BAE SYSTEMS, BUILDING 2
GREENLAWN, NEW YORK

SUB SLAB VAPOR MITIGATION SYSTEM

OPERATION, MONITORING, AND MAINTENANCE MANUAL

SUBMITTED TO:

New York State Department of Environmental Conservation
Department of Environmental Remediation
625 Broadway
Albany, New York 11207

ON BEHALF OF:

BAE Systems
Greenlawn, New York

PREPARED BY:

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PWGC Project Number: BAE1102

NOVEMBER 2013

PWGC
Strategic Environmental Engineering Solutions

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LIST OF ACRONYMS

BAE	BAE Systems, Inc.
BMS	Building management system
DCE	Dichloroethylene
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	Operation, monitoring, and maintenance
PCE	Tetrachloroethylene
PWGC	P.W. Grosser Consulting, Inc.
RCRA	Resource Conservation and Recovery Act
SSVM	Sub-slab vapor mitigation
TCE	Trichloroethylene
VFD	Variable frequency drive
VOC	Volatile organic compound

1.0 INTRODUCTION

P.W. Grosser Consulting, Inc. (PWGC) has prepared this operation, monitoring, and maintenance (OM&M) manual on behalf of BAE Systems, Inc. (BAE) for the sub-slab vapor-mitigation (SSVM) system at Building 2 of the BAE campus in Greenlawn, New York. The SSVM system is in place to mitigate chlorinated volatile organic compounds (VOCs) detected in the sub-slab soil vapor. The system was installed in response to actions taken by the New York State Department of Environmental Conservation (NYSDEC) that resulted in the BAE site being added to the State's Legacy Site Listing (Site Code 1-52-005).

1.1 Site Description

BAE Building 2 is one of five (5) main buildings located at the BAE facility, which covers approximately 23 acres in Greenlawn, New York. The facility is located southeast of the intersection of Cuba Hill Road and the Port Jefferson Branch of the Long Island Railroad. Building 2 is located on the east side of Cuba Hill Road. A Vicinity Map is included as **Figure 1** and a Site Facility Map is included as **Figure 2**.

1.2 Site History

Chlorinated VOCs, specifically tetrachloroethylene (PCE), are present in shallow soils beneath the former Alodine Room. The presence of the PCE was documented in the early 1990s during a Resource Conservation and Recovery Act (RCRA) closure of the Alodine Room by BAE's predecessor, Hazeltine Corp. The conditions at the site were known to the NYSDEC at that time but the only required action was an application of an epoxy floor coating in the Alodine Room to prevent exposure to the VOCs.

The New York State Department of Health (NYSDOH) changed their guidance policy regarding the potential for soil vapor intrusion in 2006. As a result, the NYSDEC required BAE peform further investigation. In March and April of 2010, the NYSDEC performed an investigation in and around Building 2 to evaluate subsurface conditions. The investigation confirmed the presence of soil vapor conditions beneath portions of the Building 2 floor slab that, when compared to NYSDOH soil vapor criteria, would require mitigation measures to prevent the potential for migration of the soil vapors into the occupied building space.

BAE voluntarily performed an extensive investigation in order to define the extent of the soil vapor condition at Building 2 and designed a mitigation measure to prevent vapors beneath the

slab from entering the occupied space. The following sections describe the steps required to maintain the system during its operational life.

2.0 SYSTEM DESCRIPTION

2.1 System Overview

The SSVM system was designed and installed in 2013 to prevent sub-slab vapor from entering the occupied space within Building 2. The system consists of four independent vacuum blowers that create a negative pressure gradient in the sub-slab environment of Building 2 through four separate vacuum extraction pits. Each system is comprised of an SSVM pit beneath the building slab and piping connected to a dedicated roof-mounted blower unit. The vapor is ultimately discharged to the outside air from four exhaust stacks above the roof.

The primary components for each SSVM system include the following:

- Vapor extraction pit
- Riser pipe and lateral piping
- Regenerative blower assembly
- Variable frequency drive (VFD)
- Instrumentation and controls

Each blower system has local and remote monitoring capabilities tied to BAE's building management system (BMS). Variable frequency drives operate the blower's electric motors, allowing the vacuum and flow rate produced by the blower to be adjusted manually or remotely via the BMS. Each individual blower system is operated at a vacuum and flow rate that has been field-calibrated to provide the required radius of influence to prevent sub-slab vapor from entering the occupied space of the building. The BMS monitors the vacuum at each process stream to provide operating consistency and to shut the system down in the case of a failure. In the event of a failure, an alarm notification is generated. Alarm notifications are transmitted to designated BAE personnel.

The SSVM system as-built drawings are included in **Appendix A**.

Photographs of the system construction are included as **Appendix B**.

Manufacturer's information for each system component is included as **Appendix C**.

2.2 Vapor Extraction Pits

The four vapor extraction pits were constructed as shown on Sheet 3 of the as-built drawings in **Appendix A** and in the photos in **Appendix B**. Each pit is a 3-foot-by-3-foot square and is 1-foot deep, lined with a prefabricated steel box, and sealed with low-VOC elastomeric sealant and a 15-mil vapor barrier. The excavation for each pit is oversized by a few inches and the remaining space is backfilled with crushed stone aggregate. Each pit is sealed beneath a 4-inch thick concrete slab.

A 4-inch diameter galvanized steel riser pipe connects from the sub-grade pit to the roof-mounted blower unit, passing through the building's interior space and penetrating the roof of the building. The riser pipe is described on Sheet 2 and shown on Sheet 3 of the as-built drawings in **Appendix A**.

2.3 Vacuum Blowers

Each of the four SSVM systems includes a two-horsepower Ametek Rotron regenerative vacuum blower housed in a steel weatherproof enclosure. The blower assemblies were fabricated off-site by Gasho, Inc. of Chester, Pennsylvania, and include the instrumentation and controls described in the next section. The vacuum blower assembly is shown on Sheet 3 and the locations are shown on Sheet 4 of the as-built drawings in **Appendix A**. Photos of the system components are included in **Appendix B**. The manufacturer's information for the blowers is included in **Appendix C**.

2.4 Instrumentation and Controls

Each roof-mounted blower enclosure contains an identical instrumentation and control system. The system contains a vacuum gauge and transmitter, a flow meter with transmitter, a differential pressure transmitter, a thermometer, and a pressure gauge. The enclosure also includes a dilution valve, vacuum relief valve, and a sampling port.

The exhaust stack, attached to the outside of the enclosure, includes valves to allow exhaust to be diverted to a carbon treatment system, if necessary.

The vacuum transmitter, flow rate transmitter, and differential pressure transmitter each communicate with the VFD and ultimately the BMS. All parameters can be checked manually at the blower assembly or remotely through the BMS.

Each vacuum blower system is operated by an individual VFD. The operating speeds of the VFDs were adjusted during initial start-up so that the blower systems provide complete coverage of

Building 2 while operating most efficiently. The BMS is programmed with adjustable alarm set points that indicate if the vacuum blower systems are functioning outside of the field-calibrated operating parameters. The BMS is programmed to provide an alarm to alert facilities management personnel if the system is running outside of its normal operating range.

The electrical system and the process & instrumentation diagram for the gauges and controls are shown on the as-built drawings in **Appendix A**. Photos of one of the blower enclosures and the four VFDs are included in **Appendix B**. The manufacturer's information for each system component is included in **Appendix C**.

3.0 OPERATIONS AND MAINTENANCE

3.1 System Startup

Before the initial system startup, the following was performed separately for each of the four SSVM systems, and then for the full remediation system:

- Confirm that all components have been constructed and installed as designed,
- Check that the equipment operates as specified,
- Facilitate modifications to the system based on observations, and
- Gather and evaluate initial operational data.

For a full description of startup activities, please refer to the *SSVM Startup Report*, September 2013, PWGC.

3.2 System Start-Up/Full-Scale Demonstration

Prior to the start of operations, baseline sub-slab pressures were measured in each of the 16 sub-slab monitoring points (10 permanent and 6 temporary) with a digital manometer. The vacuum blower systems were brought on-line one at a time and vacuum readings were taken from all monitoring points. Communication testing continued while the individual blower systems' flow rates were balanced. The motor speeds were adjusted and optimized until the SSVM was able to provide optimal coverage of Building 2.

Table 1 below shows the optimal settings for each SSVM system and the normal operating ranges.

Table 1 – SSVM Settings and Operating Ranges

Parameter	SSVM 1 Model Shop	SSVM 2 Oracle Training	SSVM 3 Tool Crib	SSVM 4 Facilities Storage
VFD Frequency	50 Hz	45 Hz	45 Hz	30 Hz
Motor Speed (at VFD)	2900-3100 rpm	2500-2700 rpm	2500-2700 rpm	1650-1850 rpm
Current (at VFD)	4.5-4.7 A	4.4-4.6 A	4.6-4.8 A	2.7-2.9 A
Temperature (at blower)	<130 F	<130 F	<130 F	<130 F
Vacuum (at Blower)	-34 to -42 in. W.C.	-23 to -29 in. W.C.	-18 to -22 in. W.C.	-21.5 to -26.5 in. W.C.

Hz Hertz
Rpm Revolutions per minute
A Amps
In. W.C. Inches of Water Column

3.3 Routine OM&M

Annual OM&M visits should be conducted to assess the operation of the system. OM&M visits will consist of inspecting the system for physical damage and documenting parameters listed above in **Table 1**.

The inspection for physical damage should include a thorough inspection of all electrical and mechanical connections at each pit, blower enclosure, and at the VFDs.

SSVM settings and operating parameters should be documented on a System Monitoring Form, included in **Appendix D**, to track the performance from year to year. If any parameters are outside of the operating ranges listed in **Table 1**, the engineer should be called to assess the situation.

System OM&M inspection forms detailing the system performance will be prepared on an annual basis and maintained in BAE files.

3.4 System Shutdown

The system will remain in place and operational until it is no longer needed to address potential exposures related to soil vapor intrusion. Prior to petitioning the NYSDEC for system closure, a complete sub-slab vapor/indoor air sampling program is required to confirm that VOC concentrations in the sub-slab vapor and indoor air yield a "No Further Action" response in the Soil Vapor/Indoor Air Matrices contained in the *New York State Department of Health Guidance*

for Evaluating Soil Vapor Intrusion in State of New York, October 2006. System shut will not occur without NYSDEC concurrence.

3.5 System De-activation and Removal

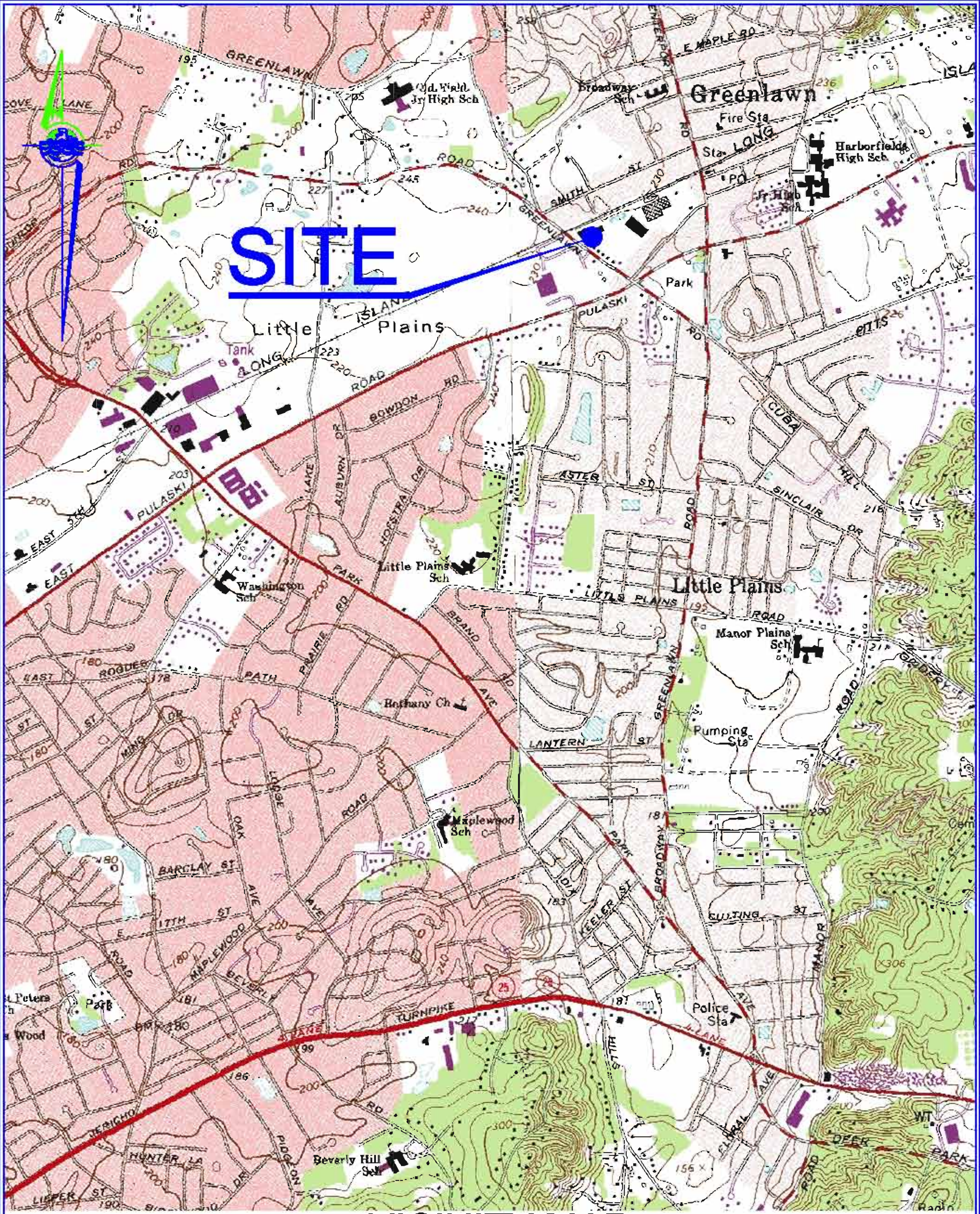
Once the determination has been made that the system may be deactivated, operation will be terminated. It is recommended that the components of the system remain in place. However, if removal of the system is appropriate, the main power to the system should be disconnected and the above-grade equipment will be removed from the building. The remaining system piping will be cut flush with grade and capped.

4.0 REPORTS

For further information on the SSVM system and the background of this site, refer to the following reports:

- *Subsurface Investigation Report and Sub-Slab Vapor Mitigation Design*, PWGC, September 2012
- *Sub-Slab Vapor Mitigation System Startup Report*, PWGC, September 2013

FIGURES



Mapped, edited, and published by the Geological Survey
Revised in cooperation with New York
Department of Transportation
Control by USGS, USC&GS, and New Jersey Geodetic Survey

VICINITY MAP

SCALE: 1:24000

J:\Projects A-D\BAE - BAE Systems\BAE 0902\cad\Vicinity Map.dwg (8x11V) Sep 28,2010-10:27am By: guzman

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450 E. PULASKI ROAD
GREENLAWN, NY

Project: BAE0902	Figure No: 1
Designed by: RWW	
Approved By: PWG	
Drawn By: LLG	Date: 10/20/09

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DATA SOURCE:
ESRI: 2010 BING MAPS

DRAWINGS PREPARED FOR:

REVISION	DATE	INITIAL	COMMENTS

DRAWING INFORMATION:

PROJECT:	BAE1102	APPROVED BY:	
DESIGNED BY:	IB	DATE:	1/18/2012
DRAWN BY:	IB	SCALE:	AS SHOWN

SHEET TITLE:

BAE SYSTEMS
BUILDING 2

5 CUBA HILL ROAD
GREENLAWN, NY 11740

FIGURE NO:

2

SHEET:

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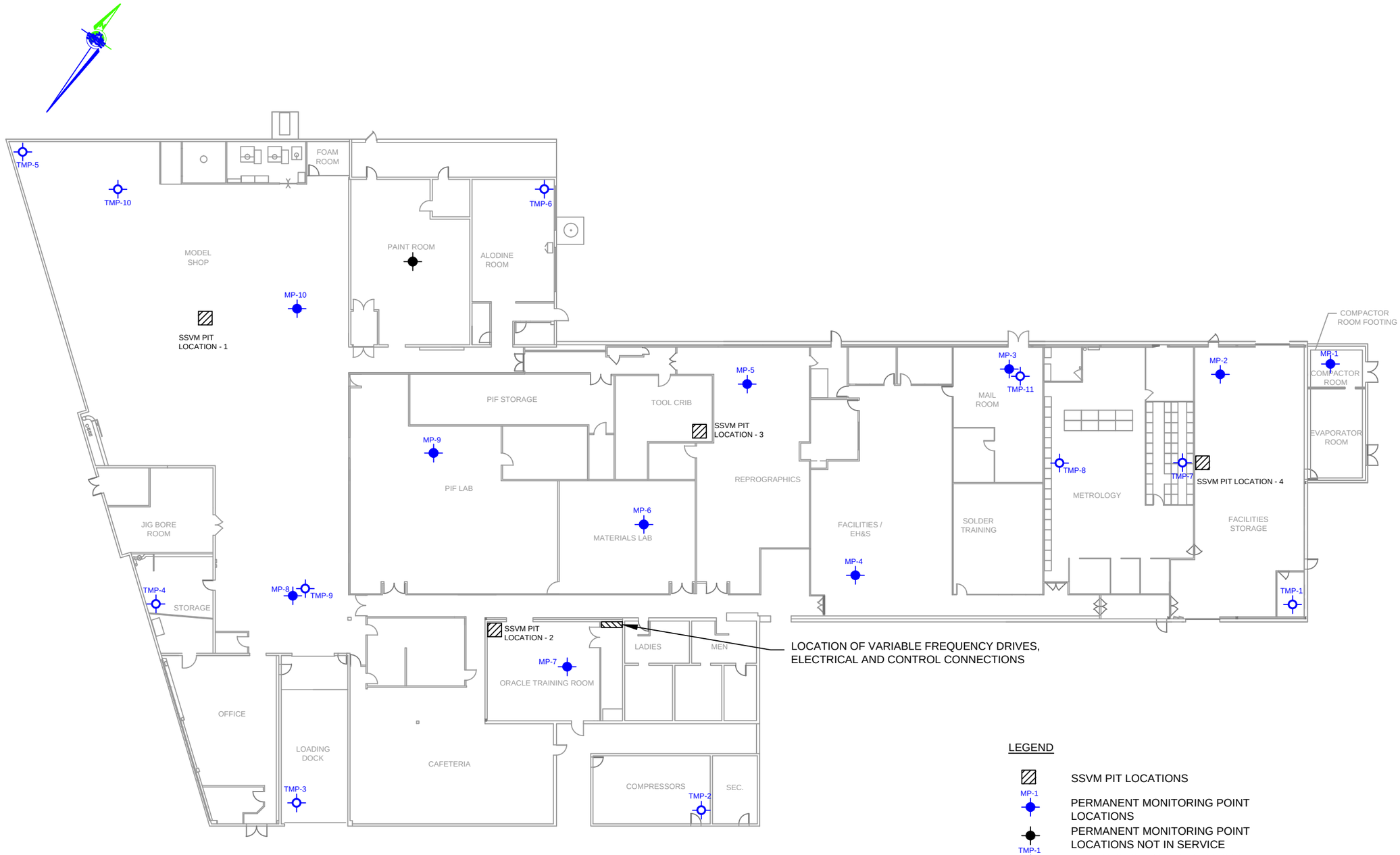
APPENDIX A

SSVM AS-BUILT DRAWINGS



LEGEND

- SSVM PIT LOCATIONS
- MP-1 — PERMANENT MONITORING POINT LOCATIONS
- PERMANENT MONITORING POINT LOCATIONS NOT IN SERVICE
- TMP-1 — TEMPORARY MONITORING POINT LOCATIONS FOR START-UP

FLOOR PLAN
GROUND FLOOR

SCALE: 1" = 30'

0 30 60

SCALE: 1" = 30'

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BUILDING 2
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REVISION	DATE	INITIAL	COMMENTS

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DESIGNED BY:	DH	DATE:	10-4-13
DRAWN BY:	AES	SCALE:	AS SHOWN

SHEET TITLE

SUB SLAB VAPOR MITIGATION SYSTEM START-UP

PIT AND MONITORING POINT AS-BUILT LOCATIONS

FIGURE NO 1

SHEET 1 OF 6

CONTRACTOR NOTES:

1. THE EXISTENCE AND LOCATION OF AERIAL, SURFACE OR SUBSURFACE UTILITIES IS NOT SHOWN ON THESE PLANS.

2. SELECTION OF PIT LOCATIONS, PIPE ROUTES AND ROOF PENETRATIONS TO BE DETERMINED BY BAE.

3. THE CONTRACTOR SHALL BE SOLELY AND DIRECTLY RESPONSIBLE TO THE OWNER AND OPERATORS OF SUCH PROPERTIES FOR ANY DAMAGE, INJURY, EXPENSE, LOSS, INCONVENIENCE, DELAY, LITIGATION, SUITS, ACTIONS, OR CLAIMS OF ANY CHARACTER STEMMING FROM THE CONSTRUCTION OPERATIONS UNDER THIS CONTRACT.

