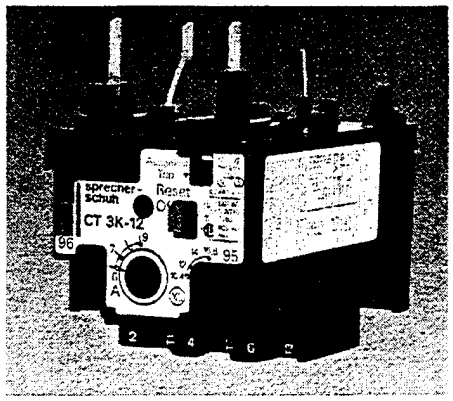
A separate NO signal contact is also provided which is isolated from the NC trip contact. This permits the use of a trip signal voltage different than that of the control voltage.

The CT3K Excellence and economy

The economic CT3K thermal overload relay also provides excellent "Class 10" protection that is accurate and consistent. Although CT3K's possess no differential tripping mechanism, they nevertheless trip under single phase conditions at a maximum of 1.25 x set current. This is achieved by a direct current calibration procedure performed on *every* device before it leaves the factory.

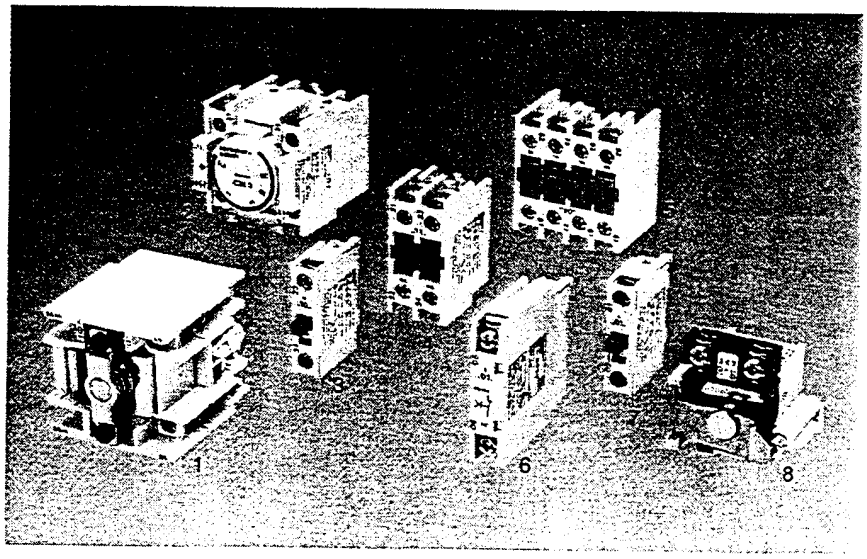
The CT3K also features permanently installed bimetal elements and a dial adjustment to accurately set the motor's FLA.

An auxiliary NO contact block is offered as an available option which snaps onto the top of any CT3K. This isolated auxiliary contact can be used as an alarm contact, for example.



Modular accessories provide more performance in less space

A comprehensive selection of modular accessories allows limitless contactor and starter configurations. All accessory modules have a standard coupling system that quickly snaps to the top or side of any CA3 contactor, requiring little or no additional panel space.



1 Mechanical latch – Holds the contactor closed so voltage can be removed from the coil.

2 Timing element – Provides on-delay or off-delay of the contactor (3 to 180 seconds).

3 Auxiliary contact block (1 pole).

4 Auxiliary contact block (2 pole).

5 Auxiliary contact block (4 pole).

6 Auxiliary contact block (1 pole - 40ms delay).

7 Auxiliary contact block (1 pole - late break).

8 Reset module – For remote reset of CT3 overload relay.

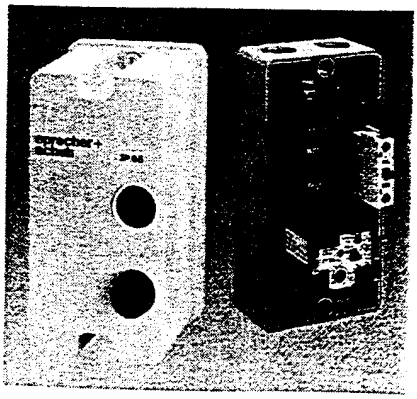
Other accessories include:

Mechanical interlocks
RC links and neutral links
Reset extension rods
Various terminals and bridges
Terminal protection covers
Labeling and marking options

Enclosed starters for any application

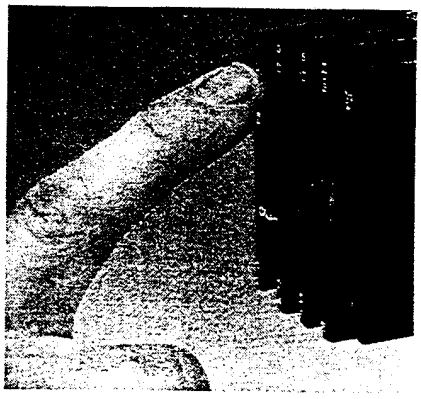
The entire CA3 contactor/starter line is available in all configurations, including combination and reduced voltage starters, pump panels and others.

A *pre-assembled* compact starter is also available for motors up to 20HP (@ 460V). This cost effective space-saving unit comes in a high impact watertight enclosure with built-in START/STOP push-buttons for speedy installation.



Safety in mind

The setting of timing elements or resetting of overload relays inside enclosures is often performed on live installations and is the most frequent cause of electrical accidents. For this reason, all CA3 contactors and accessories, as well as CT3 overload relays, offer finger and back of hand protection in accordance with the strictest international standards.

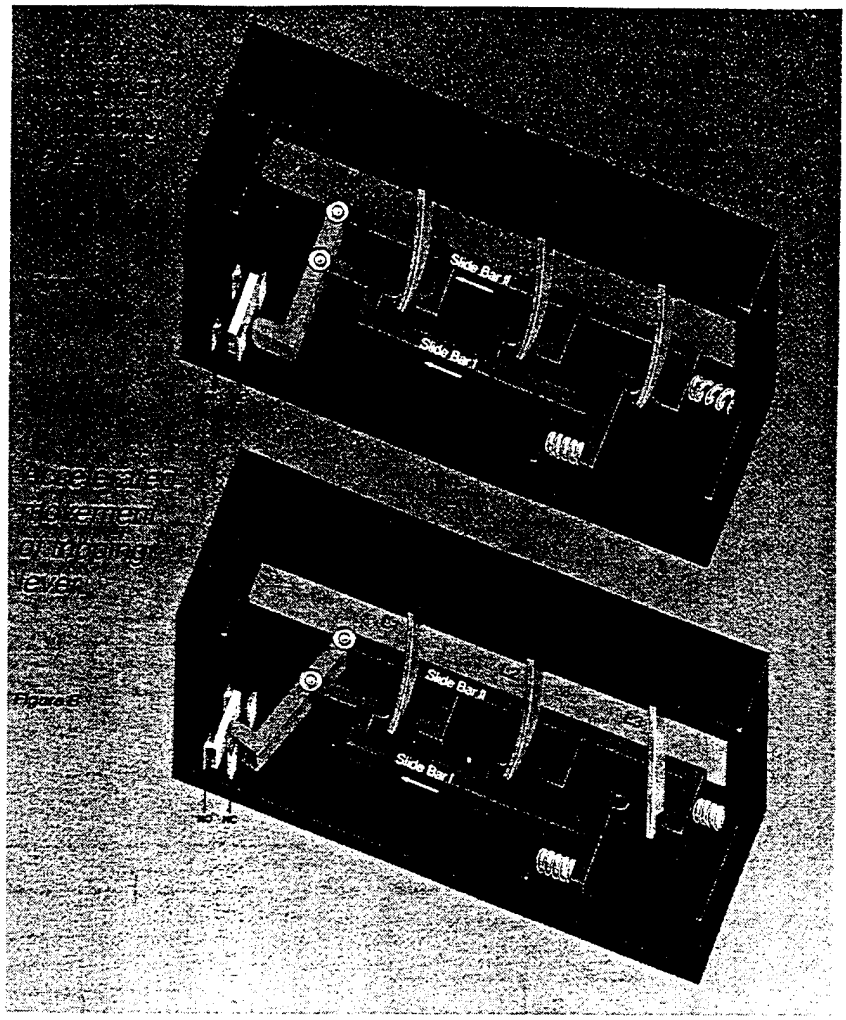


Differential Tripping – It sets us apart

Unique to IEC-style overload relays is their ability to provide *accelerated* tripping under single phase conditions. This concept is made possible by an ingenious double slide bar assembly called a "differential tripping" mechanism.

In Figure A, Slide Bar I is spring loaded to the right while Slide Bar II is spring loaded to the left. Hinge points connect the two slide bars to the tripping lever. Under a three phase symmetrical load (<FLA) the bimetal elements bend simultaneously. This causes the two slide bars to act as a single unit, positioning the tripping lever just short of tripping the normally closed contact. A three phase symmetrical overload (>FLA), however, would bend the bimetals even more, causing the tripping lever to trip the device.

The purpose of the two slide bars becomes quite evident during a single phase condition. In Figure B, if one of the phases is lost (L3 in this example), the cold bimetal element holds Slide Bar II in the same position while the additional current passing through the two remaining bimetal elements shifts Slide Bar I. This action produces a cantilever effect, accelerating the movement of the tripping lever toward the trip contacts. Any unbalanced loading of one or more of the three bimetal elements will cause this differential shift between the slide bars; thus the name "Differential Tripping."

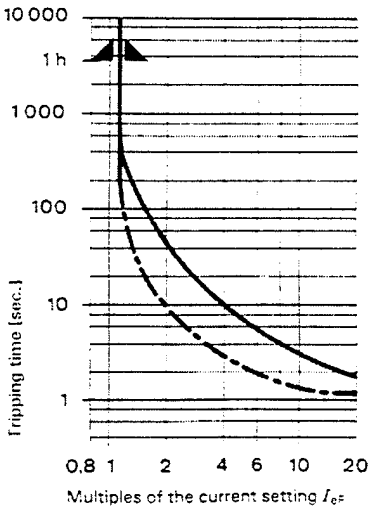


Accurate, reliable and consistant thermal overload protection

Thermal overload relays must have a high degree of tripping accuracy and consistency to protect motors. To achieve this, CT3 overload relays utilize permanently installed bimetal elements rather than interchangeable "heaters". This enables us to precisely calibrate every CT3 at the factory *as one unit*, eliminating inaccurate tripping characteristics often caused when combining parts in the field. Factory sealed calibration of every CT3 device assures a faithful reproduction of the published time/current tripping curve. This guarantees reliable and exact motor protection... every time.

Thermal response curve

The solid curve shows the mean trip times of a CT3-12 device at 20°C ambient temperature starting from a cold state. The dashed line shows mean trip times for an operationally warm device. Different models may have slightly different time/current characteristics.

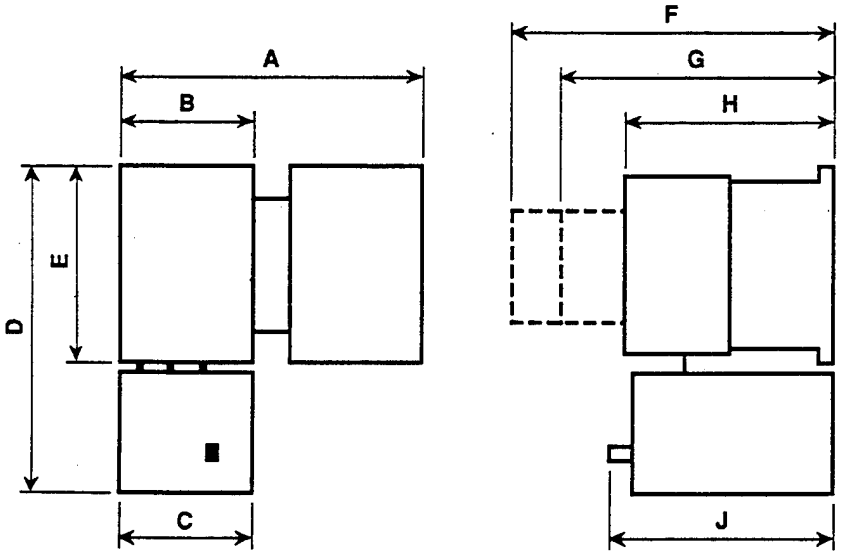


CA3 Selection Guide ①

Contactor	Continuous Amp Rating		Maximum Horsepower						Equivalent NEMA Ratings
			Single Phase		Three Phase				
	Open	Encl.	115V	230V	200V	230V	460V	575V	
CA3-9	25	24	1/3 1 3	1 1	2 1 1 2	2 1 1 2	5 2	7 1/2 2	NEMA Size 00
CA3-12	25	24	1/2	2	3	3	7 1/2	10	② Size 00+
CA3-16	25	24	1 1	3 2	5 3	5 3	10 5	15 5	NEMA Size 0
CA3-23A	40	36	1 1/2	3	5	5	10	15	② Size 0+
CA3-23	40	36	2 2	3 3	7 1/2 7 1 2	7 1/2 7 1 2	15 10	20 10	NEMA Size 1
CA3-30	40	36	2	5	10	10	20	25	② Size 1 1/2
CA3-37	50	45	3	5	10	10	25	30	② Size 1 3/4
CA3-43	50	45	3 3	7 1/2 7 1 2	10 10	15 15	30 25	40 25	NEMA Size 2
CA3-60	80	72	5	10	15	20	40	50	② Size 2 1/2
CA3-72	80	72	5	10	20	20	50	60	② Size 2 3/4

① Sprecher + Schuh ratings are in **Black Type.** NEMA equivalent ratings are in **White Type.**
② Sprecher + Schuh intermediate ratings.

Dimensions mm (inches)



Code	Description	Contactor Series		
		CA3-9, 12 & 16	CA3-23A, 23 & 30	CA3-37, 43, 60 & 72
A	Width - 2 contactors w/ mech interlock	104.5 (4.11)	124.5 (4.90)	159 (6.26)
B	Width - contactor only	44.5 (1.75)	54.5 (2.15)	74 (2.91)
C	Width - CT3 O/L relay only	① 49 (1.93)	49 (1.93)	69.5 (2.74)
D	Heigth - contactor & CT3 O/L relay	119 (4.68)	128 (5.04)	188 (7.40)
E	Heigth - contactor only	70 (2.75)	75 (2.95)	114 (4.49)
F	Depth - contactor w/ latch or timer	② 129.5 (5.10)	134 (5.27)	152 (5.98)
G	Depth - contactor w/aux contact block	② 108 (4.25)	114 (4.49)	131 (5.16)
H	Depth - contactor only	② 79 (3.11)	84 (3.31)	104 (4.07)
J	Depth - CT3 O/L relay only	③ 92 (3.62)	92 (3.62)	110 (4.33)

① For CT3K O/L relay the dimensions are 43 (1.69).
② For device with DC coil add 24 (0.94).
③ For CT3K O/L relay the dimensions are 85 (3.35).

Specifications

Standards
UL, CSA, SEV, DEMKO, SEMKO, NEMKO, RINA, Bureau Veritas, CEBEC, Lloyds Reg of Shipping, Seti, Germanischer Lloyd, USSR Reg

Rated Insulation Voltage
UL, NEMA, CSA 600V
IEC, AS, BS, SEV, VDE 660V

Test Voltage ..... 3000 volts (1 minute)

Maximum Coil Voltage ..... 110% of rated voltage

Pull-in Voltage
CA3-9 thru CA3-16 ..... 80% of rated voltage
CA3-23A thru CA3-30 ..... 85% of rated voltage
CA3-37 thru CA3-72 ..... 80% of rated voltage

Drop-out Voltage
AC coil
CA3-9 thru CA3-30 ..... 35-65% of rated voltage
CA3-37 thru CA3-72 ..... 35-55% of rated voltage
DC coil ..... 10-25% of rated voltage

Coil Burden
AC inrush VA (W)
CA3-9 thru 16 ..... 59 (46)
CA3-23A thru 30 ..... 90 (65)
CA3-37 thru 72 ..... 190 (103)
AC sealed VA (W)
CA3-9 thru 16 ..... 7.2 (2.2)
CA3-23A thru 30 ..... 8.6 (2.5)
CA3-37 thru 72 ..... 17 (4.9)
DC inrush VA
CA3-9 thru 16 ..... 7.4
CA3-23A thru 30 150
CA3-37 thru 72 350
DC sealed VA
CA3-9 thru 16 ..... 7.4
CA3-23A thru 30 ..... 3.8
CA3-37 thru 72 ..... 5.5

Switching Delay
Closing
CA3-9 thru CA3-16 ..... 10-20ms AC/20-60ms DC
CA3-23A thru CA3-30 ..... 10-20ms
CA3-37 thru CA3-72 ..... 12-22ms
Opening
CA3-9 thru CA3-72 ..... 8-18ms

Ambient Temperature
100% rated current ..... -25°C to +60°C
85% rated current ..... -25°C to +70°C

Auxiliary Contacts
Standard
CA3-9 thru 16 ..... 1 NO (NC available)
CA3-23A thru 30 ..... 1 NO (NC available)
CA3-37 thru 72 ..... 1 NO & 1 NC
Additional maximum (any combination of NO or NC)
CA3-9 thru 16 ..... 4 (for a total of 5)
CA3-23A thru 30 ..... 5 (for a total of 6)
CA3-37 thru 72 ..... 5 (for a total of 7)

sprecher+schuh

Sprecher + Schuh, Inc.
Corporate Headquarters
15503 W. Hardy St.
Houston, TX 77060
(713) 931-7000

PS 1019 – 3/91

Installation Instructions

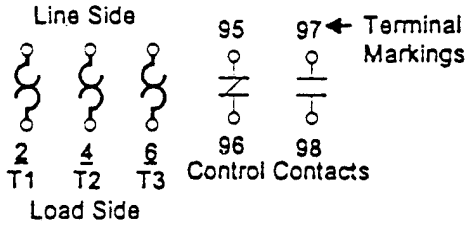
sprecher+schuh

Overload Relays - Series CT3

Installation Precautions

- Be sure overload relay is properly rated for the load. (See chart at right.)
- Use wire sizes in accordance with code and rating label.
- Check that terminations are properly torqued in accordance with label.
- Insure that overload relay has not been opened or tampered with in any way.
- Be sure that overload is protected by properly sized backup fuse in accordance with label.
- Use the function selector "TEST" position for checking circuitry and operation.
- Before energizing motor be sure overload relay is adjusted properly in accordance with instructions below.