4. EXCAVATIONS SHALL BE DUG BY HAND.

5. COST OF RESTORATION OF WORK AREA AND AREAS AFFECTED BY OR DISTURBED BY CONTRACTOR SHALL BE INCLUDED IN THE BID.

6. CONTRACTOR RESPONSIBLE FOR PERFORMING ALL WORK IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

EXCAVATION PROCEDURE AND LIMITS:

1. ALL UTILITIES ENCOUNTERED SHALL BE DEEMED ACTIVE AND SHALL BE SUITABLY PROTECTED BY THE CONTRACTOR, OR THE LOCATION OF THE PIT MAY BE ADJUSTED UPON APPROVAL BY THE ENGINEER AND OWNER.

2. THE CONTRACTOR SHALL IMMEDIATELY REPAIR EXISTING UTILITIES WHICH ARE TO REMAIN AND THAT ARE DAMAGED BY THE CONTRACTOR'S OPERATIONS. SUCH REPAIRS SHALL BE MADE BY QUALIFIED PERSONNEL WITH NEW MATERIALS USING METHODS WHICH ARE SUITABLE FOR THE ORIGINAL UTILITY CHARACTERISTICS, AND WHICH COMPLY WITH ALL CODES, ORDINANCES, AND UTILITY COMPANY REGULATIONS. THE CONTRACTOR SHALL SUBMIT A PROPOSAL TO THE ENGINEER / OWNER FOR REPAIR OF ANY UTILITIES ENCOUNTERED DURING EXCAVATION.

DISPOSAL OF EXCESS AND UNSUITABLE EXCAVATION MATERIALS:

1. DISPOSE OF ALL EXCESS AND UNSUITABLE EXCAVATED MATERIAL. ANY EXCESS EXCAVATION MATERIAL TO BE LEGALLY DISPOSED OF OFF SITE. CONTRACTOR SHALL MAKE HIS OWN ARRANGEMENTS FOR THE DISPOSAL OF THE EXCAVATED MATERIAL AND BEAR ALL COSTS OR RETAIN ANY PROFIT INCIDENTAL TO SUCH DISPOSAL. THE EXCAVATION SHALL CONFORM TO OSHA AND OTHER LOCAL CODES THAT MAY APPLY.

2. GIVEN THE NATURE OF THE SITE, IT IS POSSIBLE THAT THE EXCAVATED SOIL / DEBRIS MAY BE CONTAMINATED. CONTRACTOR SHALL SEGREGATE CONCRETE DEBRIS FROM EXCAVATED SOIL AND ARRANGE FOR ALL TESTING OF AND PROPER DISPOSAL OF ALL EXCAVATED MATERIAL / DEBRIS.

DISPOSAL OF DEMOLITION / CONSTRUCTION MATERIAL:

1. PROPERLY DISPOSE OF ALL DEMOLITION AND CONSTRUCTION MATERIAL OFF-SITE. CONTRACTOR SHALL MAKE HIS OWN ARRANGEMENTS FOR THE DISPOSAL OF THE MATERIAL AND BEAR ALL COSTS OR RETAIN ANY PROFIT INCIDENTAL TO SUCH DISPOSAL.

PIPING NOTES:

1. RISER PIPE TO BE 4" DIA. GALVANIZED STEEL. JOINTS SHALL BE THREADED (NPT).

2. TOTAL LENGTH OF PIPE WILL VARY DEPENDING ON FINAL LOCATION OF BLOWER ASSEMBLIES UPON ROOF.

3. INSTALL DI-ELECTRIC COUPLINGS / BUSHINGS / TRANSITION FITTINGS AS REQUIRED.

ELECTRICAL INSTALLATIONS:

1. ELECTRICAL INSTALLATION SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH NFPA 70 - NATIONAL ELECTRIC CODE.

2. CONTRACTOR TO COORDINATE WITH OWNER FOR POWER SOURCE FOR BLOWER AND MONITORING EQUIPMENT.

3. CONTRACTOR TO COORDINATE WITH OWNER FOR PLACEMENT OF CONDUIT FOR MONITORING EQUIPMENT / POWER.

4. ALL ELECTRICAL WORK SHALL BE PERFORMED BY A LICENSED ELECTRICAL CONTRACTOR. CONTRACTOR TO PROVIDE UNDERWRITER'S CERTIFICATE FOR ALL ELECTRIC WORK.

5. ALL BLOWER CONDUCTORS TO BE 10 AWG THWN + 10 AWG THWN GROUND IN 1" RMC.

6. ALL EXHAUST FAN CONDUCTORS TO BE 14 AWG THWN + 14 AWG THWN GROUND IN $\frac{1}{2}$" RMC.

7. ALL CONTROL WIRE TO BE 20 AWG SHIELDED PVC COATED IN $\frac{1}{2}$" RMC.

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DESIGNED BY:	DH	DATE:	6-11-2012
DRAWN BY:	FM	SCALE:	AS SHOWN

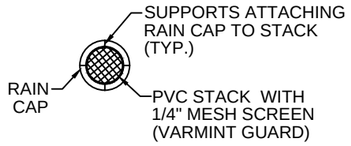
SHEET TITLE

SUB SLAB VAPOR MITIGATION

CONTRACTOR NOTES

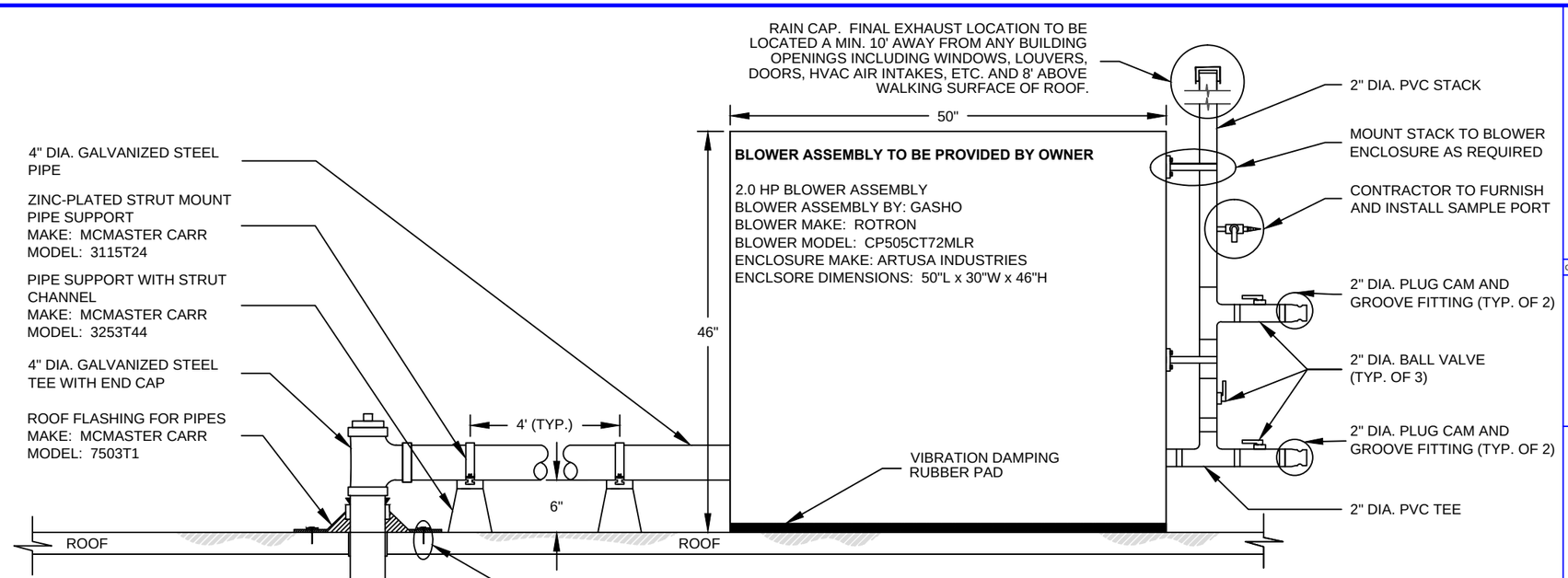
FIGURE NO 2

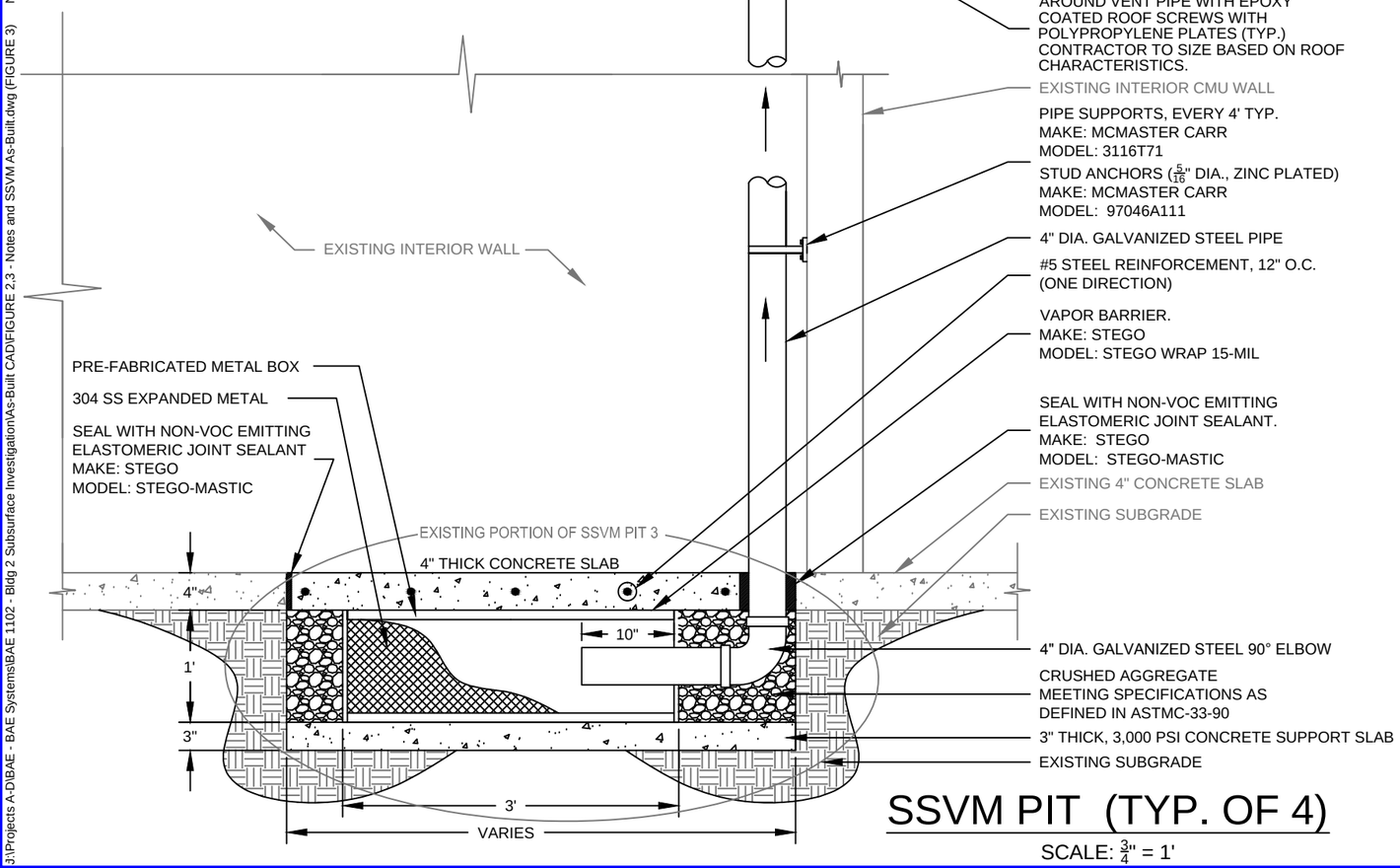
SHEET 2 OF 6



RAIN CAP

SCALE: NOT TO SCALE





SSVM PIT (TYP. OF 4)

SCALE: 3/4" = 1'

NOTE:

1. CONTRACTOR TO PROVIDE UNI-STRUT SUPPORT FOR SSVM PIT 1 VERTICAL PIPING. PROVIDE 2 VERTICAL STRUTS AND HORIZONTAL STRUTS AT 4' INTERVALS. SUPPORTS TO BE ANCHORED TO SLAB AND SUPPORTED AT ROOF TR USS.

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DRAWN BY:	FM	SCALE:	AS SHOWN

SHEET TITLE

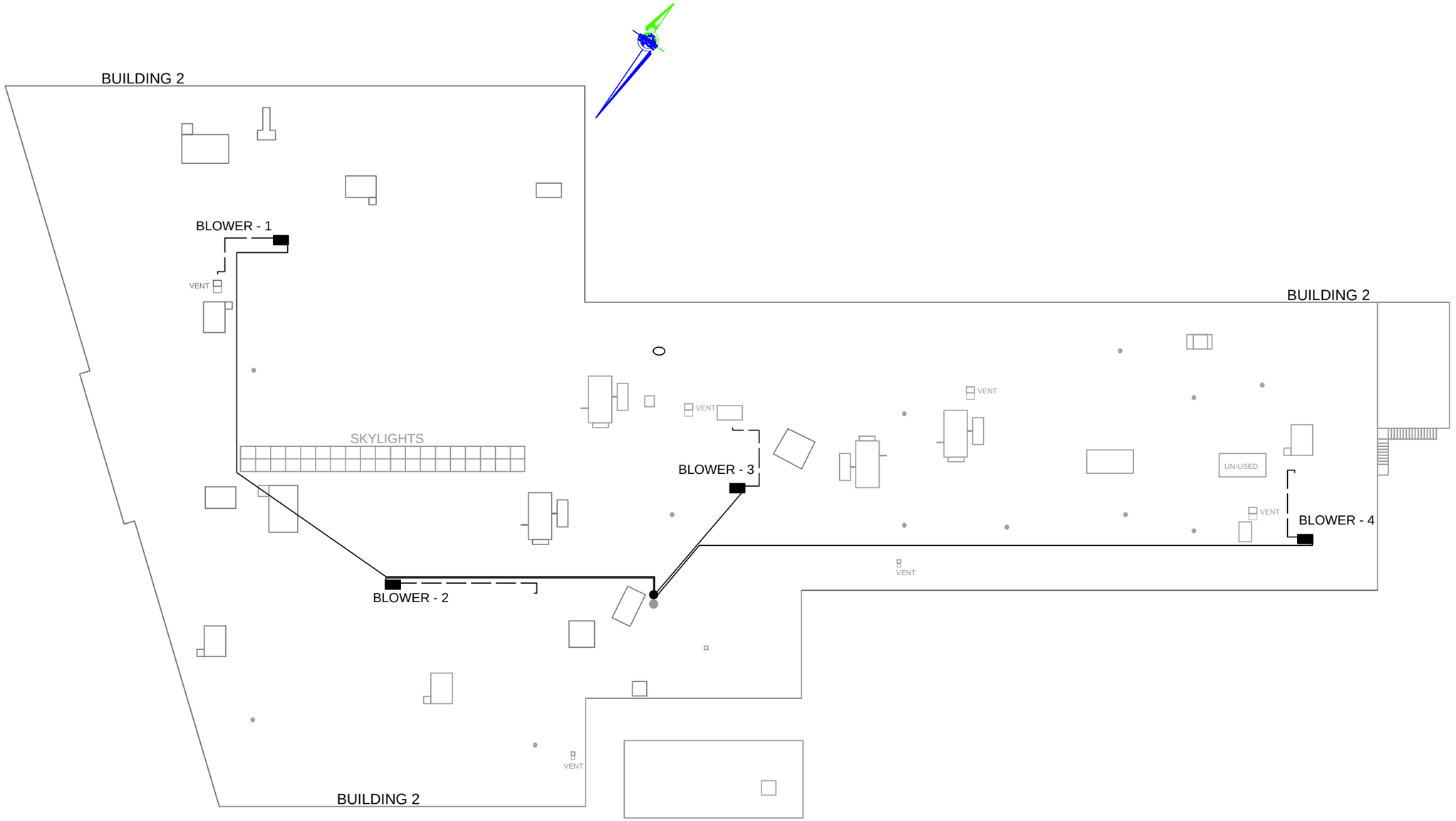
SUB SLAB VAPOR MITIGATION

SSVM AS-BUILT

FIGURE NO 3

SHEET 3 OF 6

J:\Projects A-D\BAE - BAE Systems\BAE 1102 - Bldg 2 Subsurface Investigation\As-Built CAD\FIGURE 2,3 - Notes and SSVM As-Built.dwg Nov 07,2013-6:55pm By: schweitzer



ROOF PLAN

SCALE: 1" = 30'

0 30 60

SCALE: 1" = 30'

LEGEND:

4" DIA. GALVANIZED STEEL ROOFTOP PIPING

ROOFTOP ELECTRICAL CONDUIT

ROOF-MOUNTED BLOWER ASSEMBLY

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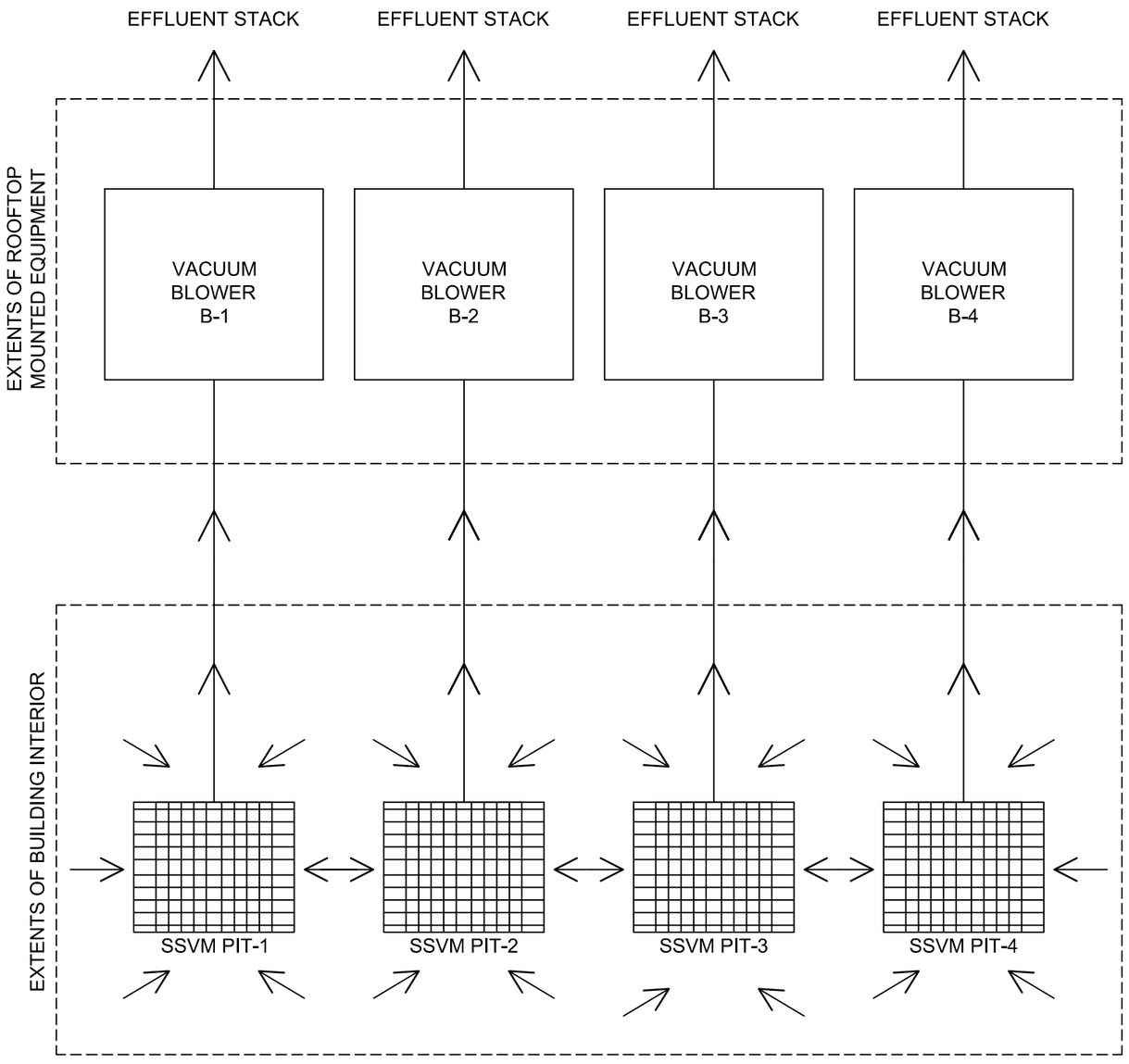
SHEET TITLE