Overload Relay Wiring Diagram

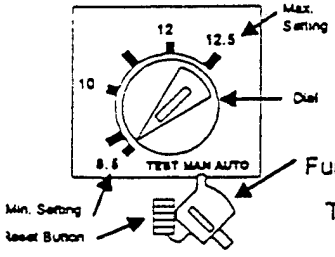


Overload Relay Ratings

Catalog Number	Setting Range (Amperes)
CT3-0.16	0.10-0.16
CT3-0.24	0.15-0.24
CT3-0.38	0.24-0.38
CT3-0.62	0.38-0.62
CT3-1.0	0 62-1.0
CT3-1.6	1.0-1.6
CT3-2.5	1.6-2.5
CT3-4.0	2.5-4.0
CT3-6.0	3.8-6.0
CT3-9.5	6.0-9.5
CT3-12.5	8.5-12.5
CT3-17.5	12.0-17.5
CT3-23	16.0-23.0
CT3-32	23.0-32.0
CT3-42-32	25.0-32.0
CT3-42-42	32.0-42.0
CT3-52	40.0-52.0
CT3-63	52.0-63.0
CT3-72.5	58.0-72.5

Setting Overload Relay

For motors with a service factor equal to or greater than 1.15, set dial at motor nameplate full load current. For motors with a service factor below 1.15 or a temperature rise greater than 40° C, the current setting should be adjusted lower. For example, set overload to .9 times full load current for 1.0 service factor (or 50° C rise) motors.



- Caution -
Do not use "AUTO" position if automatic restarting of equipment could be hazardous to personnel

Function Selector Settings:

TEST - Pressing reset button simulates tripping of overload relay.

MAN - After trip, overload relay must be manually reset by pressing reset button after cool down period.

AUTO - After trip, overload relay will automatically reset after cool down

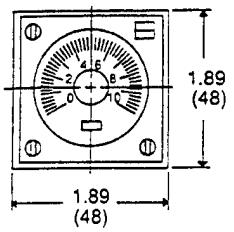
The information contained herein does not include all details or variations in equipment, nor does it provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired, or should particular problems or questions arise which are not covered sufficiently for the purchasers purpose, the matter should be referred to the nearest Sprecher + Schuh office shown at right.

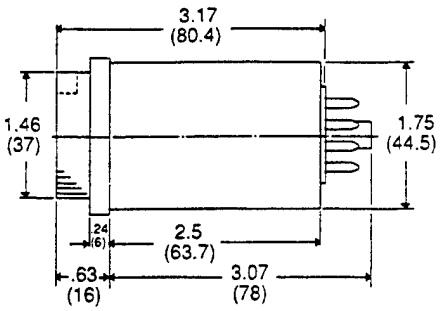
Sprecher + Schuh Regional Offices:

- Port Chester, NY Tel: (914) 937-0400
- Brookfield, WI Tel: (414) 785-9960
- Houston, TX Tel: (713) 847-2000
- Temecula, CA Tel: (714) 699-5091

March 25, 1992 IS-201

INSTALLATION **INSTALLATION** **MONTAGE**

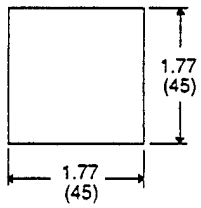




INSTALACION **INSTALAÇÃO**

PANEL CUTOUT
DÉCOUPE DU PANNEAU
SCHALTTAFEL-AUSSCHNITT
CORTE DEL PANEL
CORTE DE PAINEL

FLUSH MOUNT WITH ADAPTER
MONTAGE ENCASTRÉ AVEC ADAPTATEUR
VERSENKTER EINBAU MITTELS ADAPTER
MONTAJE AL RAS CON ADAPTADOR
MONTAGIM NIVELADA COM ADAPTADOR



WARNING:
CAUTION:

- To prevent electrical shock, disconnect from power source before installing or servicing.
- Do not remove timer from housing. This will invalidate product warranty.
- Remove power before changing timing range, unit or mode selection.
- The 700-HR timer utilizes a transformerless power supply. Do not touch the input terminals when power is applied.
- External input devices used to control the timer should be equipped with an isolation transformer and an ungrounded output.
- When 2 or more timers are controlled by the same input contact or transistor, connect the #2 terminals of the timers together.
- Recommendations for external input signal lines:
  - Use shielded wire.
  - Keep wire as short as possible.
  - Separate input signal wires from power supply for the timer and from other voltage or power lines.

AVERTISSEMENT:
ATTENTION:

- Préalablement à l'installation et aux opérations de service, couper l'alimentation secteur pour empêcher tous chocs électriques.
- Ne pas retirer le temporisateur de son compartiment sous peine d'annuler la garantie.
- Couper le courant avant de changer la gamme de temporisation, la sélection de l'unité ou le mode.
- Le temporisateur 700-HR utilise une alimentation électrique sans transformateur. Ne pas toucher les bornes d'entrée pendant la mise sous tension.
- Les appareils d'entrées externes utilisés pour contrôler le temporisateur doivent être équipés d'un transformateur d'isolation et d'une sortie non mise à la masse.
- Lorsque 2 temporisateurs ou plus sont contrôlés par le même contact ou transistor d'entrée, connecter les bornes #2 des temporisateurs ensemble.
- Recommandations au sujet des lignes de signaux d'entrée externes:
  - Utiliser un câble blindé.
  - Le câble doit être le plus court possible.
  - Séparer les câbles des signaux d'entrée de l'alimentation électrique pour le temporisateur mais aussi des autres tensions ou lignes électriques.

WARNUNG:
VORSICHT:

- Vor Installation oder Servicearbeiten Stromversorgung zur Vermeidung von elektrischem Schlag unterbrechen.
- Das Zeitrelais nicht aus dem Gehäuse entfernen. Die Garantie für das Produkt wird dadurch ungültig gemacht.
- Vor Veränderungen im Zeitregelungsbereich, Auswahl einer Einheit oder Betriebsart, die Stromzufuhr unterbrechen.
- Das 700-HR Zeitrelais nutzt transformatorlose Stromversorgung. Die Eingangsklemmen nicht berühren, wenn Strom zugeführt wird.
- Die externen Eingangsgeräte, die zur Kontrolle des Zeitrelais benutzt werden, sollten mit einem Trenntrafo und einem nichtgeerdeten Ausgang ausgestattet sein.
- Wenn zwei oder mehrere Zeitrelais durch dieselben Eingangskontakte oder den Transistor kontrolliert werden, Klemmen Nr. 2 der Zeitrelais verbinden.
- Empfehlungen für die externen Eingangssignal-Leitungen:
  - Abgeschirmten Draht benutzen.
  - Den Draht so kurz wie möglich halten.
  - Eingangssignal-Leitungen vom Netzanschluss für das Zeitrelais und von anderen Spannungs- oder Stromleitungen getrennt halten.

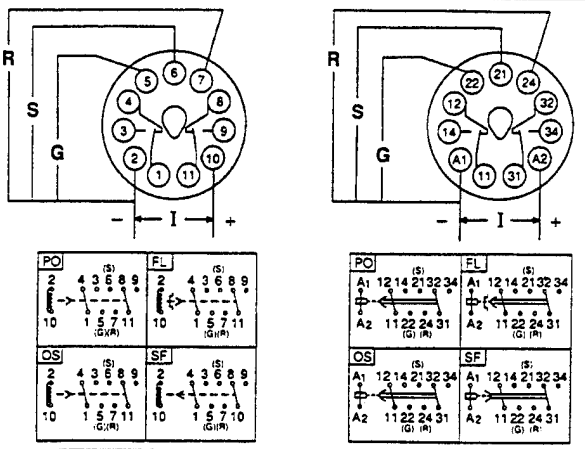
ADVERTENCIA:
PRECAUCION:

- Desconecte la corriente eléctrica antes de la instalación o servicio para evitar descargas eléctricas.
- No saque el temporizador de su recinto. Esto invalidará la garantía del producto.
- Desconecte la energía antes de cambiar el rango de temporización, la selección de modalidad o de la unidad.
- El temporizador 700-HR usa un suministro eléctrico sin transformador. No toque los bornes de entrada cuando la energía esté conectada.
- Los dispositivos de entrada externos usados para controlar el temporizador deben estar equipados con un transformador aislador y una salida sin conexión a tierra.
- Cuando 2 o más temporizadores estén controlados por el mismo transistor o contacto de salida, conecte los bornes #2 de los temporizadores juntos.
- Recomendaciones para líneas externas de señal de entrada:
  - Use cable blindado.
  - Mantega el cable tan corto como sea posible.
  - Separe los cables de señal de entrada de los del suministro eléctrico para el temporizador y los de otros voltajes o líneas eléctricas.

ADVERTÊNCIA:
ATENÇÃO:

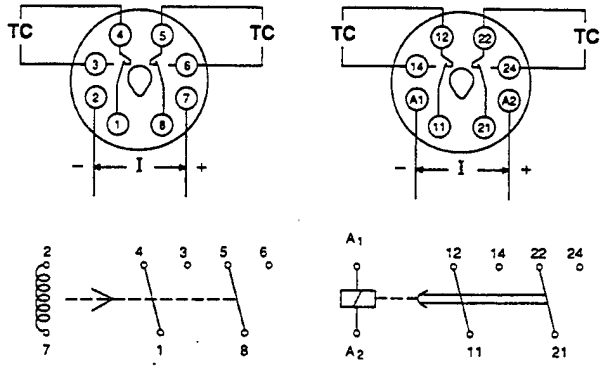
- Para evitar choques, desligar a corrente elétrica antes de iniciar a instalação.
- Não remova temporizador da embalagem. Isto invalidará a garantia do produto.
- Desligar energia antes de alterar a temporização, a seleção de modalidade e da unidade.
- O temporizador 700-HR utiliza um transformador para a energia. Não toque os terminais da entrada quando energia é ativada.
- Os dispositivos de entrada externa devem ser equipados com transformador isolante e saída sem conexão terra.
- Quando 2 ou mais temporizadores são controlados pelo mesmo contato de entrada ou transistor, conectar, juntos, os terminais #2 dos temporizadores.
- Recomendação para linhas externas de sinal de entrada:
  - Use fio encapado.
  - Mantenha o fio tão curto o quanto for possível.
  - Separe os fios de sinal de entrada dos elétricos do temporizador e dos outros elétricos ou de voltagem diferentes.

HR



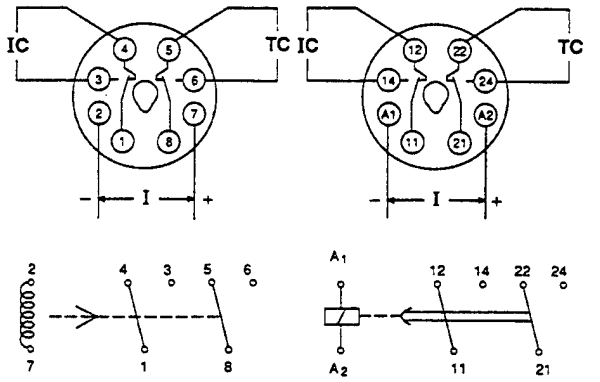
- CONTACT INPUTS (R, S, G)
  FOR OPTIMUM RELIABILITY USE EXTERNAL SWITCHES THAT ARE DESIGNED FOR LOW LEVEL SWITCHING. (700-HC54 – –)
- ENTRÉES CONTACTS (R, S, G)
  POUR UNE FIABILITÉ MAXIMUM, UTILISEZ DES COMMUTATEURS EXTERNES PRÉVUS POUR UN BAS NIVEAU DE COMMUTATION. (700-HC54 – –)
- KONTAKT-EINGÄNGE (R, S, G)
  FÜR OPTIMALE ZUVERLÄSSIGKEIT WIRD DIE BENUTZUNG VON EXTERNEN SCHALTERN, DIE FÜR SCHWACHSTROMSCHALTUNGEN KONSTRUIERT WURDEN, EMPFOHLEN. (700-HC54 – –)
- ENTRADAS DE CONTACTO (R, S, G)
  PARA UNA OPTIMA CONFIABILIDAD USE CONMUTADORES EXTERNOS QUE ESTEN DISEÑADOS PARA UN BAJO NIVEL DE CONMUTACION. (700-HC54 – –)
- ENTRADAS DE CONTATO (R, S, G)
  PARA PERFEITA CONFIABILIDADE USE TOMADAS EXTERNAS QUE SÃO CONCEBIDAS PARA BAIXAS ALTERAÇÕES. (700-HC54 – –)

HRM



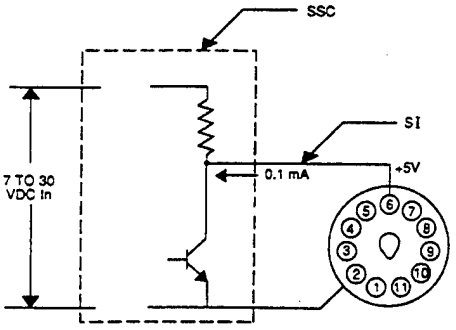
- SOLID STATE SIGNAL INPUTS (R, S, G)
  TRANSISTOR OPEN COLLECTOR: ①
  PROXIMITY SWITCH, PHOTOELECTRIC SWITCH, ETC.: ②
- ENTRÉES DE SIGNAUX À SEMI-CONDUCTEURS (R, S, G)
  COLLECTEUR OUVERT DU TRANSISTOR: ①
  COMMUTATEUR DE PROXIMITÉ, COMMUTATEUR PHOTOÉLECTRIQUE ETC.: ②
- FESTKÖRPER-SIGNAL-EINGÄNGE (R, S, G)
  OFFENER TRANSISTORKOLLEKTOR: ①
  NÄHERUNGSSCHALTER, PHOTOELEKTRISCHER SCHALTER, ETC.: ②
- ENTRADAS DE SEÑAL TRANSISTORIZADAS (R, S, G)
  COLECTOR ABIERTO DEL TRANSISTOR: ①
  CONMUTADOR DE PROXIMIDAD, CONMUTADOR FOTOELECTRICO, ETC.: ②
- ENTRADAS DE SINAL TRANSISTORIZADOS (R, S, G)
  COLETA ABERTO DE TRANSISTOR: ①
  TOMADA DE PROXIMIDADE, TOMADA FOTOELÉTRICA, ETC.: ②

HRC



① V_{CEO} = 20 V min $V_{CE(S)}$ = 1 Vmax,
I_C = 50mA min, I_{CBO} = 0.5uA max.

②



WIRING DIAGRAM KEY / CODE SCHÉMAS ÉLECTRIQUES / SCHALTPLANSCHLÜSSEL / CODIGO DE LOS DIAGRAMAS DEL CABLEADO / CÓDIGO DIAGRAMA DE CABOS

R = RESET SIGNAL / SIGNAL DE RÉARMEMENT / RÜCKSETZSIGNAL / SEÑAL DE REPOSICION / SINAL DE REARMAMENTO

S = START SIGNAL / SIGNAL DE DÉMARRAGE / STARTSIGNAL / SEÑAL DE ARRANQUE / SINAL DE INÍCIO

G = GATE SIGNAL (PAUSE) / SIGNAL GATE (PAUSE) / GATE SIGNAL (PAUSE) / SEÑAL DE COMPUERTA (PAUSA) / SINAL DE COMPORTA (PAUSA)

I = INPUT / ENTRÉE / EINGANG / ENTRADA / ENTRADA

IC = INSTANTANEOUS CONTACTS / CONTACTS INSTANTANÉS / SOFORT ANSPRECHENDE KONTAKTE / CONTACTOS INSTANTANEOS / CONTACTOS INSTANTÂNEOS

TC = TIMED CONTACTS / CONTACTS TEMPORISÉS / ZEITGESTEUERTE KONTAKTE / CONTACTOS TEMPORIZADOS / CONTATOS TEMPORIZADOS

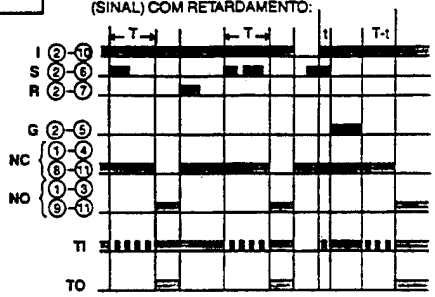
SSC = SOLID STATE CIRCUIT (PROXIMITY SWITCH, PHOTOELECTRIC SWITCH, ETC.) / CIRCUIT TRANSISTORISÉ (COMMUTATEUR PHOTOÉLECTRIQUE, ETC.) / FESTKÖRPERSCHALTKREIS (NÄHERUNGSSCHALTER, PHOTOELEKTRISCHER SCHALTER, ETC.) / CIRCUITO TRANSISTORIZADO (CONMUTADOR DE PROXIMIDAD, CONMUTADOR FOTOELECTRICO, ETC.) / CIRCUITO TRANSISTORIZADO (TOMADA DE PROXIMIDADE, TOMADA FOTOELÉTRICA, ETC.)