SUB SLAB VAPOR MITIGATION

ROOF PLAN / EQUIPMENT LAYOUT AS-BUILT

FIGURE NO 4

SHEET 4 OF 6



PROCESS FLOW DIAGRAM

SCALE: NOT TO SCALE

J:\Projects A-D\BAE - BAE Systems\BAE 1102 - Bldg 2 Subsurface Investigation\As-Built CAD\Figure 5.6 - PFD and P&ID.dwg (FIGURE 5) Nov 12,2013-4:56pm By: schweitzer

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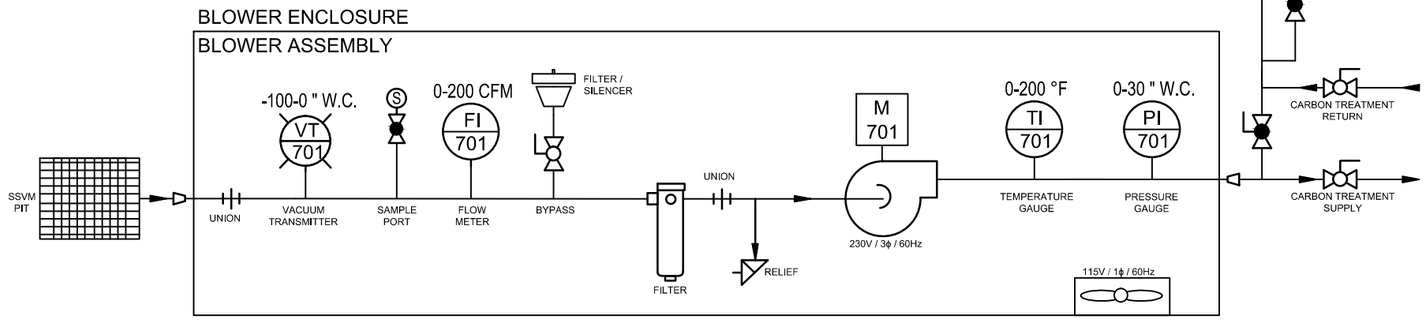
SHEET TITLE

PROCESS FLOW DIAGRAM

AS-BUILT

FIGURE NO 5

SHEET 5 OF 6



P&ID
(TYP. 1 OF 4)

SCALE: NOT TO SCALE

UNIT	RANGE	MANUFACTURER	MODEL
VT701-VT704	-100-0 " W.C.	NOSHOK	SERIES 100 - 30V
FI701-FI704	0-200 CFM	DWYER	DS-300

LEGEND

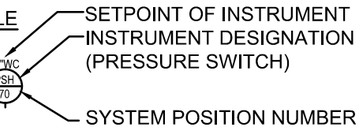
VALVES AND PIPING	NO	NC
BALL VALVE		
SAMPLE PORT		
VACUUM RELIEF VALVE		
REDUCER		
UNION		
FILTER / SILENCER		
PARTICULATE FILTER		
VENTILATION FAN		

INSTRUMENT IDENTIFICATION

INDICATING INSTRUMENT

INPUT CAUSING ALARM

EXAMPLE



EQUIPMENT

CENTRIFUGAL, REGENERATIVE BLOWER

EQUIPMENT ABBREVIATIONS

PT - PRESSURE TRANSMITTER
FI - FLOW INDICATOR
M - MOTOR
PI - PRESSURE INDICATOR
TI - TEMPERATURE INDICATOR
VI - VACUUM INDICATOR
VA- VACUUM ALARM

SYSTEM POSITION DESIGNATION

700 - SOIL VAPOR MITIGATION SYSTEM

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GREENLAWN, NY 11740

REVISION	DATE	INITIAL	COMMENTS

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PROJECT:	BAE1102	APPROVED BY:	DH
DESIGNED BY:	DH	DATE:	2-9-2012
DRAWN BY:	FM	SCALE:	NOT TO SCALE

SHEET TITLE

PROCESS & INSTRUMENTATION DIAGRAM

AS-BUILT

FIGURE NO 6

SHEET 6 OF 6

APPENDIX B

CONSTRUCTION PHOTOGRAPHS

SSVM Suction Pit with Expanded Steel Cage

SSVM Suction Pit with Surrounding Stone

SSVM Suction Pit with Vapor Barrier and Rebar

SSVM Suction Pit with New Floor

Blower #2 within Enclosure

Variable Frequency Drives

APPENDIX C

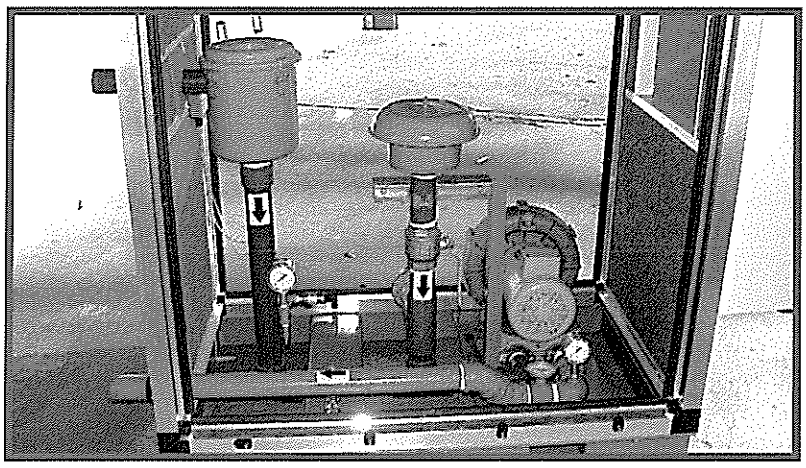
EQUIPMENT INFORMATION

Gasho
SINCE 1982

The Leader in Blower & Vacuum Solutions

460 West Gay Street

West Chester, PA 19380



P.W. Grosser Consulting, Inc.

630 Johnson Avenue, Suite 7
Bohemia, NY

P.O. PRJ #BAE-1102

Gasho Custom Package Utilizing Model CP505CT72MLR, P/N 038237, Inline Filter, Relief Valve, Gauge, Transmitter and Sound Enclosure

JG12J-2669

January 16, 2013

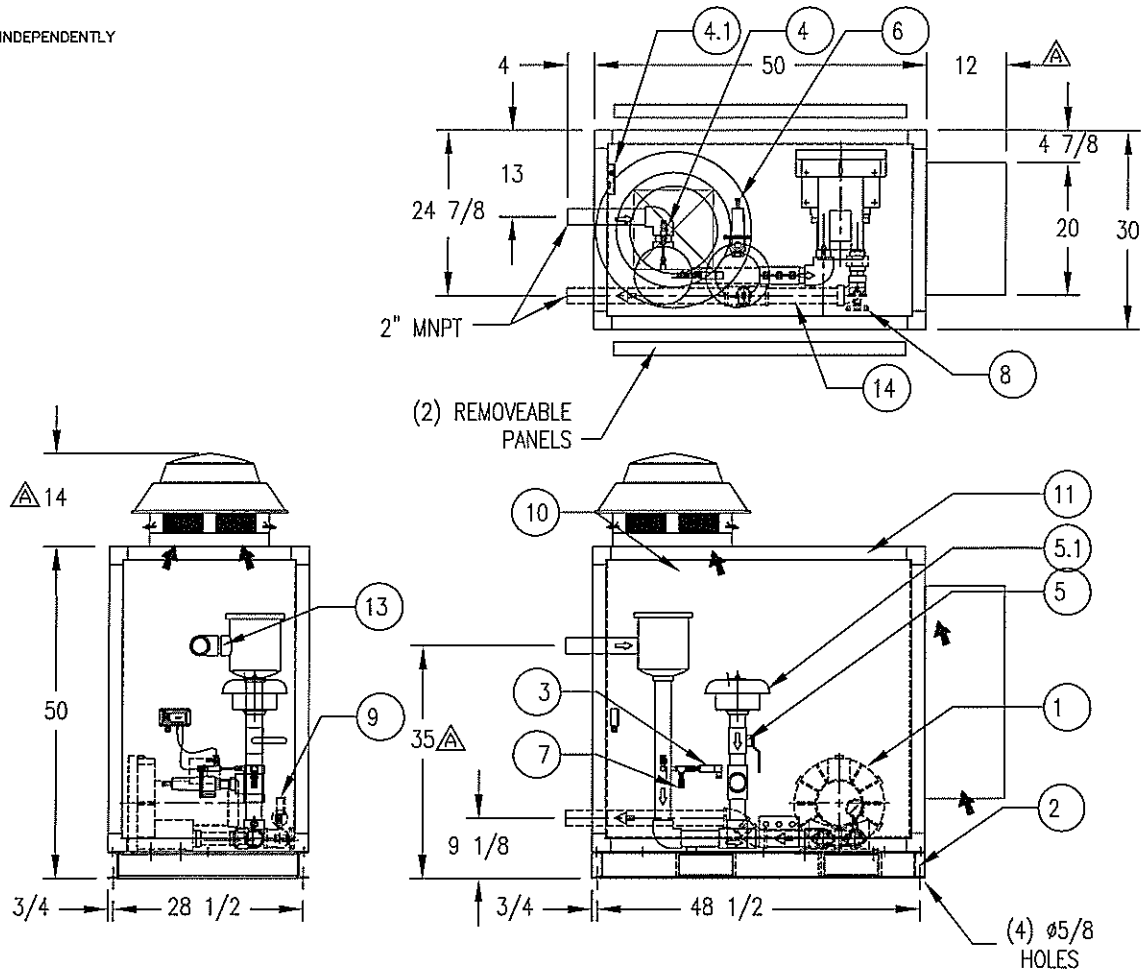
Gasho
SINCE 1952
The Leader in Blower & Vacuum Solutions

Gasho, Inc.
JG12J-2669
Blower Package with Enclosure
4 Identical Units

Description	Date	Revision

Item	Qty.	Supplier	Description	Part Number	Misc ID	Weight
1	1	Ametek Rotron	Regenerative Blower w/vfd	CP505CT72MLR	P/N 038237	82
2	1	Gasho	Base	1100-C-9327		200
3	1	Noshok	Vacuum transmitter	100-30V-1-1-2-7		2
3.1	1	Gasho	Vacuum Gauge	25.0.012.HG.120.IWC		2
3.2	1	SMC Specialties	Isolation valve	VA BRS 025-4F4M-BT		1
4	1	Dywer	Flow meter with transmitter	DS-300-2		4
4.1	1	Dwyer	Differential Pressure Transmitter	677B-07	0-10" WC	6
5	1	Gasho	2" Dilution Valve	64-108-01		7
5.1	1	Westwood	2" Inlet Filter/Silencer	EMSP-2 with paper element	Element GA-0471	8
6	1	Fisher	Vacuum Relief Valve	289H-41		12
7	1	SMC Specialties	Sample Port	VA BRS 025-4F4B-BT		1
8	1	Gasho	Bi-Metal Thermometer	30.110.025-0/250 deg. F		1
9	1	Gasho	Pressure Gauge	25.0.060.IWC		2
9.1	1	SMC Specialties	Isolation valve	VA BRS 025-4F4M-BT		1
10	1	Solberg	Inline Filter	CSL-851-200HC		15
11	1	Artusa	Enclosure	50" x 30" x 46"		240
12			ODP fan 230/460/3/60			
13	1	Gasho	Piping, inlet	2"	Sched 80 PVC	10
14	1	Gasho	Piping, discharge	2"	Sched 40 Steel	12
				Total Weight		606

NOTES:
1. CUSTOMER PIPING TO BE INDEPENDENTLY SUPPORTED
2. TOLERANCE ± 1/2"



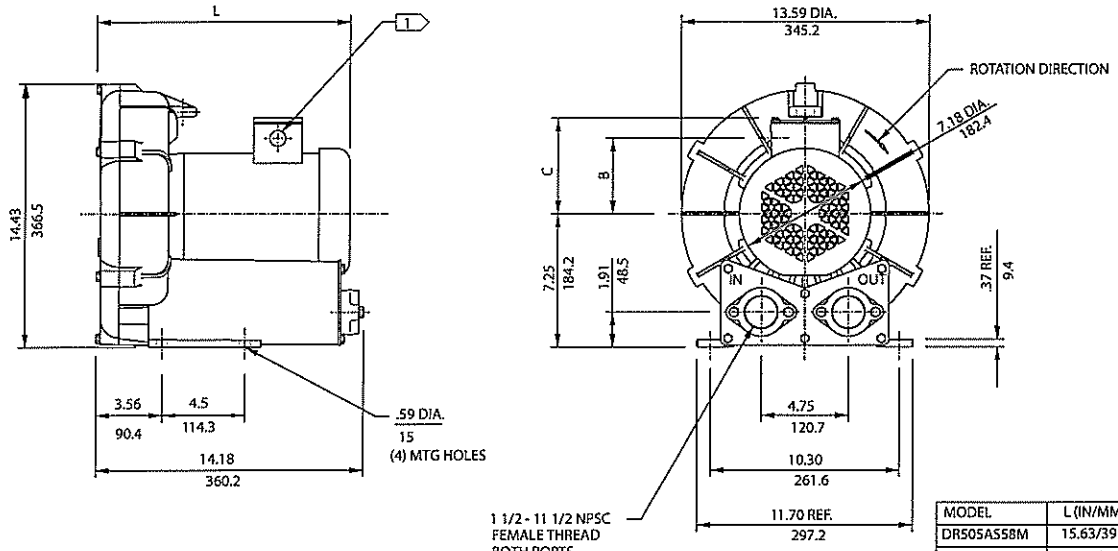
			DRAWN BY: JJH	DATE: 10/30/12	J.E.GASHO & Assoc., Inc. 460 W. GAY ST. WEST CHESTER, PENNSYLVANIA 19380
			APPROVED BY:	DATE:	
			DIMENSIONS IN INCHES		BLOWER SYSTEM CP505CT72MLR WITH ENCLOSURE
			SCALE:		
			TOLERANCE: ±1/2"	ANGULAR TOLERANCE:	
			MATERIAL:	WEIGHT:	
A	11/28/2012	UPDATED SND ENCL	SHEET 1 OF 1		JG12-J-2669 A
REV.	DATE	DESCRIPTION			

ENCLOSURE AIR FLOW
AIR – DISCHARGE
AIR – INLET

DR 505 & CP 505

ROTRON®

2.0 / 3.0 HP Regenerative Blower



IN
MM

MODEL	L (IN/MM)	B (IN/MM)	C (IN/MM)
DR505AS58M	15.63/397	4.63/117	5.64/143
DR505AS72M	14.75/374	4.25/108	5.25/133
DR505AS86M	14.38/365	4.37/111	5.18/131
DR505K58M	17.0/431	4.63/117	5.64/143
DR505K72M	15.63/397	4.37/111	5.18/131

NOTES
1. TERMINAL BOX CONNECTOR HOLE .88 (22) DIA.
2. DRAWING NOT TO SCALE, CONTACT FACTORY FOR SCALE CAD DRAWING.
3. CONTACT FACTORY FOR BLOWER MODEL LENGTHS NOT SHOWN.

		Part/Model Number						
		DR505AS58M	DR505AS72M	DR505AS86M	DR505K58M	DR505K72M	CP505FE72MLR	CP505CT72MLR
Specification	Units	037542	037543	037544	081882	037551	038239	038237
Motor Enclosure - Shaft Mtl.	-	TEFC - CS	TEFC - CS	TEFC - CS	TEFC - CS	TEFC - CS	Chem TEFC - SS	Chem TEFC - SS
Horsepower	-	2.0	2.0	2.0	3.0	3.0	3.0	2.0
Voltage	AC	115/230	230/460	575	115/230	230/460	230/460	230/460
Phase - Frequency	-	Single - 60 Hz	Three - 60 Hz	Three - 60 Hz	Single - 60 Hz	Three - 60 Hz	Three - 60 Hz	Three - 60 Hz
Insulation Class	-	F	F	F	F	F	F	F
NEMA Rated Motor Amps	Amps (A)	18.2/9.1	5.4/2.7	2.3	25.6/12.8	7.6/3.8	7.6/3.8	5.4/2.7
Service Factor	-	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Max. Blower Amps	Amps (A)	24/11.5	6.8/3.4	3.0	28/14	8.8/4.4	8.8/4.4	6.8/3.4
Locked Rotor Amps	Amps (A)	138/69	38/19	21	194/97	88/44	88/44	38/19
NEMA Starter Size	-	1/0	00/00	00	1.5/0	0/0	0/0	00/00
Shipping Weight	Lbs	97	82	84	91	86	86	82
	Kg	44	37.2	38.1	41.3	39	39	37.2

Voltage - ROTRON motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

Operating Temperatures - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

AMETEK TECHNICAL & INDUSTRIAL PRODUCTS
75 North Street, Saugerties, NY 12477
USA: +1 215-256-6601 - Europe: +44 (0) 845 366 9664 - Asia: +86 21 5763 1258
Customer Service Fax: +1 215.256.1338
www.ametektip.com

AMETEK®
TECHNICAL & INDUSTRIAL PRODUCTS

DR 505 & CP 505

2.0 / 3.0 HP Regenerative Blower

ROTRON®

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- CE compliant - Declaration of Conformity on file
- Maximum flow: 150 SCFM
- Maximum pressure: 65 or 88 IWG
- Maximum vacuum: 73 IWG
- Standard motor: 2.0 or 3.0 HP, TEFC
- Cast aluminum blower housing, impeller & cover; cast iron flanges (threaded)
- UL & CSA approved motor with permanently sealed ball bearings
- Inlet & outlet internal muffling
- Quiet operation within OSHA standards

MOTOR OPTIONS

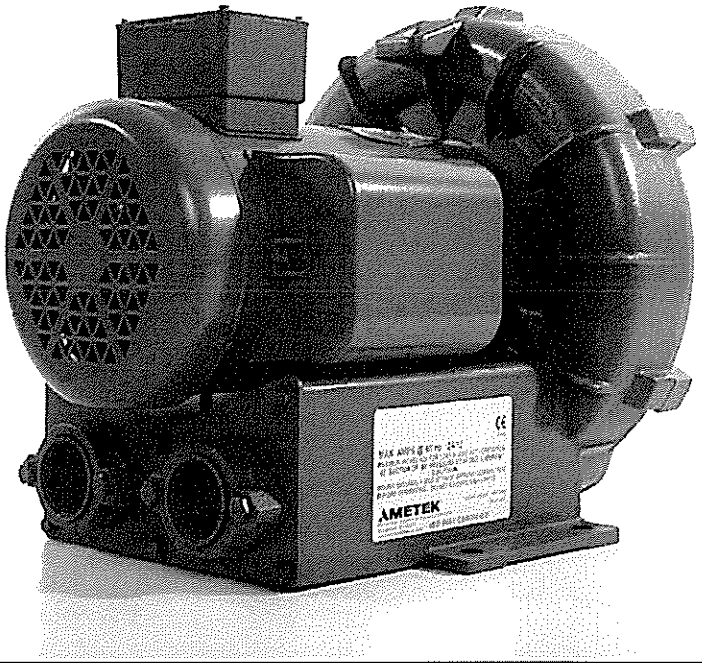
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS

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

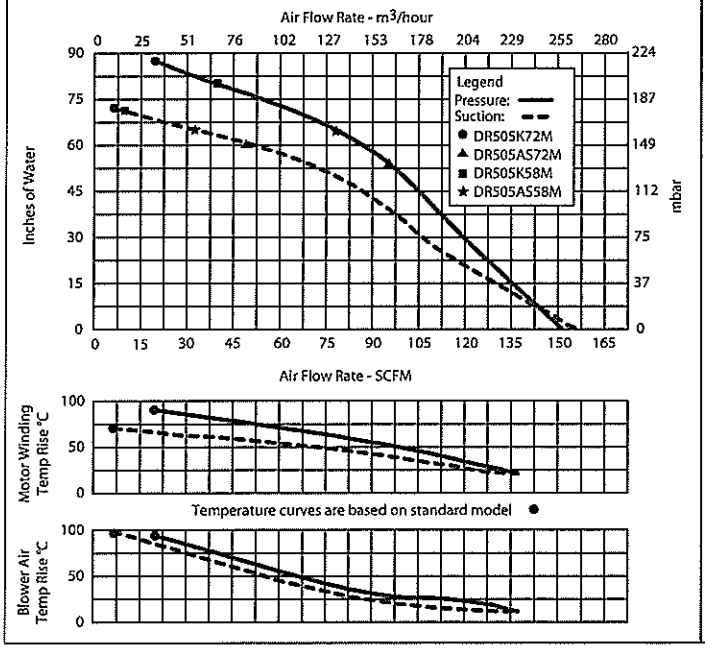
ACCESSORIES

- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

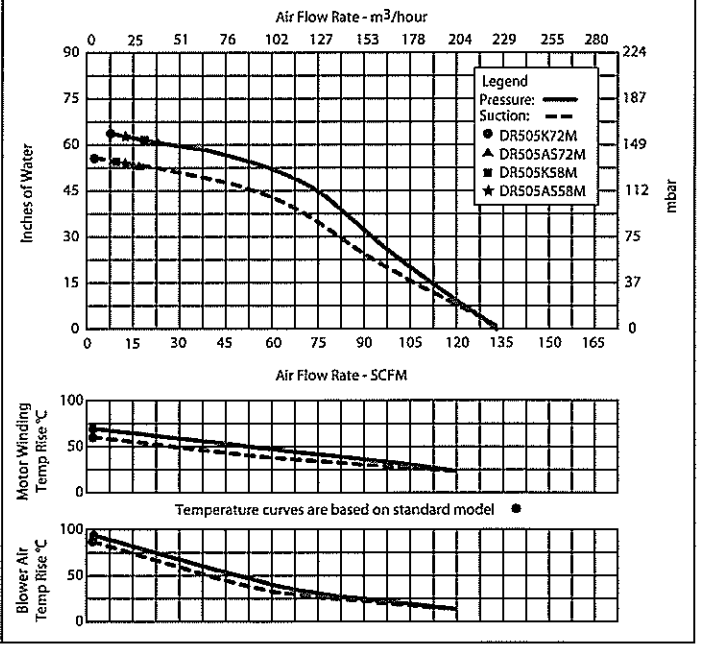


Blower Performance at Standard Conditions

60 Hz



50 Hz



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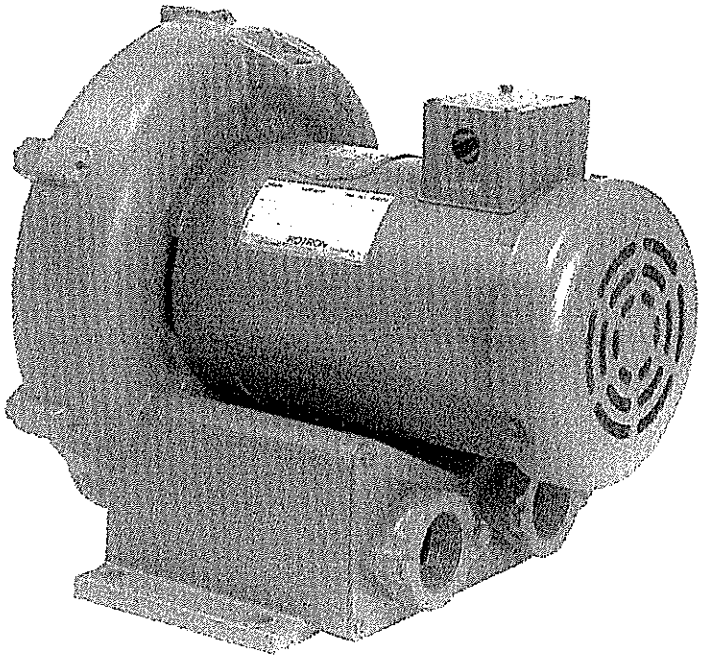
Customer Service Fax: +1 215.256.1338
www.ametektip.com

AMETEK®
TECHNICAL & INDUSTRIAL PRODUCTS

DR 505M & CP 505M Regenerative Blower

FEATURES
- Manufactured in the USA – ISO 9001 compliant
- CE compliant – Declaration of Conformity on file
- Maximum flow: 160 SCFM
- Maximum pressure: 65 or 80 IWG
- Maximum vacuum: 5.2" Hg (70.8 IWG)
- Standard motor: 2.0 or 3.0 HP, TEFC
- Cast aluminum blower housing, impeller & cover; cast iron flanges (threaded)
- UL & CSA approved motor with permanently sealed ball bearings
- Inlet & outlet internal muffling
- Quiet operation within OSHA standards

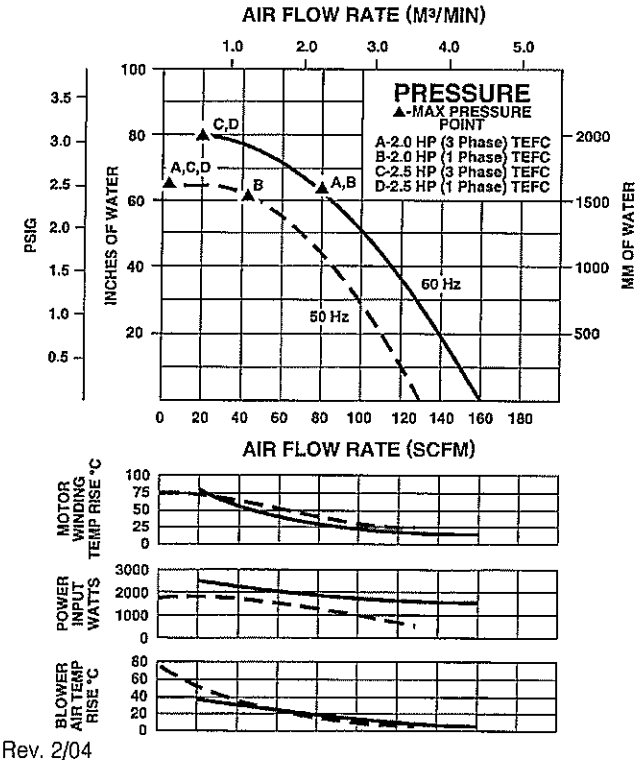


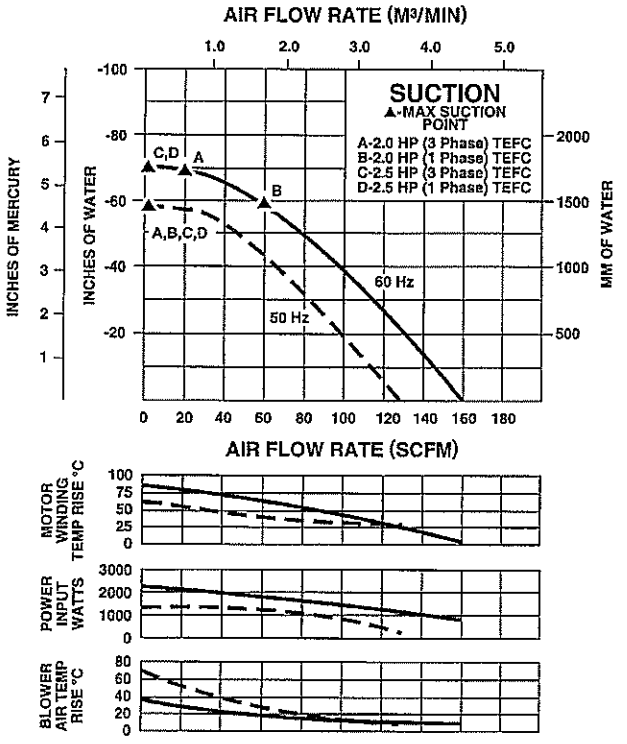
MOTOR OPTIONS
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

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

ACCESSORIES (See Catalog Accessory Section)
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

BLOWER PERFORMANCE AT STANDARD CONDITIONS

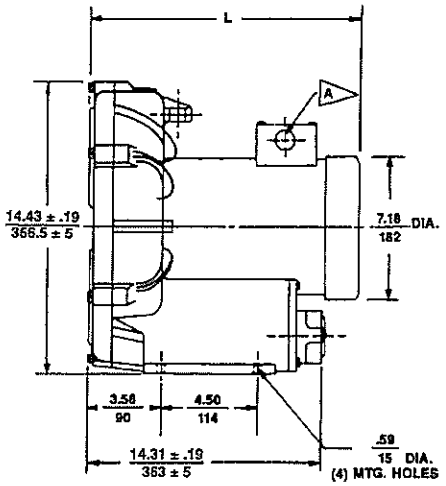


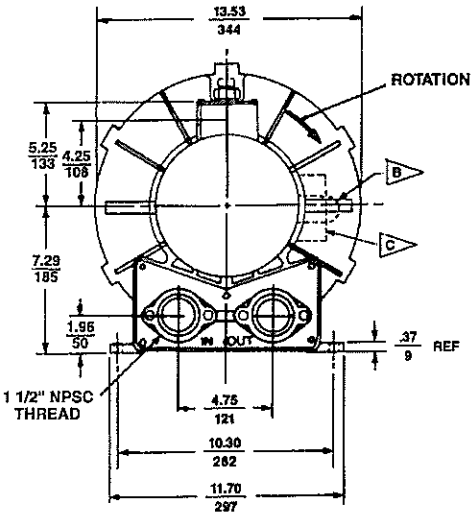


Rev. 2/04

DR 505M & CP 505M Regenerative Blower

Scale CAD drawing available upon request.





MODEL	L (IN) ± .30	L (MM) ± 8
DR505CD58M	15.28	388
DR505CD72M	13.78	350
DR505AS58M	15.28	388
DR505AS72M	13.78	350
DR505AS86M	13.78	350
CP505CT72MLR	13.78	350
CP505FE72MLR	13.78	375

DIMENSIONS: IN / MM
TOLERANCES: .XX ± .08/2
(UNLESS OTHERWISE NOTED)

A — .87/22 DIAMETER ON TEFC MOTOR

B — CAPACITOR LOCATION ON SINGLE PHASE MOTORS

C — CONDUIT BOX LOCATION ON XP MOTOR. CONTAINS .75 INCH PIPE TAP

SPECIFICATIONS

MODEL	DR505AS58M	DR505AS72M	DR505AS86M	DR505CD58M	DR505CD72M	CP505FE72MLR	CP505CT72MLR
Part No.	037542	037543	037544	037546	037545	038239	038237
Motor Enclosure – Shaft Material	TEFC – CS	TEFC – CS	TEFC – CS	TEFC – CS	TEFC – CS	ChemTEFC–SS	ChemTEFC–SS
Horsepower	2.0	2.0	2.0	3.0	3.0	Same as DR505CD72M – 037545 except add Chemical Processing (CP) features from catalog inside front cover	Same as DR505AS72M – 037543 except add Chemical Processing (CP) features from catalog inside front cover
Voltage [1]	115/230	230/460	575	115/230	230/460		
Phase – Frequency [1]	Single - 60 Hz	Three - 60 Hz	Three - 60 Hz	Single - 60 Hz	Three - 60 Hz		
Insulation Class [2]	F	F	F	F	F		
NEMA Rated Motor Amps	18.2/9.1	5.4/2.7	2.3	21.6/10.8	7.4/3.7		
Service Factor	1.15	1.15	1.15	1.15	1.15		
Locked Rotor Amps	138/69	38/19	21	150/75	48/24		
Max. Blower Amps (At Cutoff) [3]	24/12	6.8/3.4	3.0	26/13	7.2/3.6		
Recommended NEMA Starter Size	1/0	0/00	00	1.5/0	0/0		
Shipping Weight	83 lb (38 kg)	76 lb (35 kg)	82 lb (37 kg)	91 lb (41 kg)	82 lb (37 kg)		

[1] Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

[2] Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

[3] Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

Specifications subject to change without notice. Please consult your Local Field Sales Engineer for specification updates. Rev 2/04

SERVICE AND PARTS MANUAL FOR BLOWER MODEL

CP454 – CP656

Technical & Industrial Products
627 Lake Street, Kent, Ohio 44240 U.S.A.
Telephone: 330-673.3452 Fax: 330-677-3306
e-mail: rotronindustrial@ametek.com
internet: www.ametektip.com

Your Choice. Our Commitment.™

WARRANTY, INSTALLATION, MAINTENANCE AND TROUBLESHOOTING INSTRUCTIONS

AMETEK

TECHNICAL AND INDUSTRIAL PRODUCTS
627 Lake Street, Kent, Ohio 44240 USA
Telephone: 330-673-3452 Fax: 330-677-3306
e-mail: rotronindustrial@ametek.com web site: www.ametektip.com

1. AMETEK Rotron DR, EN and HiE regenerative direct drive blowers are guaranteed for one full year from the date of installation (limited to 18 months from the date of shipment) to the original purchaser only. Should the blower fail we will evaluate the failure If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.

2. AMETEK Rotron Minispiral, Revaflow, Multiflow, Nautilair, remote drive blowers, moisture separators, packaged units, CP blowers, Nasty Gas™ models and special built (EO) products are guaranteed for one full year from date of shipment for workmanship and material defect to the original purchaser only. Should the blower fail, If failure is determined to be workmanship or material defect related, we will at our option repair or replace the blower.

3. **Parts Policy** - AMETEK Rotron spare parts and accessories are guaranteed for three months from date of shipment for workmanship and material defect to the original purchaser only. If failure is determined to be workmanship or material defect related we will at our option repair or replace the part.

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

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

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

1. **Bolt It Down** - Any blower must be secured against movement prior to starting or testing to prevent injury or damage. The blower does not vibrate much more than a standard electric motor.

2. **Filtration** - All blowers should be filtered prior to starting. Care must be taken so that no foreign material enters the blower. If foreign material does enter the blower, it could cause internal damage or may exit at extremely high velocity.

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

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

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

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

4. **Wiring** - Blowers must be wired and protected/fused in accordance with local and national electrical codes. All blowers must be grounded to prevent electrical shock. Slo-Blo or time delay fuses should be used to bypass the first second of start-up amperage.

5. **Pressure/Suction Maximums** - The maximum pressure and/or suction listed on the model label should not be exceeded. This can be monitored by means of a pressure or suction gage (available from Rotron), installed in the piping at the blower outlet or inlet. Also, if problems do arise, the Rotron Field representative will need to know the operating pressure/suction to properly diagnose the problem.

6. **Excess Air** - Bleed excess air off. DO NOT throttle to reduce flow. When bleeding off excess air, the blower draws less power and runs cooler.

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

Maintenance Procedure

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

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

Troubleshooting

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

* 3 phase units

** 1 phase units

*** Disassembly and repair of new blowers or motors will void the Rotron warranty. Factory should be contacted prior to any attempt to field repair an in-warranty unit.

Blower Disassembly:

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

1) Disconnect the power leads. **CAUTION:** Be sure the power is disconnected before doing any work whatsoever on the unit.

2) Remove or separate piping and/or mufflers and filters from the unit.

3) Remove the cover bolts and then the cover. **NOTE:** Some units are equipped with seals. It is mandatory that these seals be replaced once the unit has been opened.

4) Remove the impeller bolt and washers and then remove the impeller. **NOTE:** Never pry on the edges of the impeller. Use a puller as necessary.

5) Carefully note the number and location of the shims. Remove and set them aside. NOTE: If the disassembly was for inspection and cleaning the unit may now be reassembled by reversing the above steps. If motor servicing or replacement and/or impeller replacement is required the same shims may not be used. It will be necessary to re-shim the impeller according to the procedure explained under assembly.

6) Remove the housing bolts and remove the motor assembly (arbor/.housing on remote drive models).

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

Muffler Material Replacement:

1) Remove the manifold cover bolts and them manifold cover.

2) The muffler material can now be removed and replaced if necessary. On blowers with fiberglass acoustical wrap the tubular retaining screens with the fiberglass matting before sliding the muffler pads over the screens.

3) Reassemble by reversing the procedure.

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

Blower Reassembly:

1) Place the assembled motor (assembled arbor assembly for remote drive models) against the rear of the housing and fasten with the bolts and washer.

2) To ensure the impeller is centered within the housing cavity re-shim the impeller according to the procedure outlined below.

3) If blower had a seal replace the seal with a new one.

4) Place the impeller onto the shaft making sure the shaft key is in place and fasten with the bolt, washer and spacer as applicable. Torque the impeller bolt per the table below. Once fastened carefully rotate the impeller to be sure it turns freely.

5) Replace the cover and fasten with bolts.

6) Reconnect the power leads to the motor per the motor nameplate.

Bolt Size	Torque Pound-Force-Foot
1/4-20	6.25 +/- 0.25
5/16-18	11.5 +/- 0.25
3/8-16	20.0 +/- 0.5
½-13	49.0 +/- 1
5/8 –11	90.0 +/- 2

Impeller Shimming Procedure:

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

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

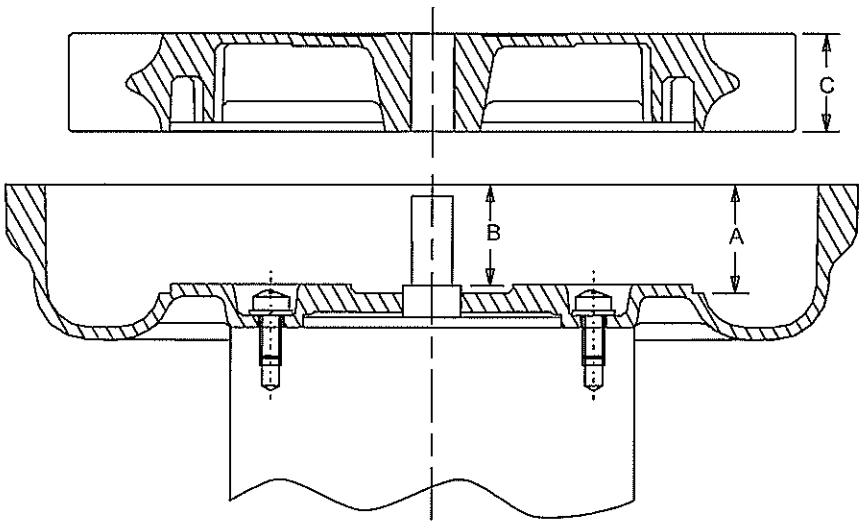
Measure the Following:

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

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

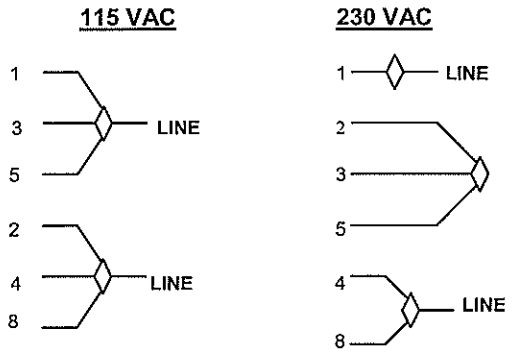
Shim Thickness = B – (A+C)/2

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



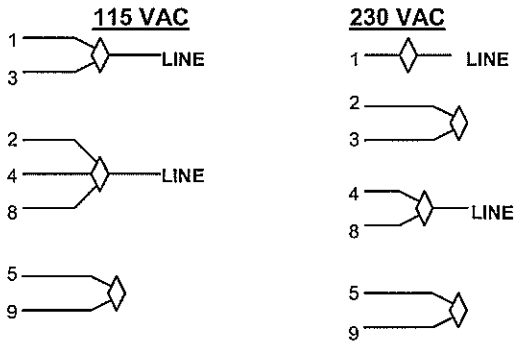
WIRING DIAGRAMS, TEFC and ODP MOTORS

A. 1Ø, 6 WIRE



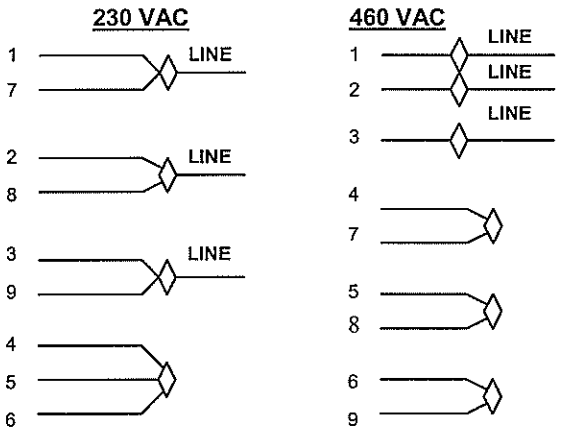
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