SI = START INPUT (TIMER STARTS AT LOW LEVEL OF THIS SIGNAL) / ENTRÉE DÉMARRAGE (LE TEMPORISATEUR DÉMARRE À BAS NIVEAU DE CE SIGNAL) / STARTEINGANG (ZEITRELAIS BEGINNT BEI KLEINSIGNAL) / ENTRADA DE ARRANQUE (EL TEMPORIZADOR ARRANCA A UN BAJO NIVEL DE ESTA SEÑAL). / ENTRADA DE INIZIO (O TEMPORIZADOR INICIA À BAIXO NÍVEL NO SINAL)

TYPE HR:

PO

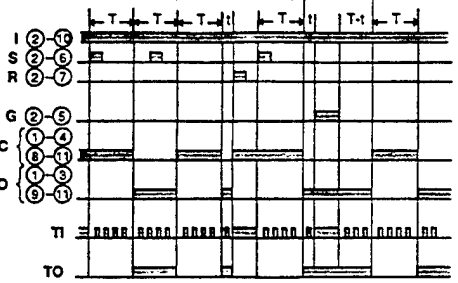
(SIGNAL) ON DELAY:
SIGNAL DE DÉBUT DE TEMPORISATION:
(SIGNAL) EINSCHALTVERZÖGERUNG:
RETARDO AL CONECTARSE (SEÑAL):
(SINAL) COM RETARDAMENTO:



T>t

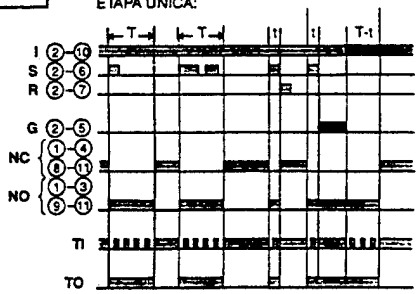
FL

FLICKER (REPEAT CYCLE):
CLIGNOTEMENT (RÉPÉTER CYCLE):
FLACKER (WIEDERHOLZYKLUS):
CENTELLEO (REPETIR EL CICLO):
PISCA-PISCA (REPETIR CICLO):



OS

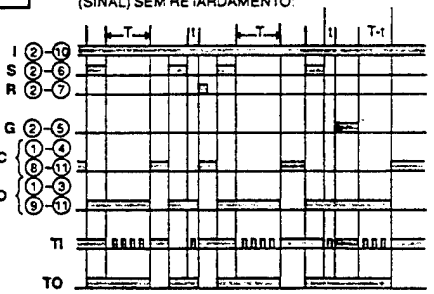
ONE SHOT:
UN COUP:
EINZELSCHRITT:
ETAPA UNICA:
ETAPA UNICA:



T>t

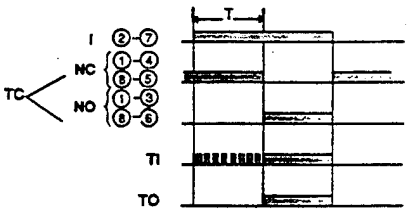
SF

(SIGNAL) OFF DELAY:
SIGNAL D'ARRÊT DE TEMPORISATION:
(SIGNAL) AUSSCHALTVERZÖGERUNG:
RETARDO AL DESCONECTARSE (SEÑAL):
(SINAL) SEM RETARDAMENTO:



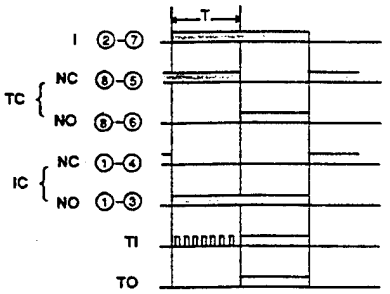
TYPE HRM:

ON DELAY
DÉBUT TEMPORISATION
EINSCHALTVERZÖGERUNG
DE RETARDO AL CONECTARSE
COM RETARDAMENTO



TYPE HRC:

ON DELAY
DÉBUT TEMPORISATION
EINSCHALTVERZÖGERUNG
DE RETARDO AL CONECTARSE
COM RETARDAMENTO



TIMING CHART KEY / CODE TABLEAU DE TEMPORISATION / SCHLÜSSEL FÜR ZEITREGELUNGSTABELLE / CODIGO DEL GRAFICO DE TEMPORIZACION / CÓDIGO DA GRÁFICO DE TEMPORIZAÇÃO

I =
INPUT
ENTRÉE
EINGANG
ENTRADA
ENTRADA

S =
START SIGNAL
SIGNAL DE DÉMARRAGE
STARTSIGNAL
SEÑAL DE ARRANQUE
SINAL DE INÍCIO

R =
RESET SIGNAL
SIGNAL DE RÉARMEMENT
RÜCKSETZSIGNAL
SEÑAL DE REPOSICION
SINAL DE REARMAMENTO

G =
GATE SIGNAL (PAUSE)
SIGNAL GATE (PAUSE)
GATE SIGNAL (PAUSE)
SEÑAL DE COMPUERTA (PAUSA)
SINAL DE COMPORTA (PAUSA)

NC =
OUTPUT (NC)
SORTIE (NF)
AUSGANG (RUHEKONTAKT)
SALIDA (NC)
SAÍDA (NC)

NO =
OUTPUT (NO)
SORTIE (NO)
AUSGANG (ARBEITSKONTAKT)
SALIDA (NA)
SAÍDA (NO)

TI =
POWER / TIMING INDICATOR
INDICATEUR DE PUISSANCE/TEMPORISATION
STROM / ZEITREGELUNGS-ANZEIGE
INDICADOR DE TEMPORIZACION/ENERGIA
INDICADOR DE ENERGIA/TEMPORIZAÇÃO

TO =
TIMED OUT INDICATOR
INDICATEUR DE DÉPASSEMENT
ZEITABLAUF-ANZEIGE
INDICADOR DE TERMINACION DEL PERIODO DE TEMPORIZACION
INDICADOR DO TÉRMINO DA TEMPORIZACÃO

TC =
TIMED CONTACTS
CONTACTS TEMPORISÉS
ZEITGESTEUERTE KONTAKTE
CONTACTOS TEMPORIZADOS
CONTATOS TEMPORIZADOS

IC =
INSTANTANEOUS CONTACTS
CONTACTS INSTANTANÉS
SOFORT ANSPRECHENDE KONTAKTE
CONTACTOS INSTANTANEOS
CONTACTOS INSTANTÂNEOS

40063-057-01 (B)
Printed in Japan

WARRICK CONTROLS

Installation

INSTALLATION OF WARRICK SERIES 27 — INTRINSICALLY SAFE SENSING CIRCUIT

This bulletin should be used by experienced personnel as a guide to the installation of the Series 27. Selection or installation of equipment should always be accomplished by competent technical assistance. We encourage you to contact Warrick 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 installed according to these instructions, this device provides an intrinsically safe output for interface into Class I and II, Division I, Groups A, B, C, D, E, F, and G Hazardous locations. 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 unless it is mounted in a suitable U.L. approved explosion-proof enclosure with suitable U.L. approved explosion-proof seals.

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 (50mm) from non-intrinsically safe terminals.
3. Wire the control device(s) to the Series 27 relay as shown in the specific application wiring diagram on reverse side. 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 (3 wire) field wiring.

Model	Max. Sensitivity (K OHMS)	Distance (Ft.)
27XXDO	3	4,000
27XXEO	10	900
27XXGO	100	75

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.

One of the two ground 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 on reverse side).

Terminal G1 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, the Series 27 should be mounted in a tool accessible enclosure of proper NEMA rated integrity.
3. For additional guidance on "Hazardous Location Installations" and "Intrinsically Safe Devices", consult ANSI/ISA standard RP 12-6 or NEC articles 500 through 516.

MODEL NUMBER DESIGNATION:

SERIES 27 X X X X

- **Enclosure:** 0 - open (no enclosure); 1 - NEMA 1 Enclosure
- **Sensitivity** (ohms): D-3,000; E-10,000; G-100,000
- **Primary AC Supply:** 1 - 120 VAC; 2 - 240 VAC (50/60 Hz)
- **Mode of Operation:** A - Direct; B -Inverse
- **Control Series**

SPECIFICATIONS

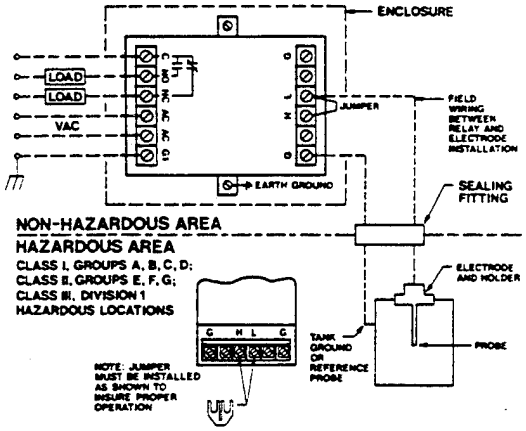
CONTACT DESIGN: SPDT (1 form C), one normally open (N.O.) and one normally closed (N.C.)
CONTACT RATING: 8 Amps - 250 VAC, 8 Amps - 30 VDC. Resistive.
CONTACT LIFE: Electrical @ rated load = 100,000 cycles minimum. Mechanical = 10,000,000 cycles.
ELECTRONICS MODULE: Solid state components epoxy encapsulated in a black nylon shell.
SENSITIVITY RANGE: 0-100,000 Ohms maximum specific resistance.
TEMPERATURE RANGE: (minus) -40 deg F. to (plus) + 150 deg F.
PRIMARY AC SUPPLY LINE: A) Voltage — (120, and 240 VAC) (plus) + 10%, (minus) — 10%. B) Frequency — 50/60 Hertz. C) Power — (Relay energized) 1.7 VA.
SECONDARY CIRCUIT: Nominal 11 Volts, AC, RMS, Current: 2.3 Milliampere, RMS.
TERMINALS: Size 6 pan head screws with captivated wire clamping plate.

WARRICK CONTROLS

INSTALLATION OF WARRICK SERIES 27 — INTRINSICALLY SAFE SENSING CIRCUIT

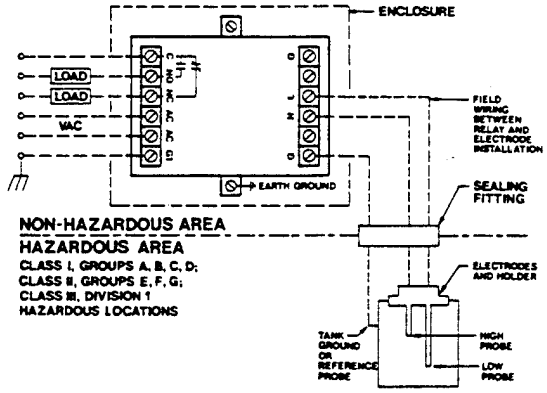
SINGLE LEVEL SERVICE — CONDUCTANCE ACTUATED:

Connect incoming AC (120, 240 VAC) supply to AC terminals:
Incoming earth ground to terminal G1.
Install metallic jumper between terminals H-L.
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.
NOTE: Jumper must be installed as shown to insure proper operation. Wire contacts (C-NO) normally open and (C-NC) normally closed into load circuit as required.



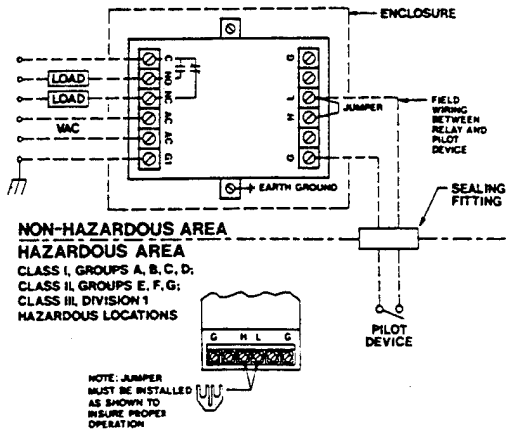
DIFFERENTIAL LEVEL SERVICE — CONDUCTANCE ACTUATED:

Connect incoming AC (120, 240 VAC) supply to AC terminals:
Incoming earth ground to terminal G1.
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 on an additional electrode of length equal to the longest electrode.
Wire contacts (C-NO) normally open and (C-NC) normally closed into load circuit as required.



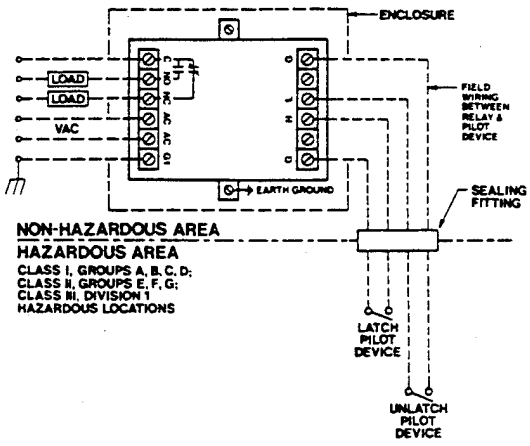
SINGLE INPUT (NON-LATCHING) - PILOT CONTACT ACTUATED:

Connect incoming AC (120, 240 VAC) supply to AC terminals:
Incoming earth ground to terminal G1.
Install metallic jumper between terminals H-L.
Wire contacts (C-NO) normally open and (C-NC) normally closed into load circuits as required.
Connect the pilot contact to terminals G-L.
NOTE: Jumper must be installed as shown to insure proper operation.



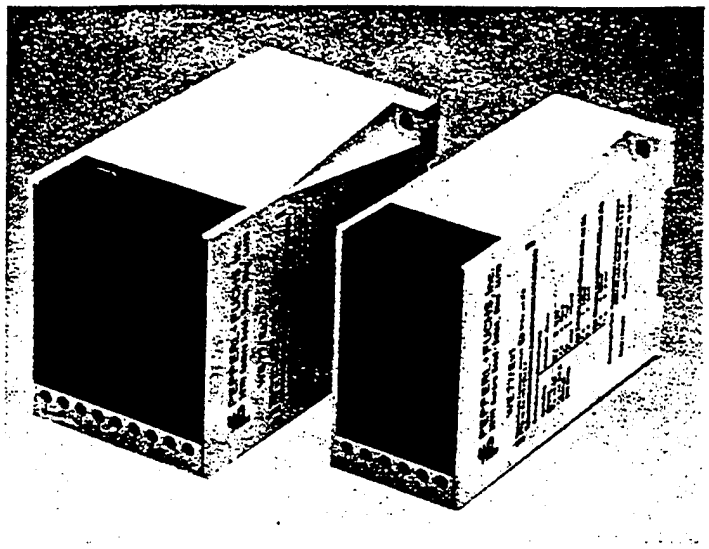
DUAL INPUT (LATCHING) - PILOT CONTACT ACTUATED:

Connect incoming AC (120, 240 VAC) supply to AC terminals:
Incoming earth ground to terminal G1.
Wire contacts (C-NO) normally open and (C-NC) normally closed into load circuits as required.
Connect the latch pilot contact to terminals G-H and the unlatch pilot contact to terminals G-L.



10/91 4237 NORMANDY COURT ROYAL OAK, MI 48073 PHONE 313/545-2512

Intrinsically Safe Switch Isolator



2 Models

WE77/Ex1-UL

Single Channel, SPDT Relay Output
Housing Style A

WE77/Ex2-UL

Dual Channel, SPDT Relay Output
Housing Style B

Description

This device is a transformer isolated intrinsic safety barrier with a built-in amplifier that isolates and transfers discrete signals from a potentially explosive area to a safe area. The following discrete inputs may be used:

- Dry Contact Closures
- P+F NAMUR Output Proximity Sensors
- Open Collector (Potential Free) Transistors

It may also be used to act as an amplifier/interface for discrete signals in non-explosive applications.

Operation

The output changes state when the input signal changes state depending upon the mode of operation selected (see functional diagram).

Approval

UL LISTED

General Specifications

HOUSING STYLES	A & B (See Dimension Page)
OPERATING TEMP. RANGE	-13°F to +140°F
MAXIMUM WIRE SIZE	(2) #16 AWG
HOUSING MATERIAL	NORYL SE O
WEIGHT	
WE77/Ex1-UL	13.5 oz.
WE77/Ex2-UL	14.5 oz.
APPROVED FOR	Class I, II, III; Division 1 and 2; Groups A-G Hazardous Locations

Technical Data

SUPPLY VOLTAGE	120VAC,-15%+10%/45-60Hz*
The supply is isolated from the input and output	
POWER CONSUMPTION	approximately 3.5VA
INPUT	Intrinsically Safe follows FM Approval Standard No. 3610 and all European Standards
The input is isolated from the output and supply	
OPEN CIRCUIT VOLTAGE	approximately 8VDC
SHORT CIRCUIT CURRENT	approximately 8mA
SWITCHING POINT (S)	1.2mA≤S≤2.1mA (1.7mA typical)
RELAY OUTPUT	SPDT
The output is isolated from the supply and input	
AC RATING	Max. Voltage ≤240VAC Max. Current ≤4A Max. Power ≤500VA/cos ϕ ≥.75
DC RATING	110V/0.2A 60V/0.5A 24V/1.0A
MAX. SWITCHING FREQUENCY	10Hz
RESPONSE TIME	Energize approximately 20mS De-energize approximately 10mS

*Other voltages available upon request.

Operation

Mode Condition

Standard pre-set A-mode: Output energizes with input resistance low.

R-mode option: Output energizes with input resistance high.

RS-mode option: R-mode with lead breakage monitoring of the input.

Lead Breakage Monitor

Additional circuitry monitors the input current.

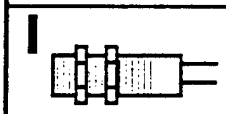
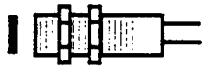
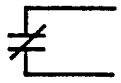
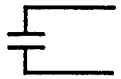
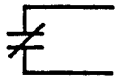
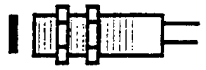
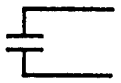
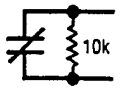
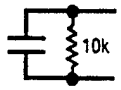
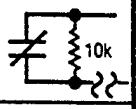
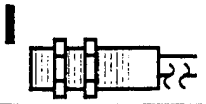
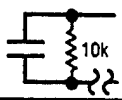
Output de-energizes if current falls below 150μA.