B. 1Ø, 7 WIRE



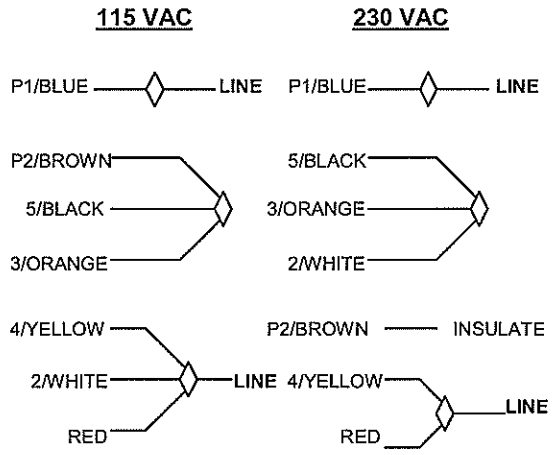
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

C. 3Ø, 9 WIRE



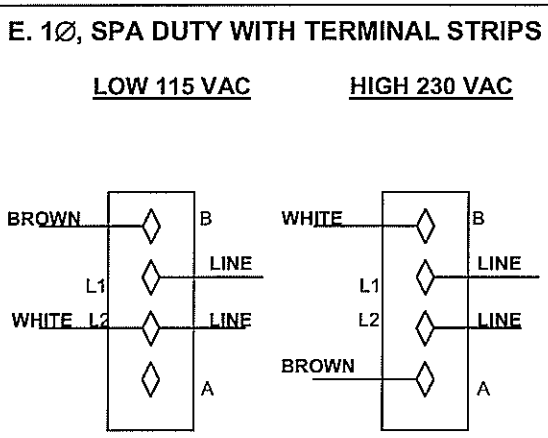
INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

D. 1Ø, EMERSON 1/8 HP MOTOR



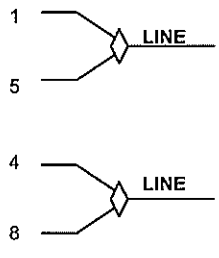
INTERCHANGE RED AND BLACK TO REVERSE ROTATION

E. 1Ø, SPA DUTY WITH TERMINAL STRIPS



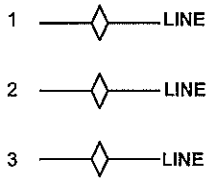
F. 1Ø, 230 VAC

SINGLE VOLTAGE



INTERCHANGE LEAD WIRES 5 & 8 TO REVERSE ROTATION

G. 3Ø, 575 VAC



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

AMETEK®
ROTRON TECHNICAL MOTOR DIVISION
REGENERATIVE BLOWER GROUP

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

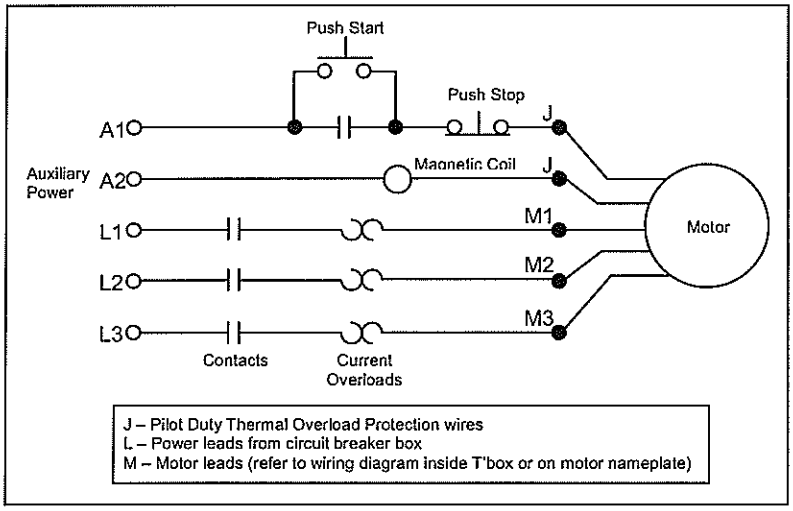
IMPORTANT: Read before wiring this Explosion-proof Blower

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

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

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

Schematic



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

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

POLICY REGARDING INSTALLATION OF AMETEK ROTRON REGENERATIVE BLOWERS IN HAZARDOUS LOCATIONS

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

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

AMETEK Rotron will not knowingly specify, design or build any regenerative blower for installation in a hazardous, corrosive environment without the proper surface treatment and sealing options.

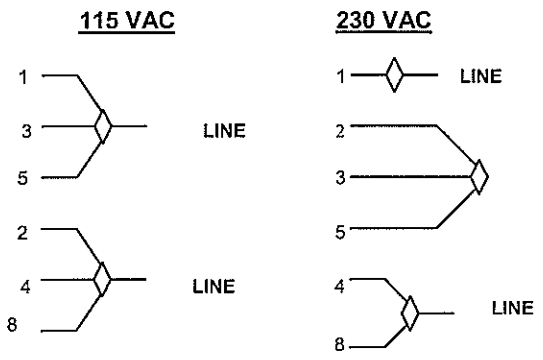
AMETEK Rotron has a complete line of Chemical Processing and Nasty Gas™ regenerative blowers with Chem-Tough™, stainless steel parts, and seals.

AMETEK Rotron offers general application guidance; however, suitability of the particular blower selection is ultimately the responsibility of the purchaser, not the manufacturer of the blower.

FS2 Rev B 3/10/98

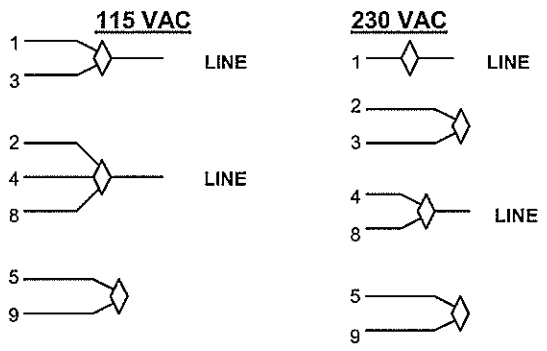
WIRING DIAGRAMS, XP MOTORS

H. 1Ø, 6 WIRE



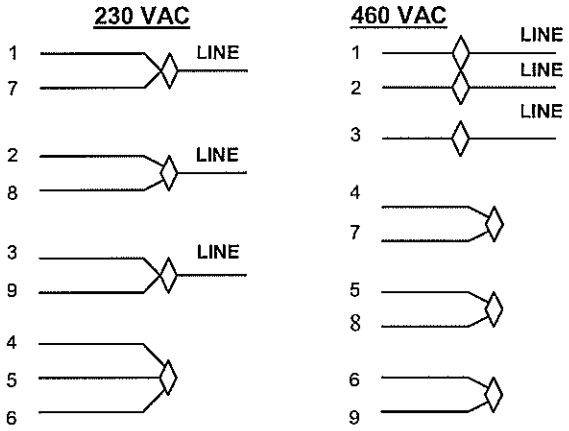
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

I. 1Ø, 7 WIRE



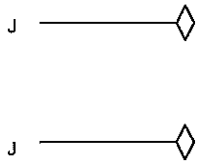
INTERCHANGE LEADWIRES 5 & 8 to REVERSE ROTATION

K. 3Ø, 9 WIRE



INTERCHANGE ANY TWO LEAD LINES TO REVERSE ROTATION

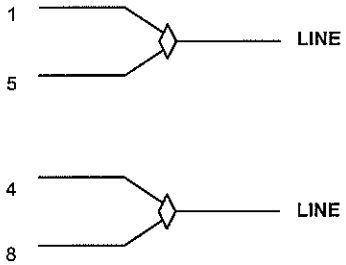
L. PILOT DUTY THERMAL OVERLOADS



HOOK J LEADS TO CONTROL CIRCUITRY

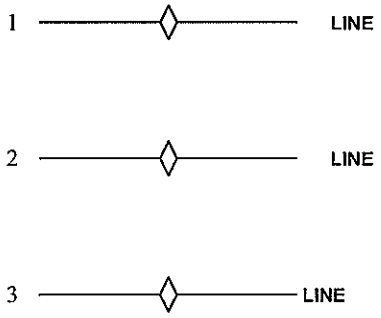
M. 1Ø 230 VAC

SINGLE VOLTAGE



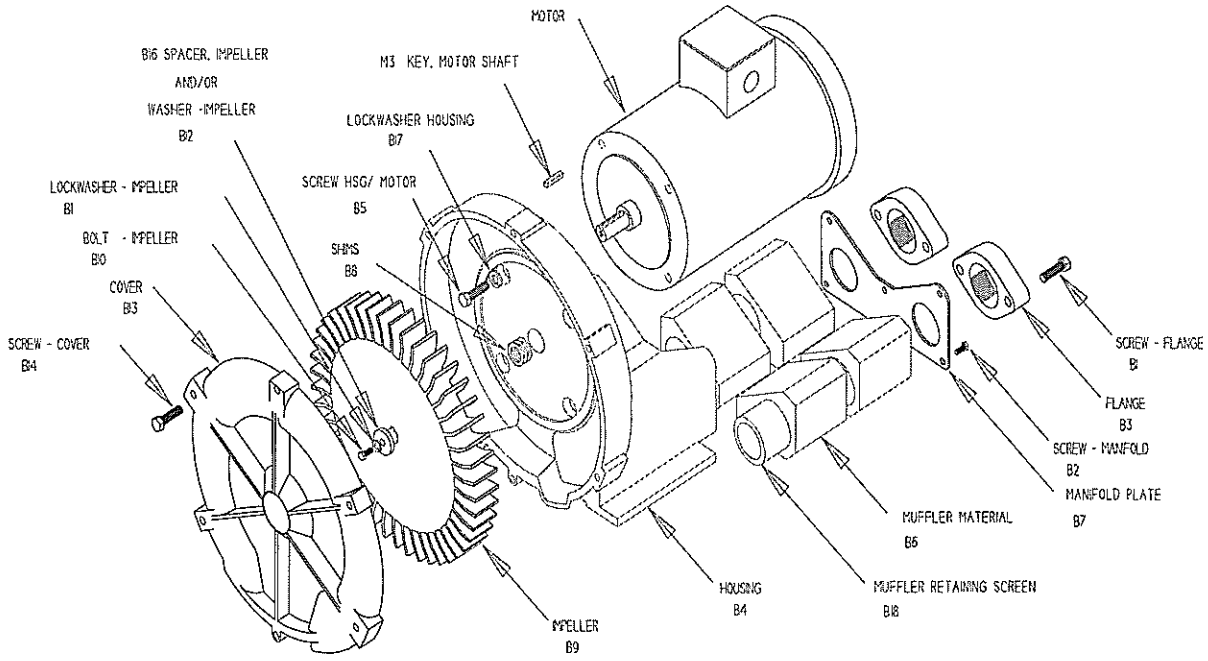
INTERCHANGE LEADWIRES 5 & 8 TO REVERSE ROTATION

N. 3Ø 575 VAC



INTERCHAGE ANY TWO LEAD LINES TO REVERSE ROTATION

ASSEMBLY DIAGRAM
CP454 CP513 CP523 CP505 CP555 CP606 CP656
DIRECT DRIVE BLOWERS



Parts Breakdown

Item No.	Qty. Req'd	Description	Model: CP454	CP454	CP513	CP523	CP505	CP555	CP606
		Part No.:	038234	080490	038241	038242	038236	038244	038246
			038235	080491	038240	038243	038237	038245	038247
			038960	080494	038966	038968	038238	038970	038972
			038961	080495	038967	038969	038239	038971	038973
							038962		
							038963		
							038965		
M3	1	Key Motor Shaft	See Next Page	155003	See Next Page	See Next Page	See Next Page	See Next Page	See Next Page
B1	4	Screw, Flange	155317	155317	140042	140042	155317	140042	155195
B2	6	Screw, Manifold	155496	155496	(10 pcs) 160556	(10 pcs) 160556	155170	155496	155496
B3	2	Flange	551337	155337	551337	551337	551337	551337	551336
B4	1	Housing	551318	551092	529143	529429	529134	529142	529813
B5	4	Screw, Hsg /Motor	155327	155327	155327	155327	251777	155327	155327
B6	4	Muffler Material	515743	515743	516560	516560	(6 pcs) 515743	515743	529781
	4	Muffler Insert	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B7	1	Manifold Plate	551328	551328	529875	529875	551329	529317	551330
B8	*	Shim .002"	510356	510356	510356	500664	510356	510356	510356
	*	Shim .005"	510357	510357	510357	500665	510357	510357	510357
	*	Shim .010"	510358	510358	510358	500666	510358	510358	510358
	*	Shim .020"	510359	510359	510359	500667	510359	510359	510359
	*	Shim .030"	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B9	1	Impeller	551201	551095	529301	(2 pc) 529931	529300	529302	551202
B10	1	Bolt, Impeller	160556	160556	160556	160556	160556	160556	160556
B11	1	Lockwasher, Impeller	251308	251308	251308	251308	251308	251308	251308
B12		Washer, Impeller	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B13	1	Cover	528672	551094	528717	528717	517468	528675	515040
B14	6	Screw, Cover	155236	155236	(8 pcs) 155196	(8 pcs) 155328	155236	(7 pcs) 155236	155236
B16	1	Spacer, Impeller Bolt	515055	515055	515055	515055	515055	515055	515055
B17		Lockwasher, Housing	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
B18	1	Screen, Muffler Retaining, Right (**)	551309	551089	551309	551309	529989	551309	529818
	1	Insert-Muffler	Not Used	551006	Not Used	Not Used	Not Used	Not Used	Not Used
	1	Screen, Muffler Retaining, Left (**)	551309	551089	551309	551309	529989	551309	529818
	1	Insert-Muffler	Not Used	551006	Not Used	Not Used	Not Used	Not Used	Not Used
B19		Bolt, Muffler Hsg/Hsg	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
	1	Lip Seal	516587	516587	516587	516587	516587	516587	516587

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

9/6/00 REV. E

Model	Part No.	Motor	Wiring Diagram	Specific Parts	Bearing, Rear (M1)	Bea Impeller
CP454W72LR	038234	515746	K + L	M3 155123		
CP454EZ72LR	038235	529238	C	M3 155322		
C454FR72LR	038960	550471	K + L	M3 155003		
CP454R72LR	038961	510317	C	M3 510629		
CP454W72MLR	080490	515746	K + L			
CP454EZ72MLR	080491	529238	C			
CP454FR72MLR	080494	550471	K + L			
CP454R72MLR	080495	550317	C			
CP505AX72LR	038236	510325	K + L	M3 155123		
CP505CT72LR	038237	517341	C	M3 155322		
CP505M72LR	038238	516687	K + L	M3 155123		
CP505FE72MLR	038239	551359	C	M3 155322		
CP505AS72MLR	038963	510318	C	M3 510629		
CP505FS72MLR	038962	550467	K + L	M3 155003		
CP505CD72MLR	038965	510763	C	M3 510629		
CP513EZ72LR	038241	529238	C	M3 155322		
CP513W72LR	038240	515746	K + L	M3 155123		
CP513R72LR	038967	510317	C	M3 510629		
CP513FR72LR	038966	550471	K + L	M3 155003	510449	51C
CP523M72LR	038242	517675	K + L	M3 155099 B13A 529190		
CP523CS72LR	038243	551367	C	M3 1 55320 B13A 529190		
CP523K72LR	038969	516571	C	M3 155099 B13A 529190		
CP523FU72LR	038968	550468	K + L	M3 155320 B13A 529190		
CP555M72LR	038244	516687	K + L	M3 155123		
CP555CS72LR	038245	517342	C	M3 155322		
CP555FU72LR	038970	550469	K + L	M3 155003		
CP555K72LR	038971	511306	C	M3 510629		
CP606M72MLR	038246	516687	K + L	M3 155123		
CP606CR72MLR	038247	517343	C	M3 155322		
CP606FU72MLR	038972	550469	K + L	M3 155003		
CP606CK72LR	038973	510895	C	M3 510629		
CP656FF72XLR	080054	550759	C			
CP656M72XLR	080064	516687	K + L			
CP656CR72XLR	080065	517343	C			
CP656FU72XLR	080142	550469	K + L			
CP656CK72XLR	080143	510895	C			

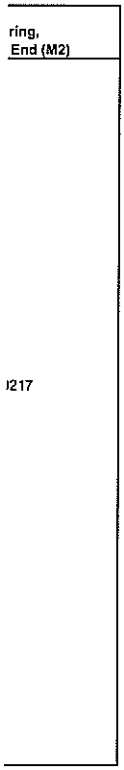
*As Needed **Viewed looking at inlet/outlet ports

9/6/00 REV. E

CP656
080054
080064
080065
080142
080143
155123
121837
155170
550754
529813
155327
(10 pcs) 551585
550691
550758
510356
510357
510358
510359
Not Used
550756
160556
251308
Not Used
550757
155236
515055
Not Used
529989
(10 pcs) 550691
829989
(10 pcs) 550691
Not Used
516587

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

9/6/00 REV. E



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

9/6/00 REV. E

Current Output Pressure Transmitter

SERIES **100**

HIGH PERFORMANCE CURRENT OUTPUT PRESSURE TRANSMITTER

NOSHOK 100 Series Current Output Pressure Transmitters are designed to provide a previously unequalled level of performance, utilizing diffused semiconductor and sputtered thin film strain gage technology. 100 Series transmitters are highly repeatable, shock resistant and are extremely stable over long periods of time. CE compliance which includes substantial levels of RFI, EMI and ESD noise protection combined with reverse polarity over-voltage protection hardens the product so it performs well in the most demanding applications.

Advanced manufacturing techniques have made this level of performance previously found in transmitters costing hundreds of dollars more. Final calibration tests performed on all NOSHOK transmitters prior to shipment insures 100% "out of the box" reliability

Features

Accuracy up to +/-0.25 % Full Scale (Best Fit Straight Line)
Welded stainless steel pressure chamber
Advance diffused semiconductor and sputtered thin film sensor for maximum stability
Compact size
High alternating load resistance
High overpressure protection
CE compliant to suppress RFI, EMI and ESD noise interference
Compatible with NOSHOK Smart System Indicators

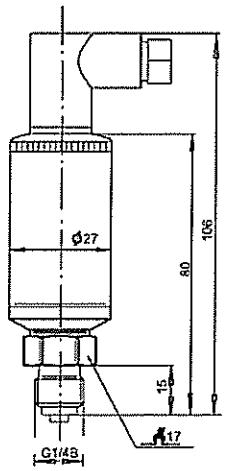
Applications

Hydraulic and pneumatic systems
Injection molding machines
Railroad engine controls
HVAC systems
Stamping and forming presses
Refrigeration controls
Industrial machinery and machine tools
Pumps and compressors

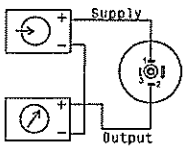
SPECIFICATIONS

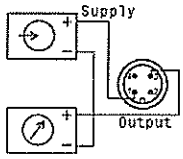
Output signal	4 mA to 20 mA, 2 wire
Pressure ranges	Standard gauge ranges from vacuum to 15000 psi
Proof pressure	2 times Full Scale for ranges 0 psi to 15 psi through 0 psi to 6000 psi; 1.5 times Full Scale for ranges including 0 psi to 5 psi, 0 psi to 10 psi, 0 psig to 7500 psig through 0 psig to 15000 psig
Burst pressure	5 times Full Scale for ranges 0 psi to 15 psi through 0 psi to 6000 psi; 2 times Full Scale for ranges including 0 psi to 5 psi, 0 psi to 10 psi, 0 psig to 7500 psig through 0 psig to 15000 psig
Accuracy	+/-0.50 % Full Scale (Best Fit Straight Line); +/-0.25 % optional (Includes the combined effects of linearity, hysteresis and repeatability)
Repeatability	+/-0.05 % Full Scale
Hysteresis	+/-0.1 % Full Scale
Stability	+/-.2 % Full Scale for 1 year, non-accumulating
Response time	<1 ms (between 10 % and 90 % Full Scale)
Power supply	12 Vdc to 30 Vdc, unregulated
Load limitations	Load in resistance must be $(V_{power\ supply} - 12)/.020$ Amp
Wetted materials	316 stainless steel for vacuum through 300 psi;17-4PH stainless steel sensing diaphragm and 316 stainless steel pressure connection for higher ranges
Housing material	316 stainless steel
Adjustment	+/-5% Full Scale for zero and span
Pressure cycle limit	150 Hz
Durability	> 100,000,000 Full Scale cycles
Temperature ranges	Compensated 32 °F to 176 °F (0 °C to 80 °C) Zero effect +/-0.017 % Full Scale/°F Span effect +/-0.017 % Full Scale/°F Ambient -40 °F to 185 °F (-40 °C to 85 °C) Media -22°F to 212 °F (-30 °C to 100 °C) Storage -40 °F to 212 °F (-40 °C to 100 °C)
Environmental rating	IP65, NEMA 4X according to EN 60529/IEC 529
Electromagnetic rating	CE compliant to EMC norm EN 61326:1997/A1:1998 RFI, EMI and ESD protection
Electrical protection	Reverse polarity, over-voltage and short circuit protection
Shock resistance	1000g's per IEC 770
Vibration resistance	30g's per IEC 770
Weight	Approximately 1.75 oz.