Changing the Mode of Operation

	Single Channel	Dual Channel
Mode of Operation	**Jumper at Terminals**	**Jumper at Terminals**
A-mode	3 and 4	2 and 3, 7 and 8
R-mode	4 and 5	3 and 4, 6 and 7
RS-mode	no jumper	no jumper

Functional Diagram

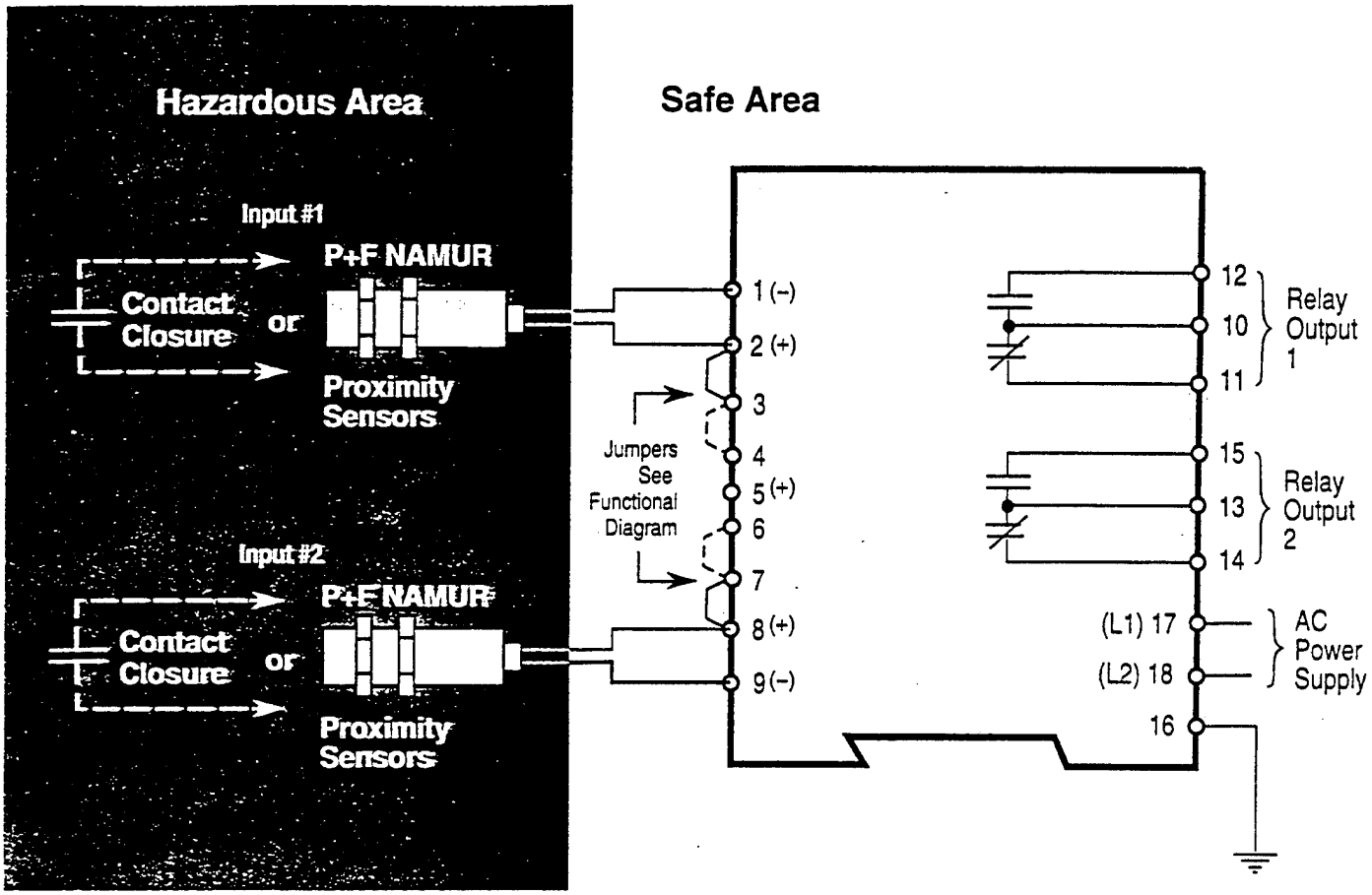
A, R and RS mode
(comparison between NAMUR inductive,
NAMUR capacitive sensor and contact closure).

INPUT			Mode of Operation	Output	LED
NAMUR Inductive Sensor	NAMUR Capacitive Sensor	Contact Closure			
			A	*ON*	*ON*
				OFF	OFF
			R	OFF	OFF
				*ON*	*ON*
			RS regular operation	OFF	OFF
				*ON*	*ON*
			RS lead breakage	OFF	OFF
				OFF	OFF

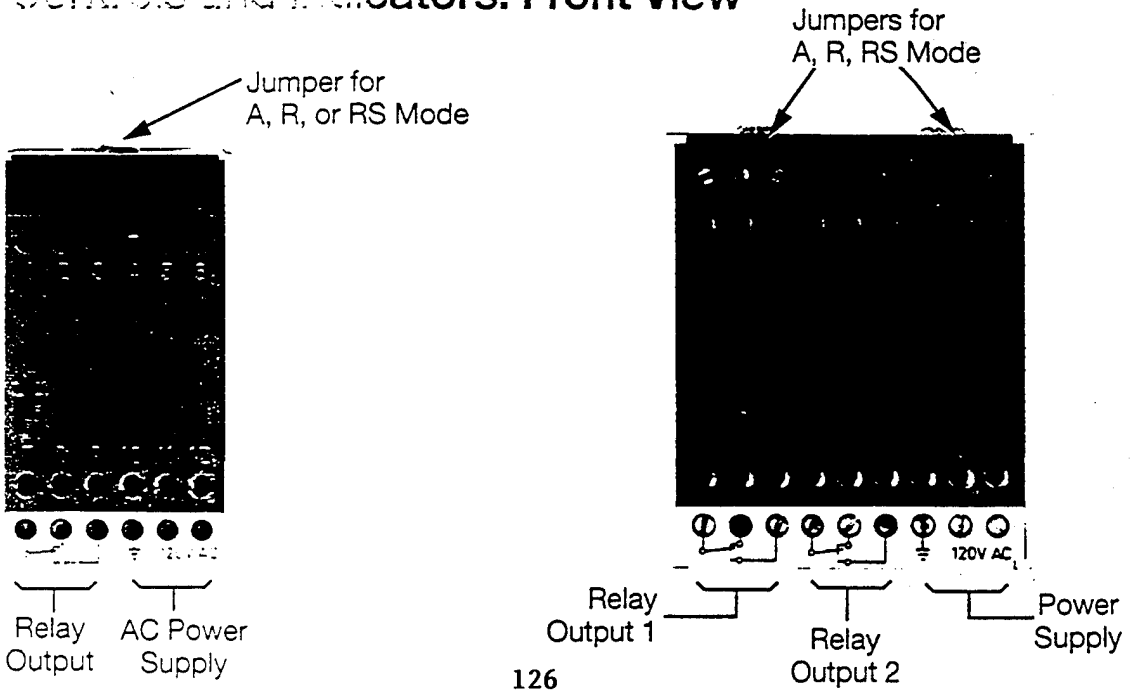
When lead breakage monitoring of a contact closure is desired, the resistor shown **must** be connected at the contact closure for proper results.

Connection Diagram

WE77/Ex2-UL

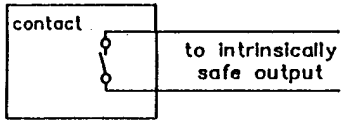


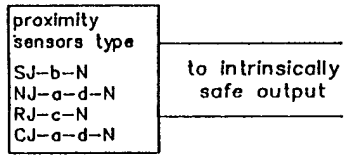
Operating Controls and Indicators: Front View