Outline Dimensions, inches (millimeters)



Need drawing for bendix and conduit versions





Function	M12x1	Mini-Hirschmann
+ Supply	Pin 1	Pin 1
+ Output	Pin 3	Pin 2

Need wiring for bendix and conduit connections instead of table

ORDERING INFORMATION

Series 100

Pressure ranges

-30 inHg to 0 psig	**30V**	0 psig to 60 psig	**60**	0 psig to 5000 psig	**5000**
-30 inHg to 15 psig	**30/15**	0 psig to 100 psig	**100**	0 psig to 6000 psig	**6000**
-30 inHg to 30 psig	**30/30**	0 psig to 150 psig	**150**	0 psig to 7500 psig	**7500**
-30 inHg to 60 psig	**30/60**	0 psig to 200 psig	**200**	0 psig to 10000 psig	**10000**
-30 inHg to 100 psig	**30/100**	0 psig to 300 psig	**300**	0 psig to 15000 psig	**15000**
-30 inHg to 150 psig	**30/150**	0 psig to 500 psig	**500**	0 psia to 15 psia	**15A**
-30 inHg to 200 psig	**30/200**	0 psig to 600 psig	**600**	0 psia to 30 psia	**30A**
-30 inHg to 300 psig	**30/300**	0 psig to 750 psig	**750**	0 psia to 60 psia	**60A**
0 psig to 5 psig	**5**	0 psig to 1000 psig	**1000**	0 psia to 100 psia	**100A**
0 psig to 10 psig	**10**	0 psig to 1500 psig	**1500**	0 psia to 150 psia	**150A**
0 psig to 15 psig	**15**	0 psig to 2000 psig	**2000**	0 psia to 200 psia	**200A**
0 psig to 30 psig	**30**	0 psig to 3000 psig	**3000**	0 psia to 300 psia	**300A**

psig = gauge pressure Other ranges available on special request

Accuracy	**1**	+/-0.5 % Full Scale (Best Fit Straight Line)	**2**	+/-0.25 % Full Scale (Best Fit Straight Line)		
Output	**1**	4 mA to 20 mA				
Process connection	**1**	1/8 "NPT male	**2**	1/4 "NPT male	**3**	7/16 "-20 UNF #4 SAE J-514 male
Electrical connection	**1**	36 " cable (connected to option 7)	**2**	4 pin bendix	**3**	6 pin bendix
	6	1/2 " NPT conduit (with 36" cable)	**7**	Mini-hirschmann (DIN 43650C with mate)		
Options	**ORF**	Threaded orifice				

Example **100 - 500 - 1 - 1 - 2 - 7 - ORF**

Series	100
Pressure range	0 psig to 500 psig
Accuracy	+/-0.50 % Full Scale
Output	4 mA to 20 mA
Process connection	1/4 "NPT male
Electrical connection	Hirschmann
Option	Orifice

The Instrumentation Company
NOSHOK INCORPORATED

NOSHOK, Inc.
Corporate Headquarters
1010 West Bagley Road
Berea, Ohio 44017
440-243-0888
440-243-3472 Fax
E-Mail: noshok@noshok.com
WEB: www.noshok.com

CO 111902 Preliminary Specifications
Specifications subject to change without notice

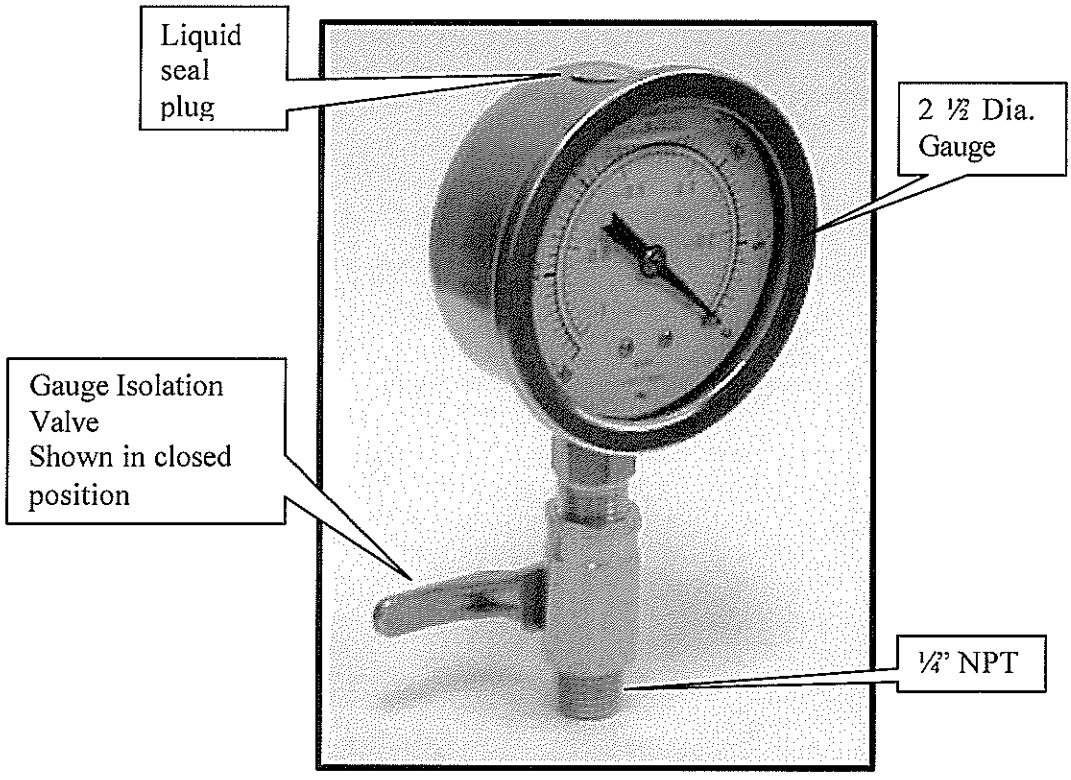
J. E. GASHO & ASSOCIATES, INC.

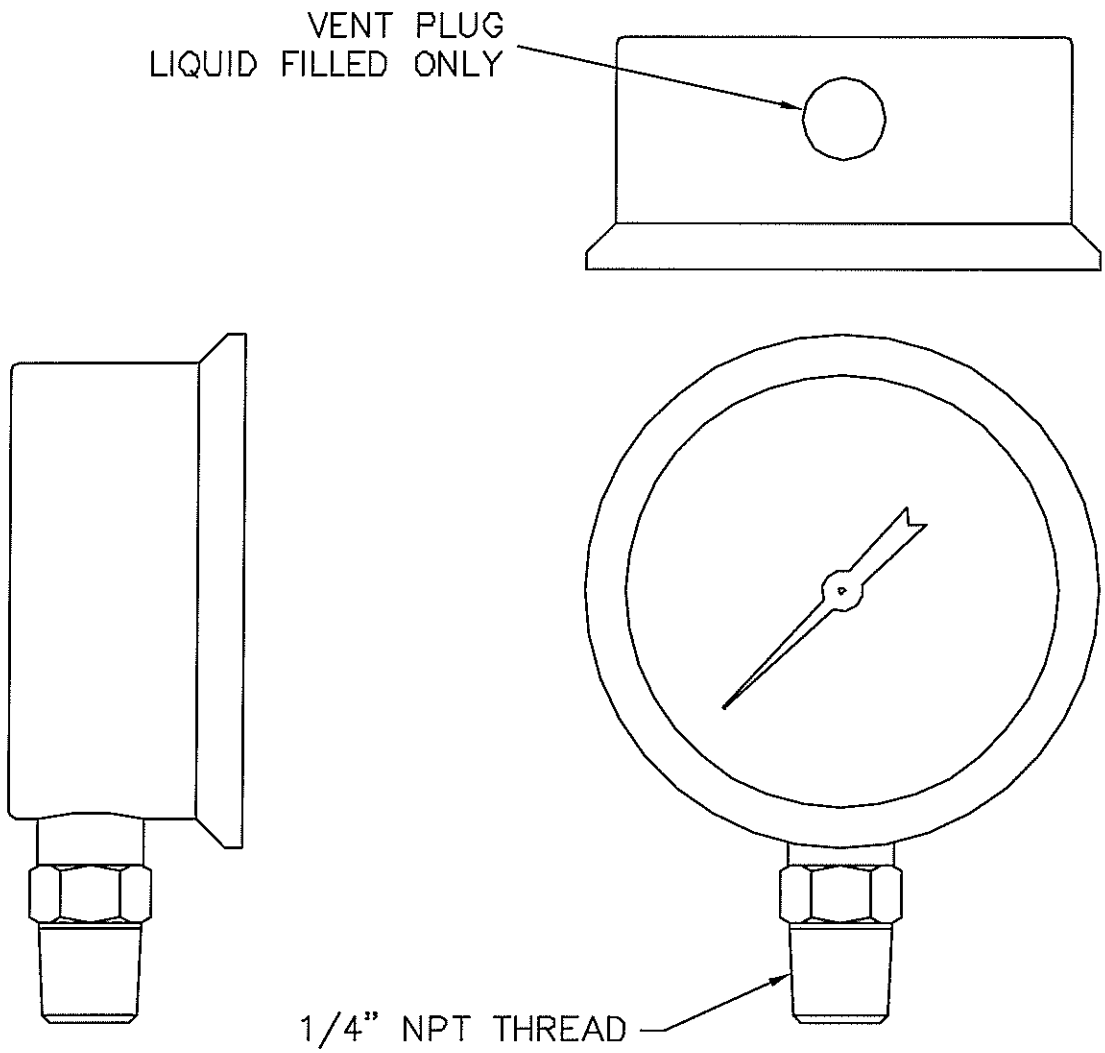
Authorized Manufacturer's Representative
Air / Gas Moving Equipment
460 W. GAY STREET
WEST CHESTER, PA 19380
PHONE: 610-692-5650 FAX: 610-692-5837

Pressure and Vacuum Gauges

We use both standard gauges and liquid filled gauges from a variety of manufacturers. Gauges are installed on our packages with gauge isolation valves (gauge cocks) part number BRS-VA-025-4F4M-BT. The gauge isolation valve can be used as a snubber while reading the gauge by opening it slightly. To protect gauges from damage due to shocks or pulsations in the system, gauge isolation valves should be closed except when the gauge is being read.

Liquid filled gauges may display incorrect readings due to variations in atmospheric pressure. To determine if a gauge is subject to this condition, the liquid filled cavity should be temporarily vented to atmosphere. Most liquid filled gauges have a seal plug in the liquid filled cavity. Remove this plug to allow the cavity to be vented to atmosphere. In some instances the case can be lightly squeezed to burp it. Replace the plug.





25.0.015PSI

- NOMINAL SIZE
  - 25 = 2.5in
  - 40 = 4.0 in.
- TYPE
  - 0 = NON-FILLED
  - 1 = LIQUID FILLED
- RANGE

NOTES:
1. WE USE BOTH STANDARD GAUGES & LIQUID FILLED GAUGES FROM A VARIETY OF MANUFACTURERS
2. STANDARD RANGES:
   - PRESSURE: 0-6 PSI & 0-160 IWC
     0-15 PSI
     0-30 PSI
   - VACUUM: 0-12 IN. HG. & 0-160 IWC
     0-30 IN., HG.

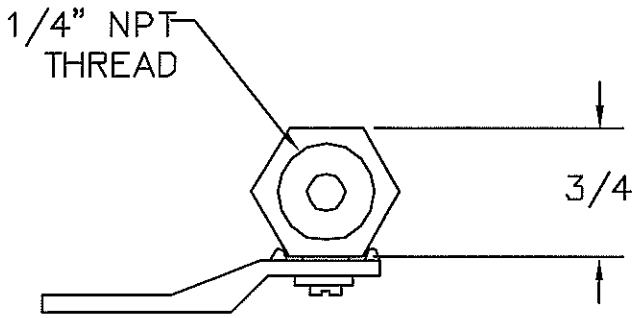
REV.	DATE	DESCRIPTION

DRAWN BY: M. WITTE	DATE 8-18-00
APPROVED BY:	DATE
DIMENSIONS IN INCHES	
SCALE	
TOLERANCE	ANGULAR TOLERANCE
MATERIAL	WEIGHT
SHEET 1 OF 1	

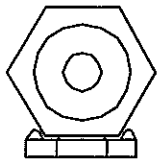
J. E. GASHO & Assoc., Inc.
460 W. GAY ST.
WEST CHESTER, PENNSYLVANIA 19380

PRESSURE GAUGE NUMBERING SYSTEM

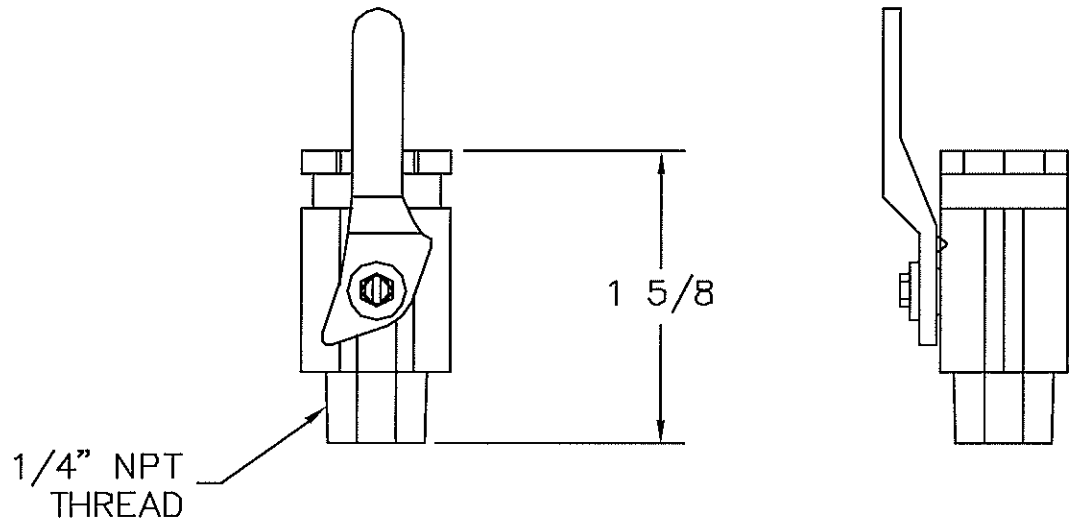
—



PLAN VIEW – CLOSED



PLAN VIEW – OPEN

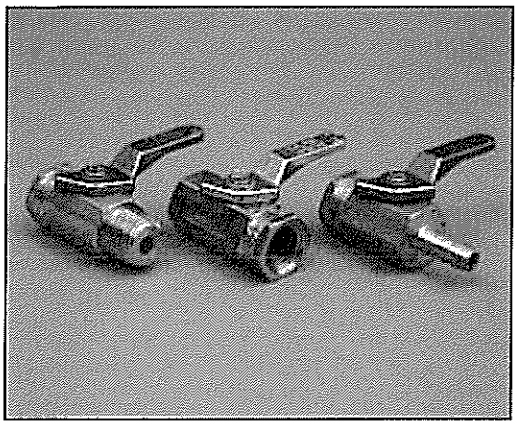


			DRAWN BY: M. WITTE	DATE 8–17–00
			APPROVED BY:	DATE
			DIMENSIONS IN INCHES	
			SCALE	
			TOLERANCE	ANGULAR TOLERANCE
			MATERIAL	WEIGHT
REV.	DATE	DESCRIPTION	SHEET 1 OF 1	

J. E. GASHO & Assoc., Inc.
460 W. GAY ST.
WEST CHESTER, PENNSYLVANIA 19380

GAUGE ISOLATION VALVE
SMC
VA BRS 025–4F4M–BT

—



Maximum Operating Pressure - 500 psi
Maximum Operating Temperature - 180 Degrees F
Ball Through Hole Diameter - .218

025 SERIES BALL VALVE

025 One-Way Ball Valve Design Considerations

The 025 Series One-Way Ball Valve compact design promotes multiple configurations to fit the exact end use application. The 025 Ball Valve Series is rated to 500 psi and will support flow and pressure only in the flow direction. The 025 Series has a one-piece body construction, stamped with directional flow arrows, to cover 1/4" NPT end configuration applications. The Zinc Die Cast Lever Handle is standard. Handles can be ordered Reversed - to lie over the outlet when the valve is in the open position. UL configurations are available and rated to 250 psi. UR configurations are available and rated to 500 psi.

Example:	Inlet End	Outlet End	Seal	Handle	Plating
	1/4 FNPT	1/4 MNPT	Buna-N	Steel	ENP

SMC Part Number: 025-4F4M-B,SH,ENP

The handle will lie over the Inlet port when the valve is in the open position. SMC Part Numbers are a description of the valve as read left to right, Inlet to Outlet.
Example: 025-4F4M-B,SH,ENP = 1/4 FNPT Inlet x 1/4 MNPT Outlet

025 Series Options

Material Options Brass Body, Nickel Plated Brass Ball, Teflon® Seats, Stainless Handle Screw

Seal Options Buna-N, Ethylene Propylene, Fluoroelastomer (Viton®), Neoprene

Body Options

- 1/4 Female x 1/4 Female NPT
- 1/4 Female x 1/4 Male NPT
- 1/4 Female x 1/8 Female NPT
- 1/4 Female x 1/8 Male NPT
- 1/4 Female x 1/4 Hose Barb
- 1/4 Female x 11/16-16 Male
- 1/4 Female x 7/16-24 Female
- 1/4 Female x 1/4 Female Flare
- 1/4 Female x 3/8 Compression

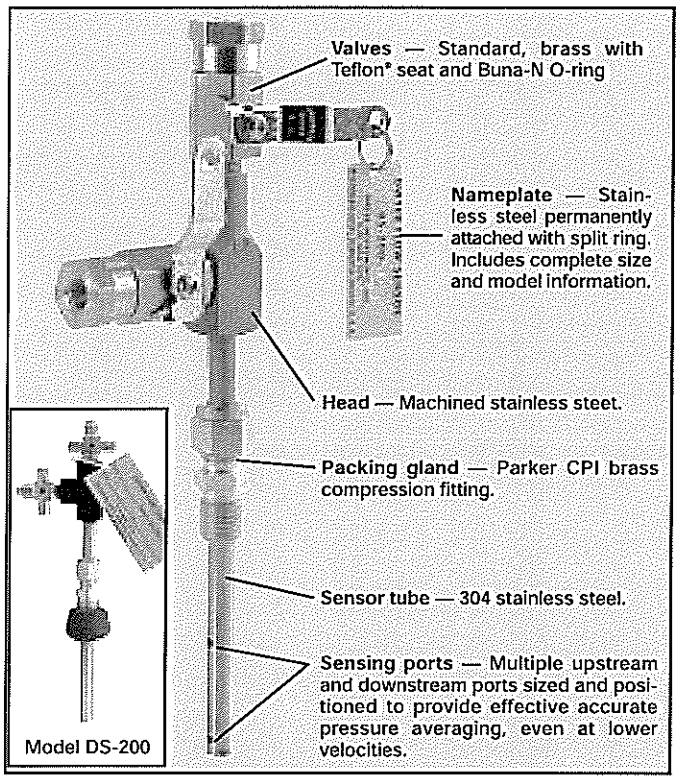
Handle Options Zinc Die Cast Lever (Standard), Zinc Die Cast Lever with Red Vinyl Sleeve, Steel Lever, Steel Lever, Round Handle, Steel Lever, Steel Lever with Red Vinyl Sleeve, Round Zinc Die Cast Handle, Black Nylon T-Handle, Blue Nylon Knob, .312 x 1" Stem, Screw Slot Headed Ball

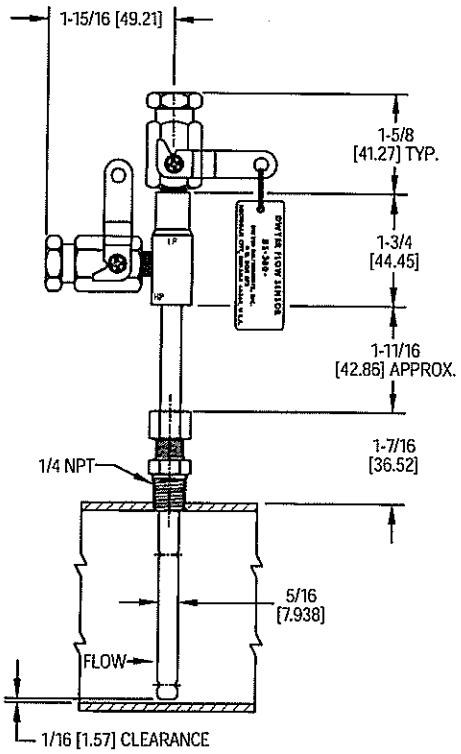
Plating Options Electroless Nickel, Black Zinc

SMC will quote alternate materials or customize our standard products when quantities ensure competitive pricing.
Contact Customer Service at (651) 653-0599, FAX - (651) 653-0989, E-Mail - info@specialtymfg.com

Series DS Flow Sensors

For use with the Dwyer Capsuhelic® differential pressure gage.