HAZARDOUS LOCATION

CLASS I, DIVISION 1, GROUPS A, B, C, D AND
CLASS II, DIVISION 1, GROUPS E, F & G
CLASS III



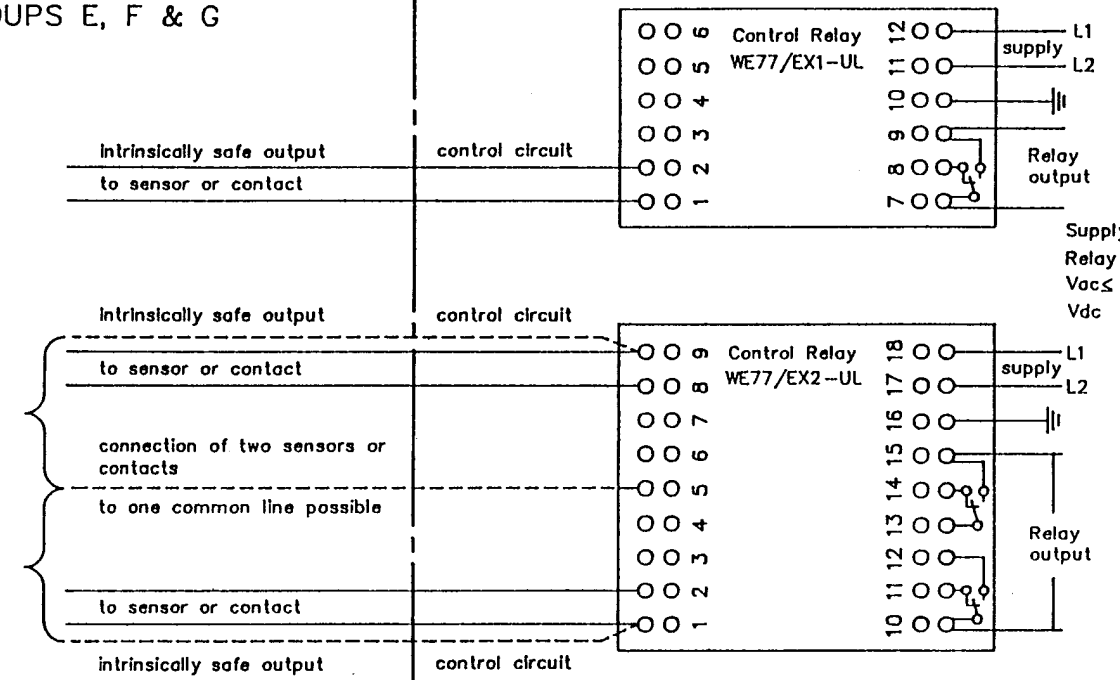


a– sensing range (mm)
b– slot width (mm)
c– ring diameter (mm)
d– mechanical form

Maximum capacitance of each sensor 0.4 microfarads, maximum inductance of each sensor 1.0 millihenry.

* The total series inductance and the shunt capacitance for the field device and cable must be restricted to the following max. values (per terminal pair)

Control Relay	Groups	Max. Inductance, * (millihenries) in series w/Terminals				Max. Capacitance, * (microfarads) across Terminals			
		1&2	8&9	1&5	5&9	1&2	8&9	1&5	5&9
WE77/EX1-UL	A and B	175	–	–	–	4.15	–	–	–
	C	525	–	–	–	18.45	–	–	–
	D	1400	–	–	–	35.1	–	–	–
WE77/EX2-UL	A and B	96	96	96	96	4.15	4.15	4.15	4.15
	C	288	288	288	288	18.45	18.45	18.45	18.45
	D	768	768	768	768	35.1	35.1	35.1	35.1



NON HAZARDOUS LOCATION

Supply 110 VAC as unit label
Relay output (each changeover contact)
Vac≤ 240V, ≤ 4A, ≤ 500VA, cosφ≥ .75
Vdc 110V, .2A
60V, .5A
24V, 1A

ILL.2
SEC.1
VOL.1
E 106378

No changes without prior UL approval

NOTE: Proximity sensors are not a part of the UL listed system

In.	Date	Cons.	Resp.	Sale	Appr.	Change from	Change into
a							Added –UL to all model numbers
0	2-1-89						
a	4-18-89	M.Gl.	Cl		DS		

Scale –
Vendor
Dimens –

Title INSTALLATION DWG. FOR CONTROL RELAYS WE77/EX1–UL, WE77/EX2–UL

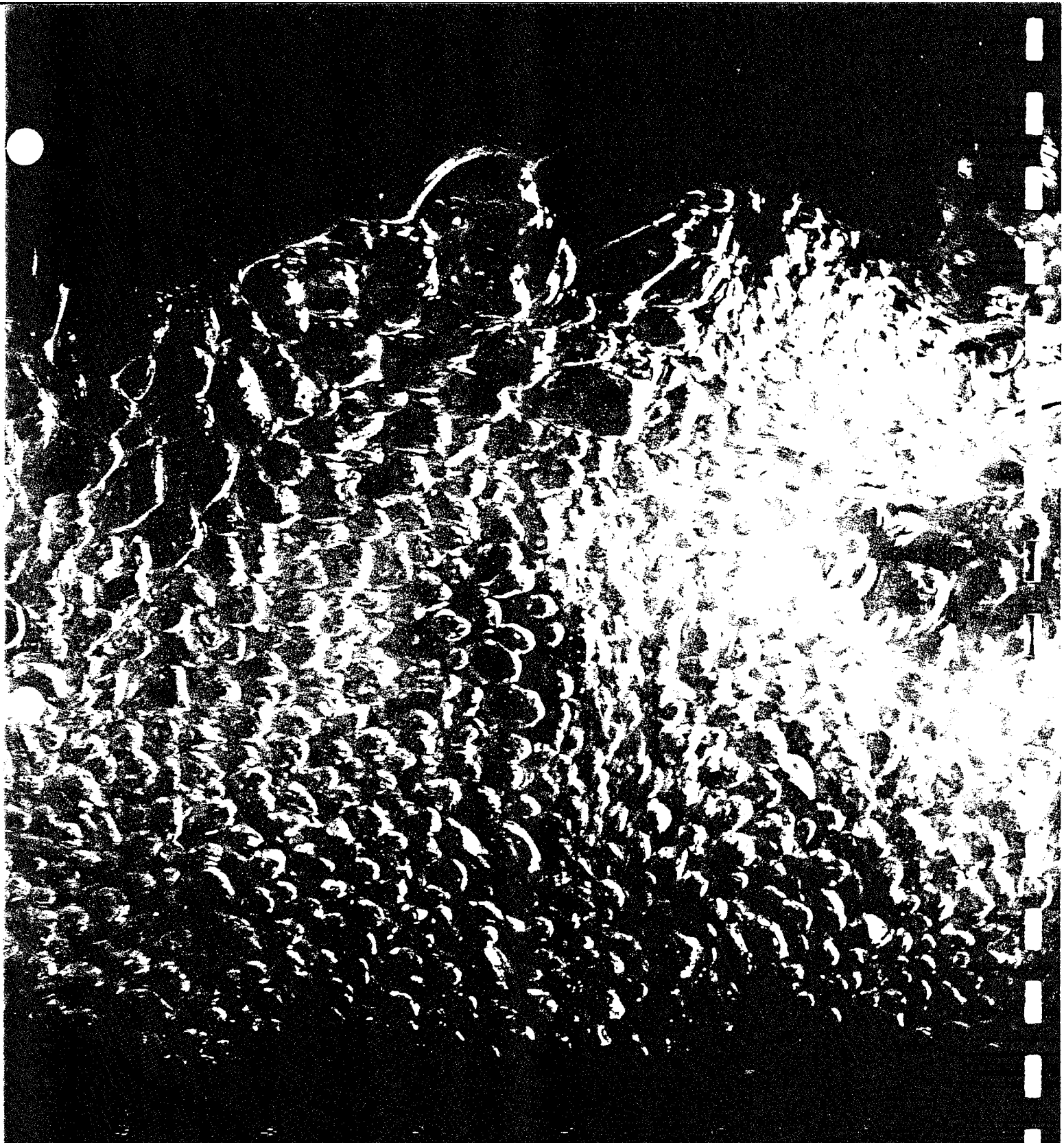
Drawing No. ID–15a

Part list no.

Repl. for

Pepperl+Fuchs® Inc.
Twinsburg, OH 44087–2202

Sh. 1 of 1

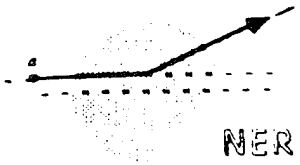


As a manufacturer of top quality
in stripping systems since 1983,
North East Environmental Products
is committed to improving water so
that it will be clean and safe for people.
Call us.

North East
Environmental Products, Inc.
17 Technology Drive
West Lebanon, NH 03784
603-298-7061
Fax: 603-298-7063

D

Sample Analytical Results



603 893-4260

NEW ENGLAND RADON, LTD.

45 Stiles Road, Suite 206
Salem, New Hampshire 03079

LABORATORY ANALYSIS

RADON IN WATER TEST

NAME: E.S.E., INC.
ADDRESS: FIVE OVERLOOK DRIVE
AMHERST, NH 03031

DATE: JUNE 14, 1995

TEST SITE: USAFS/AIR STRIPPER
BLDG. 107

ID #	Sample No.	RESULTS pCi/l	SOURCE
ESE-1-I	592958	93,593	• INLET PORT TO STRIPPER JUNE 13, 1995; 11:25 AM EDT
ESE-2-I	465191	144	• OUTLET PORT OF STRIPPER JUNE 13, 1995: 11:30 AM EDT
ESE-3-I	421562	<100	• OUTLET PORT OF STRIPPER JUNE 13, 1995: 12:25 PM EDT
ESE-3-D	421799	138	• OUTLET PORT OF STRIPPER JUNE 13, 1995: 12:25 PM EDT (DUPLICATE)

USAF New Boston Station
NEW 80 gpm AIR STRIPPER.
SAMPLES COLLECTED BY DAN BERUBE/ESE.
ANALYSIS BY LIQUID SCINTILLATION
PRELIMINARY - Kevin Alexat/ESE 6/15/95

FAX TRANSMITTAL # of Pages 1
TO: J. ESPOSITO
CO: ESE
DEPT.

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