Dwyer Flow Sensors are averaging pitot tubes that provide accurate and convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® differential pressure gage of appropriate range, the result is a flow indicating system delivered off the shelf at an economical price.

Pitot tubes have been used in flow measurement for years. Conventional pitot tubes sense velocity pressure at only one point in the flowing stream. Therefore, a series of measurements must be taken across the stream to obtain a meaningful average flow rate. The Dwyer flow sensor eliminates the need for "traversing" the flowing stream because of its multiple sensing points and built-in averaging capability.

Series DS-200 models are available in ten insertion lengths from 1" - 10". Operation is similar to DS-300 units. Basic differences are the multi-turn shut-off valves, 3/8" NPT mounting and installed 1/4" SAE 45° flared pressure connections.

Dwyer Series DS-300 flow sensors are designed to be inserted in the pipeline through a compression fitting. They are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8" NPT(F) connections. Accessories include adapters with 1/4" SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic kit. Standard valves are rated at 200 psig (13.7 bar) and 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 flow sensors are available for pipe sizes from 1" to 10". If replacing a DS-200 flow sensor or using an A-160 thredolet with a DS-300, an optional 1/4" x 3/8" bushing, P/N A-161 is required.

DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4" dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. This extra strength also allows them to be made in longer insertion lengths up to 24 inches (61 cm). All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing. Process connections to the valve assembly are 1/8" NPT(F). A pair of 1/8" NPT × 1/4" SAE 45° flared adapters are included, compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. Supplied solid brass mounting adapter has a 3/4" dia. compression fitting to lock in required insertion length and a 3/4" NPT(M) thread for mounting in a thred-o-let (not included).

STOCKED MODELS

Select model with suffix which matches pipe size

DS-200-1"	**DS-300-1"**
DS-200-1¼"	**DS-300-1¼"**
DS-200-1½"	**DS-300-1½"**
DS-200-2"	**DS-300-2"**
DS-200-2½"	**DS-300-2½"**
DS-200-3"	**DS-300-3"**
DS-200-4"	**DS-300-4"**
DS-200-6"	**DS-300-6"**
DS-200-8"	**DS-300-8"**
DS-200-10"	**DS-300-10"**

DS-400-6"
DS-400-8"
DS-400-10"
DS-400-12"
DS-400-14"
DS-400-16"
DS-400-18"
DS-400-20"
DS-400-24"

Options and Accessories

A-160 Thredolet,⅜" NPT, forged steel, 3000 psi
A-161 Brass Bushing, ¼" x ⅜"
DS-200-VK Series DS Flow Sensors Valve Kit
Less Valves (DS-300) To order, add suffix -LV

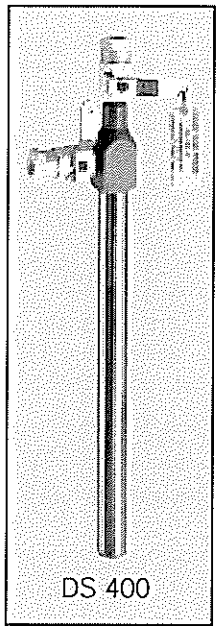
How To Order

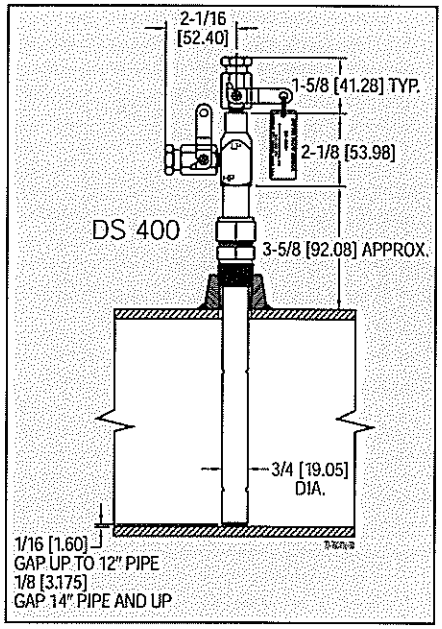
Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2" pipe would be a Model No. DS-300-2".

For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches



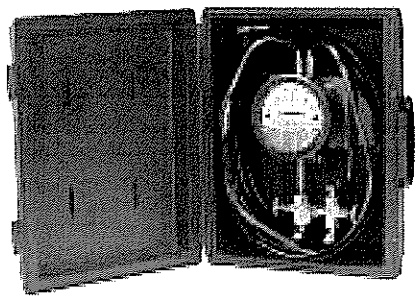


GAGE RANGE (IN. W.C.)	MEDIA @ 70°F	FULL RANGE FLOWS BY PIPE SIZE (APPROXIMATE)									
		1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"	10"
2	Water (GPM)	4.8	8.3	11.5	20.5	30	49	86	205	350	560
	Air @ 14.7 PSIA (SCFM)	19.0	33.0	42.0	65.0	113	183	330	760	1340	2130
	Air @ 100 PSIG (SCFM)	50.0	90.5	120.0	210.0	325	510	920	2050	3600	6000
5	Water (GPM)	7.7	14.0	18.0	34.0	47	78	138	320	560	890
	Air @ 14.7 PSIA (SCFM)	30.0	51.0	66.0	118.0	178	289	510	1200	2150	3400
	Air @ 100 PSIG (SCFM)	83.0	142.0	190.0	340.0	610	820	1600	3300	5700	10000
10	Water (GPM)	11.0	19.0	25.5	45.5	67	110	195	450	800	1260
	Air @ 14.7 PSIA (SCFM)	41.0	72.0	93.0	163.0	250	410	725	1690	3040	4860
	Air @ 100 PSIG (SCFM)	120.0	205.0	275.0	470.0	740	1100	2000	4600	8100	15000
25	Water (GPM)	18.0	32.0	40.5	72.0	108	173	310	720	1250	2000
	Air @ 14.7 PSIA (SCFM)	63.0	112.0	155.0	255.0	390	640	1130	2630	4860	7700
	Air @ 100 PSIG (SCFM)	185.0	325.0	430.0	760.0	1200	1800	3300	7200	13000	22000
50	Water (GPM)	25.0	44.0	57.5	100.0	152	247	435	1000	1800	
	Air @ 14.7 PSIA (SCFM)	90.0	161.0	205.0	360.0	560	900	1600	3700	6400	
	Air @ 100 PSIG (SCFM)	260.0	460.0	620.0	1050.0	1700	2600	4600	10000	18500	
100	Water (GPM)	36.5	62.0	82.0	142.0	220	350	620	1500		
	Air @ 14.7 PSIA (SCFM)	135.0	230.0	300.0	505.0	800	1290	2290	5000		
	Air @ 100 PSIG (SCFM)	370.0	660.0	870.0	1500.0	2300	3600	6500	15000		

Model A-471 Portable Kit

The Dwyer Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 PSIG even when the flow sensor differential pressure to be read is less than 0.5" w.c. With accuracy of ±3% of full scale, the Capsuhelic® gage can be used in ambient temperatures from 32°F to 200°F. Zero and range adjustments are made from outside the gage. The standard gage with a die cast aluminum housing can be used with the flow sensor for air or oil applications. For water flow measurements, the optional forged brass housing should be specified. The Capsuhelic gage may be panel or surface mounted and permanently plumbed to the flow sensor if desired. The optional A-610 pipe mounting bracket allows the gage to be easily attached to any 1¼" - 2" horizontal or vertical pipe.

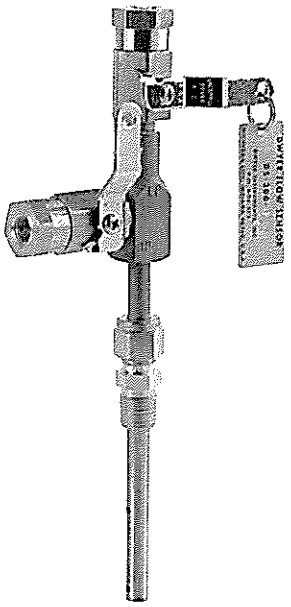
For portable operation, the A-471 Capsuhelic Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings. See pages 7 and 8 for complete information on the Capsuhelic gage.

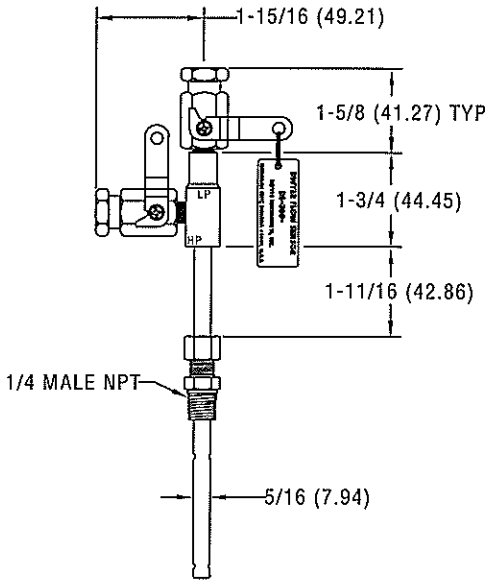


CAPSUHELIC GAGE SHOWN INSTALLED IN A-471 PORTABLE KIT

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations





Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system delivered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1″ to 10″.

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*

Upstream Condition	Minimum Diameter of Straight Pipe		
	Upstream		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

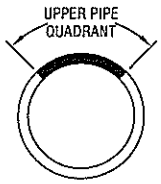
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

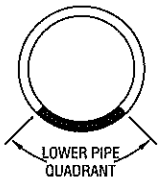
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4" x 3/8') will be needed.

2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.

4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16" to allow for thermal expansion.

5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

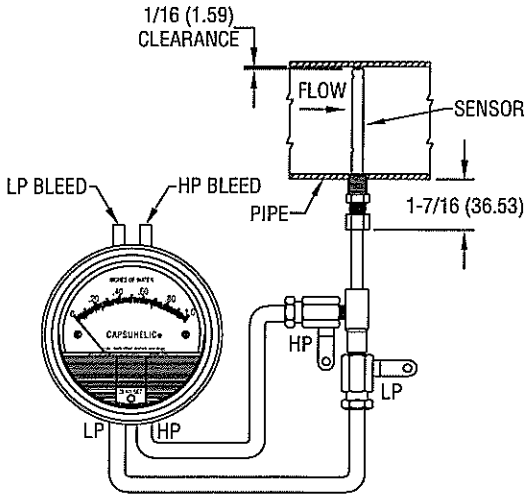
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

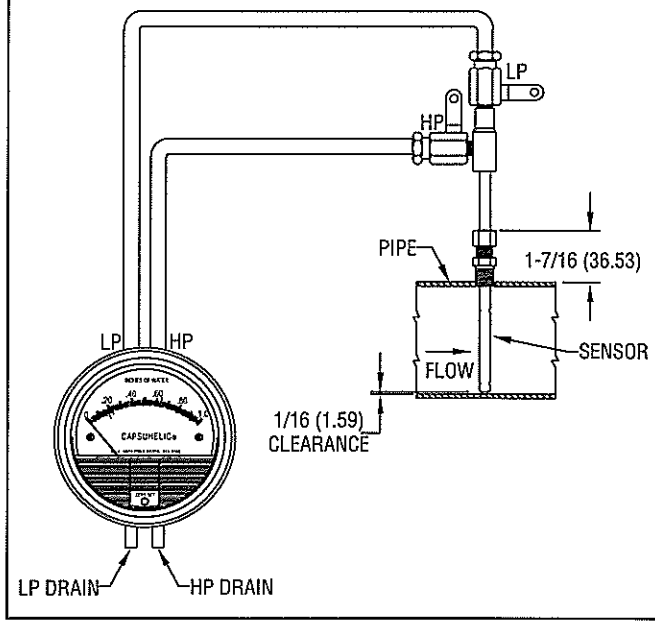
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

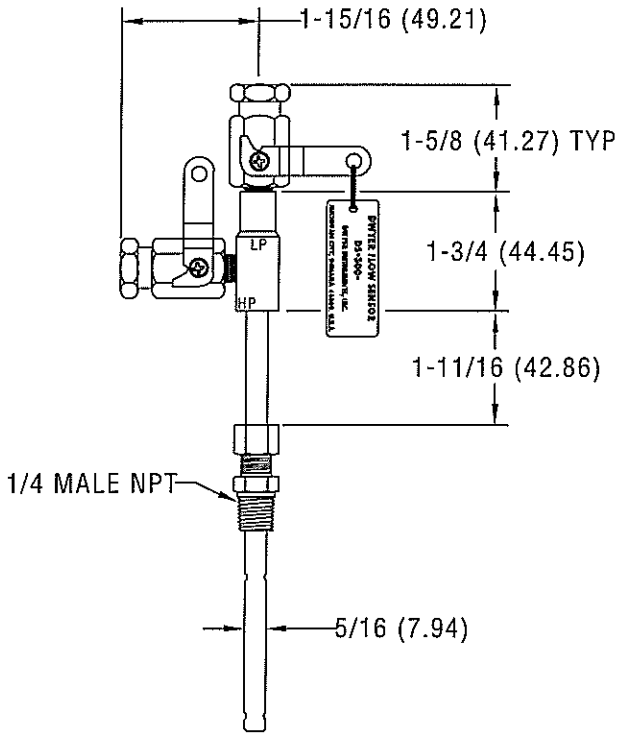
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Water Flow



Air or Gas Flow





Flow Calculations and Charts

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. When direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic® or Capsuhelic® gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic® and Capsuhelic® gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 "Flow of Fluids Through Valves, Fittings and Pipe." It is available from Crane Valve Company, www.cranevalve.com.

Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient "K"	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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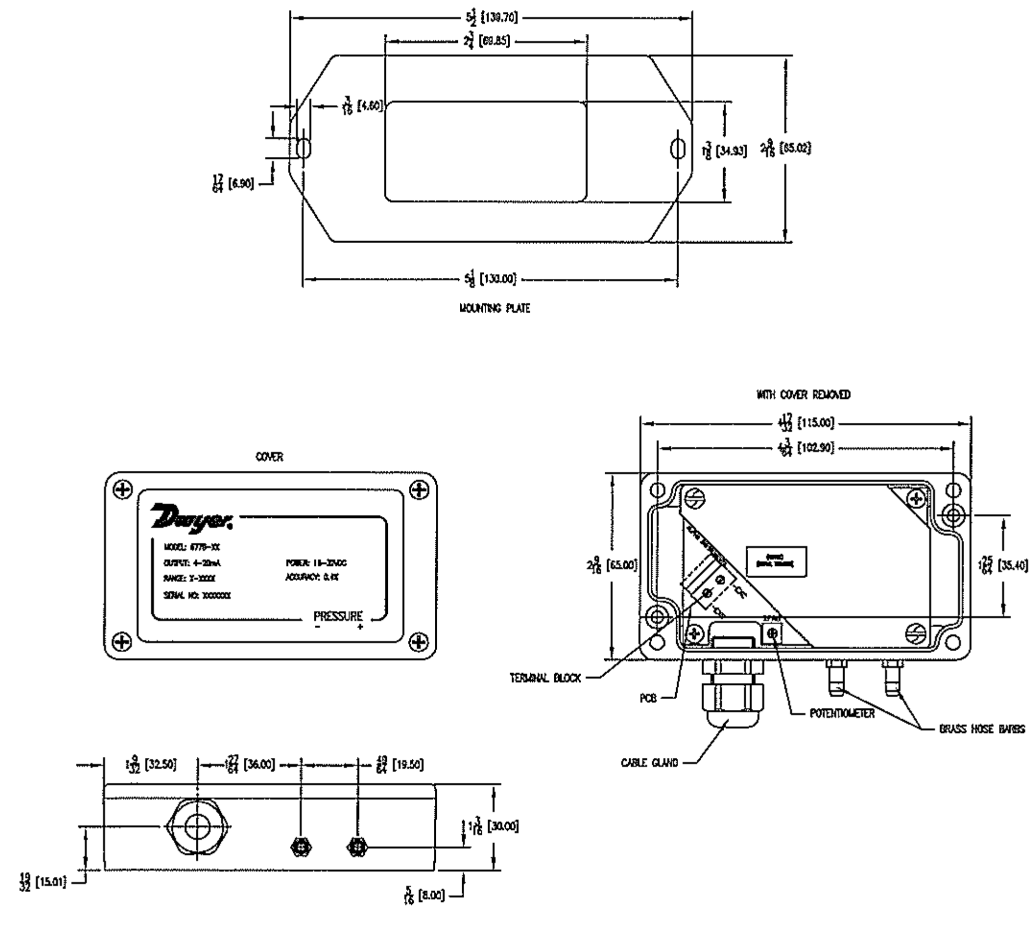


SCALE 1:1

*** DWYER PURCHASING USE ONLY ***	
FR. Number	Description

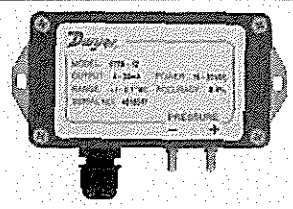
☐ Items to be supplied with each order. Quantities plus 20%.
☐ Items to be supplied in blanket quantities, vendor to inform DWYER when they require additional quantities.

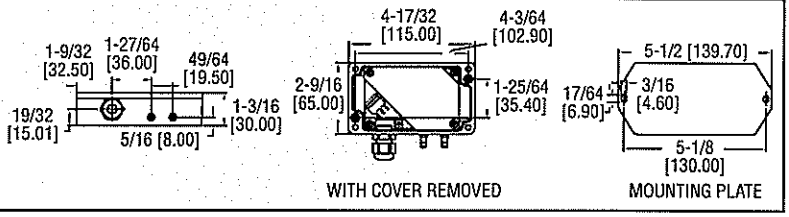
NO.	CHANGES	BY/DATE	DATE / DWN BY / CHKD / APPD	NAME	MATERIAL / FINISH
				677B SERIES PRESSURE TRANSMITTER ARTWORK (FOR REFERENCE ONLY)	DWYER INSTRUMENTS, INC. MICHIGAN CITY, INDIANA 46360 U.S.A.
				3	FR. NO.

Series 677B

Differential Pressure Transmitter

NEMA 4 Enclosure with Integral Mounting Bracket





Series 677B Differential Pressure Transmitters are designed to measure pressures as low as 0.1 in w.c. with ±0.4% accuracy. Use Series 677B for building energy management systems, environmental pollution control, oven pressurization, lab and fume hood control, HVAC and VAV applications. The transmitter features 15 psid overpressure, reverse polarity protection and EMI/RFI protection. Internal regulation permits use with unregulated DC power supplies. The NEMA 4 housing allows for versatile mounting locations and integral mounting tabs simplify installation.

Model	Range (in w.c.)	Model	Range (in w.c.)
677B-01	0 to 0.1	677B-08	0 to 25
677B-02	0 to 0.25	677B-11	0 to ±0.05
677B-03	0 to 0.5	677B-12	0 to ±0.1
677B-04	0 to 1	677B-13	0 to ±0.25
677B-05	0 to 2.5	677B-14	0 to ±0.5
677B-06	0 to 5	677B-15	0 to ±1
677B-07	0 to 10		

ACCESSORIES

A-302F-A, 303 SS Static Pressure Tip with mounting flange. For 3/16" ID rubber or plastic tubing. 4" insertion depth. Includes mounting screws
A-489, 4" Straight Static Pressure Tip with Flange
See page 587 for process tubing options.

SPECIFICATIONS

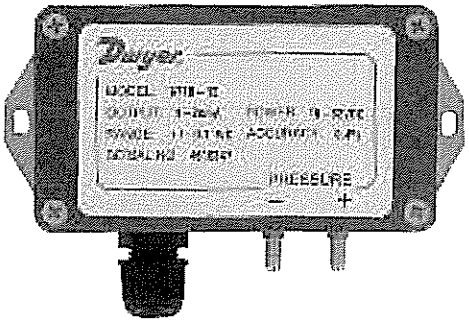
Service: Air and non-conductive, non-corrosive gases.
Wetted Materials: 302 SS, glass, nickel, silicone rubber and brass.
Accuracy: ±0.4% FS* at room temperature.
*RSS includes non-linearity, hysteresis and non-repeatability.
Stability: ±1% FS/yr.
Temperature Limits: Operating and Compensated: 0 to 185°F (-18 to 85°C); Storage: -65 to 220°F (-54 to 105°C).
Pressure Limit: 15 psi (100 kPa).
Thermal Effects: (Includes zero and span) <0.028% FS/°F, 0 to 185°F (-18 to 85°C).
Power Requirement: 16 to 32 VDC.
Output: 4 to 20 mA DC, 2-wire.
Zero and Span Adjustments: Internally accessible potentiometers, noninteractive.
Response Time: Approximately 10 ms.
Max. Loop Resistance: DC: 0 to 800 Ω.
Process Connection: 3/16" OD barbed brass pressure fitting.
Enclosure Rating: NEMA 4 (IP65).
Weight: 11.5 oz (330 g).
Agency Approval: CE.

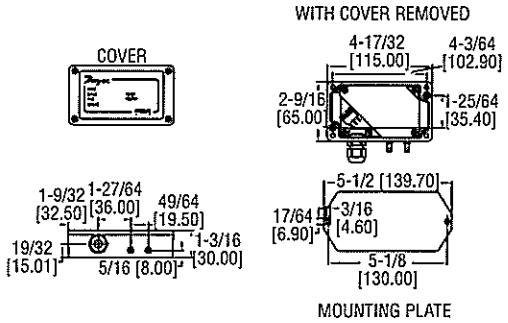
OPTION

For NIST traceable calibration certificate, use order code NISTCAL-PT1.

Series 677B Differential Pressure Transmitter

Specifications - Installation and Operating Instructions





Series 677B Differential Pressure Transmitters are designed to measure pressures as low as 0.1 in w.c. with ±0.4% accuracy. Use Series 677B for building energy management systems, environmental pollution control, oven pressurization, lab and fume hood control, HVAC and VAV applications. The transmitter features 15 psid overpressure, reverse polarity protection and EMI/RFI protection. Internal regulation permits use with unregulated DC power supplies. The NEMA 4 housing allows for versatile mounting locations and integral mounting tabs simplify installation.

Mounting

Series 677B is designed for mounting by using the two (2) slots (suitable for #6 and #8 screws) that are provided on the mounting baseplate. For optimum performance, isolate the instrument from vibration and provide relatively clean, dry air to the pressure ports.

Note: Even though there is no flow through the 677B, a filter is located in both the high and low pressure ports for use in extreme dust or moisture conditions.

In most applications, preferred installation is with the baseplate mounted vertically and located on a flat surface in a junction box or attached to a nearby beam. Quick and easy field replacement is possible by removing the two case screws that hold the housing to the baseplate and lifting the housing free. The baseplate will remain mounted and can be used with the replacement units housing.

NOTICE The axis most sensitive to vibration is the one perpendicular to the baseplate. Avoid mounting with maximum vibration along axis.

Piping

Two (2) 3/16" OD barbed pressure fittings are provided for pressure connection with 3/16" or 1/8" ID push on tubing. For best results, 1/8" ID tubing is suggested for tubing lengths up to 100 feet long.

The overpressure limit with the new tension diaphragm construction is up to 15 psi regardless of range.

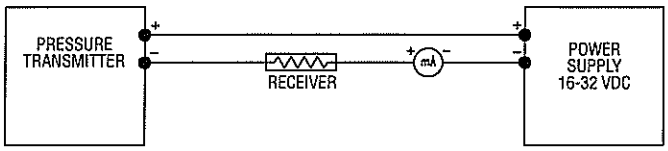
SPECIFICATIONS

Service: Air and non-conductive, non-corrosive gases.
Wetted Materials: 302 SS, glass, nickel, silicone rubber and brass.
Accuracy: ±0.4% FS* at room temperature.
*RSS includes non-linearity, hysteresis and non-repeatability.
Stability: ±1% FS/yr.
Temperature Limits:
Operating and Compensated: 0 to 185°F (-18 to 85°C);
Storage: -65 to 220°F (-54 to 105°C).
Pressure Limit: 15 psi (100 kPa).
Thermal Effects: (Includes zero and span) <0.028% FS/°F, 0 to 185°F (-18 to 85°C).
Power Requirement: 16 to 32 VDC.
Output: 4 to 20 mA DC, 2-wire.
Zero and Span Adjustments: Internally accessible potentiometers, noninteractive.
Response Time: Approximately 10 ms.
Max. Loop Resistance: DC: 0 to 800 Ω.
Process Connection: 3/16" OD barbed brass pressure fitting.
Enclosure Rating: NEMA 4 (IP65).
Weight: 11.5 oz (330 g).
Agency Approval: CE.

Model	Range (in w.c.)
677B-01	0 to 0.1
677B-02	0 to 0.25
677B-03	0 to 0.5
677B-04	0 to 1
677B-05	0 to 2.5
677B-06	0 to 5
677B-07	0 to 10
677B-08	0 to 25
677B-11	0 to ±0.05
677B-12	0 to ±0.1
677B-13	0 to ±0.25
677B-14	0 to ±0.5
677B-15	0 to ±1

Electrical
The Series 677B is a two (2) wire circuit (+SUPPLY, -RECEIVER) with a 4 to 20 mA output. The unit is calibrated at the factory using a 250 ohm load at 24 VDC.

WIRING DIAGRAM FOR 677B SERIES



Calibration
The 677B series is factory calibrated and should require no field adjustment. However, the zero adjustment is provided near the screw terminal strip. Whenever possible, any zero and/or span offsets should be corrected by software adjustment in the user's control system. Use the zero and span adjustments on the 677B series only if absolutely necessary. The 677B series is calibrated in the vertical position at the factory (baseplate vertical). For use in any other orientation, position the unit and follow the adjustment procedure listed below. If a change in range is needed, contact the Customer Service Department for a replacement in the appropriate range.

Zero Adjustment
While monitoring the current output with both pressure ports open to atmosphere, the zero may be adjusted. For unidirectional pressure changes, turn the zero adjustment screw until a reading of 4 mA (± .16 mA) is achieved. For bidirectional ranges, set the zero to 12 mA (± .16 mA).

MAINTENANCE
Upon final installation of the Series 677B Transmitter, no routine maintenance is required. The Series 677B is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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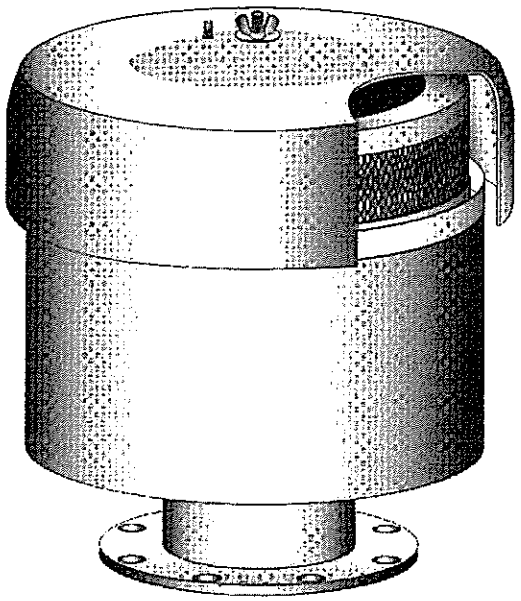
Air Intake Filter/Silencers

Model EMS - Series



The "EMS" Series air intake filter/silencer is designed for both indoor and outdoor applications requiring 6 - 8 dB noise reduction and a high degree of filtration. The unique heavy gauge construction reduces noise transmission and enhances durability in even the most severe environments. This series is ideal for applications such as reciprocating engines, positive displacement blowers and centrifugal compressors. Easy filter element access reduces maintenance time during filter element replacement.

Standard Construction Features

- Available in sizes from 1 inch to 16 inch
- Female NPT discharge connection sizes 1 inch to 4 inch
- 125/150# ANSI drilled plate flanges for sizes 5 inch to 16 inch
- Carbon steel construction
- Removable weatherhood
- Available with paper, felt and wire mesh filter element
- Removable weatherhood
- Gray phenolic resin based fast drying primer suitable for overcoating with urethanes, acrylics, epoxies and industrial enamels. Standard two mil thickness
- 1/8" NPT pressure tab

Optional Construction Features and Accessories

- Stainless steel construction
- Aluminum construction
- Special finish per specification
- Pre-filter wraps
- Special filtration and back-pressure designs
- Special acoustic designs
- Oversized flanges
- Contact factory for additional features to meet your requirements

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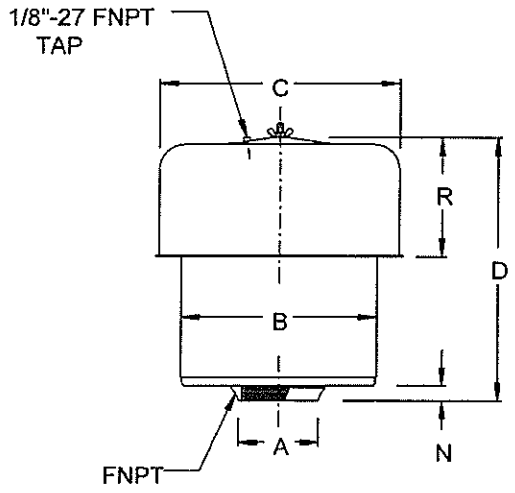
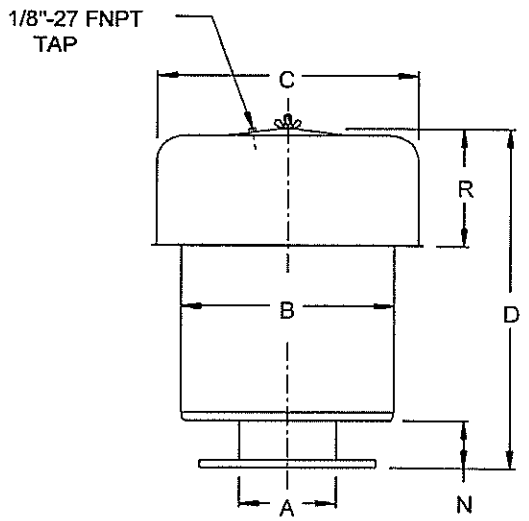
Air Intake Filter/Silencers

Model EMS - Series



1" to 4" Female NPT Connection
(4" flange connection available upon requrest)



5" and Larger-125/150# ANSI Drilled Plate Flange
(5" FNPT connection available upon request)

									Element Model Number		
Model No.	A	C	B	D	N	R	Weight	CFM	Paper	Felt	Wire
EMS-1	1	9 1/2	6 5/8	5 3/8	9/16	2 1/4	8	35	P-642	F-642	W-642
EMS-125	1 1/4	9 1/2	6 5/8	5 3/8	9/16	2 1/4	8	35	P-642	F-642	W-642
EMS-15	1 1/2	9 1/2	6 5/8	5 3/8	9/16	2 1/4	8	75	P-642	F-642	W-642
EMS-2	2	9 1/2	6 5/8	5 7/16	5/8	2 1/4	8	120	P-642	F-642	W-642
EMS-25	2 1/2	14 7/8	12	11 7/8	13/16	4 7/16	20	200	P-974	F-974	W-974
EMS-3	3	14 7/8	12	13 5/8	13/16	4 7/16	20	275	P-974	F-974	W-974
EMS-35	3 1/2	14 7/8	12	13 5/8	13/16	6 7/16	25	375	P-976	F-976	W-976
EMS-4	4	14 7/8	12	13 5/8	1	6 7/16	25	500	P-976	F-976	W-976
EMS-5	5	14 7/8	12	25 1/2	3	7 3/8	36	750	P-1197	F-1197	W-1197
EMS-6	6	22	18	26 1/4	3	8 5/8	53	1100	P-13118	F-13118	W-13118
EMS-8	8	22	18	25	3	10 3/4	70	2200	P-171310	F-171310	W-171310
EMS-10	10	22	18	25	3	10 3/4	95	3000	P-171310	F-171310	W-171310
EMS-12	12	22	18	25	3	10 3/4	108	4300	P-171310	F-171310	W-171310
EMS-14	14	30	24	40	4	15 3/4	180	5900	P-231914	F-231914	W-231914
EMS-16	16	30	24	40	4	15 3/4	190	7700	P-231914	F-231914	W-231914

- When ordering specify paper (P); felt (F) or wire mesh (W) filter element.
- 1 inch to 4 inch standard female NPT connection; 4 inch flange connection available upon request
- 5 inch to 16 inch standard 125/150# ANSI drilled plate flange connection; 5 inch female NPT connection available upon request

Dimensions in inches, weights in pounds. Dimensions and weights are nominal and may vary slightly with production models. Request certified drawings for exact dimensions.

Gasho
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The Leader in Blower & Vacuum Solutions
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West Chester, PA 19380
610-692-5650 Fax 610-692-5837
cs@gasho.org

Gasho Replacement Inlet Filter Elements

High quality replacement elements are available for the filters of various manufactures used on packages built by Gasho.
Paper elements are normally used in inlet filters and replaced when they are dirty.
Polyester elements are cleanable.

Filter Size, In.	Gasho Filter #	Box Quantity	O.D.	I.D.	Ht.	List Price
1	GA-0470	6	5-13/16	4	2	$17.00
2	GA-0471	6	5-13/16	4	2-1/2	$17.00
2.5-3	GA-0472	2	9-3/4	7-1/4	4	$23.00
4	GA-1063	2	9-3/4	7-1/4	6	$27.00
5	GA-0474	1	11-1/2	9-7/8	7	$35.00
6	GA-0475	1	13-5/8	11-5/8	8-5/8	$53.00
8-12	GA-1163	1	17	13	10	$185.00

GA-0471 Elements are frequently used to replace GA-0470

Manufacturer Cross Reference

Gasho Filter #	Universal Filter #	EM Prod. Filter #	Full-On Filters #	Solberg #
GA-0470	81-0470		FOF810470	32-00
GA-0471	81-0471	P-642	FOF810471	32-02
GA-0472	81-0472	P-974	FOF810472	32-04
GA-1063	81-1063	P-976	FOF811063	32-06
GA-0474	81-0474	P-1197	FOF810474	32-08
GA-0475	81-0475	P-13118	FOF810475	32-10
GA-1163	81-1163	P-171310	FOF811163	32-12

February 2012

289 Series Spring-Loaded Relief Valves

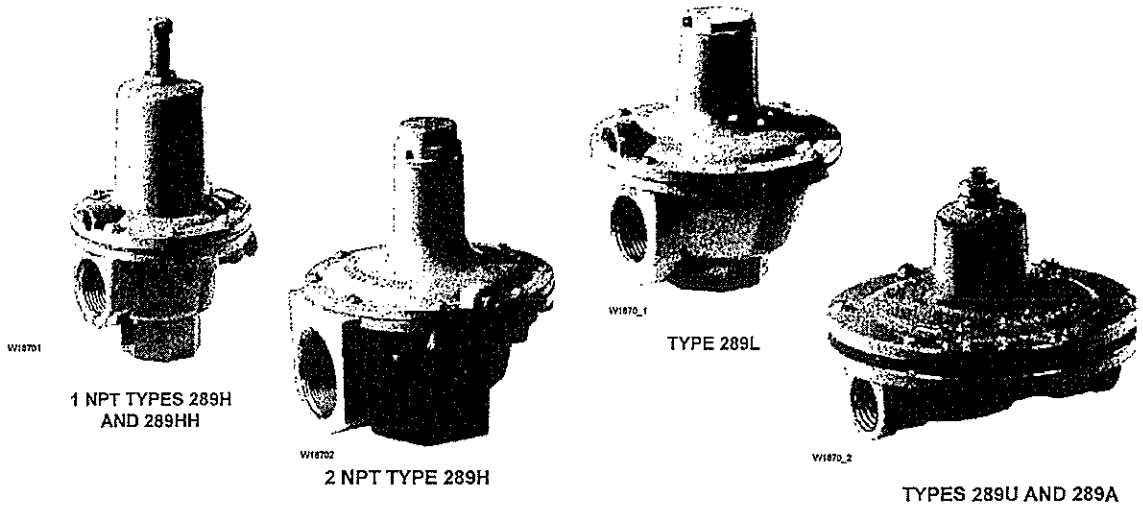

Figure 1. Types 289H, 289L, and 289U Relief Valves

Introduction

The 289 Series relief valve is a throttling relief valve used downstream of pressure regulators to protect the downstream system from overpressure. A smooth throttling action minimizes pressure surges in the system during emergency operation. These relief valves are available in 1/4, 3/4, 1, or 2 NPT sizes with spring ranges (relief pressure settings) from 5-inches w.c. to 75 psig / 12 mbar to 5.2 bar.

All sizes above 1/4 NPT feature a pitot tube booster (Figure 1) for achieving the highest possible relief capacity with a minimum buildup of system pressure. When the valve is opening, high gas velocity through the orifice creates an area of relatively low pressure near the end of the pitot tube. This pitot tube effect forms a partial vacuum above the diaphragm which helps to open the valve.

The relief valve diaphragm functions as a valve disk to control flow in all types except the Types 289H and 289HH, which use O-ring seats. The Nitrile (NBR) or Neoprene (CR) seating surfaces provide tight shutoff. The 289 Series relief valves are ideal for low-pressure settings due to the increased sensitivity provided by the large diaphragm area.

Features

- **Throttling Type Relief**—Smooth, sensitive throttling action minimizes pressure surges.
- **High Flow Rates**—As shown by the Figure 3 capacity curves, high flow rates can be achieved with minimum pressure buildup due to the boosting system which increases the relief valve opening.
- **Small Size**—The 289 Series relief valves are small and compact, making them suitable for areas limited in space.
- **Reliability Due to Simplicity**—A single internal assembly decreases the possibility of mechanical failure.

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Specifications

Available Configurations

Type 289A: 1/4 NPT spring-loaded relief valve for relief pressure settings of 3 to 22 psig / 0.21 to 1.5 bar, two spring ranges

Type 289H: 1 or 2 NPT spring-loaded relief valve for relief pressure settings of 1 to 50 psig / 0.07 to 3.4 bar four spring ranges, in the 1 NPT and of 7-inches w.c. to 10 psig / 17 mbar to 0.69 bar, four spring ranges, in the 2 NPT

Type 289HH: 1 NPT spring-loaded relief valve for relief pressure settings of 45 to 75 psig / 3.1 to 5.2 bar

Type 289L: 3/4 or 1 NPT spring-loaded relief valve for relief pressure settings of 10 to 40-inches w.c. / 25 to 99 mbar, two spring ranges

Type 289U: 1/4 NPT spring-loaded relief valve for relief pressure settings of 5-inches w.c. to 3 psig / 12 mbar to 0.21 bar, two spring ranges

Inlet Connections

Type 289L: 3/4 or 1 NPT

Types 289A and 289U: 1/4 NPT

Type 289H: 1 or 2 NPT

Type 289HH: 1 NPT

Outlet (Vent) Connections

Same size as inlet connection

Maximum Allowable Relief (Inlet) Pressure[1] and Maximum Relief Set Pressure

See Table 1

Capacity Data

See Figure 3

Standard Construction Materials

Valve Body and Spring Case

Types 289A and 289U: Zinc
Types 289H (1 NPT), 289HH, and 289L: Aluminum
Type 289H (2 NPT): Cast iron body with Aluminum spring case

Diaphragm

Type 289A: Neoprene (CR)
Types 289H and 289HH: Nitrile (NBR) or Fluorocarbon (FKM)
Types 289L and 289U: Nitrile (NBR)

Standard Construction Materials (continued)

Orifice

Types 289A and 289L: Aluminum
Type 289H (2 NPT Only): Brass or Stainless steel

O-Ring Seat (Types 289H and 289HH Only):
Nitrile (NBR) or Fluorocarbon (FKM)[2]

O-Ring Seat Holder and Washer (1 NPT Types 289H and 289HH Only):
Aluminum

Seat Washer (2 NPT Type 289H Only):
Stainless steel

Pitot Tube

Types 289H, 289HH (1 NPT), and 289L: Aluminum*Type 289H (2 NPT):* Brass or Stainless steel

Gaskets

Type 289L: Neoprene (CR)
All Others: Composition

Spring: Zinc-plated steel

Diaphragm Plate

Types 289A and 289U: Zinc
All Others: Zinc-plated steel

Closing Cap

Type 289L: Plastic, Aluminum, or Zinc
Type 289H (2 NPT): Zinc

Temperature Capabilities[1]

With Nitrile (NBR) and Neoprene (CR) Elastomer:
-20° to 150°F / -29° to 66°C

With Fluorocarbon (FKM):
20° to 300°F / -7° to 149°C
Available with Types 289H and 289HH only

Approximate Weights

Types 289A and 289U: 0.75 pounds / 0.3 kg

Type 289H

1 NPT: 4 pounds / 2 kg
2 NPT: 15 pounds / 7 kg

Type 289HH: 4 pounds / 2 kg

Type 289L: 15 pounds / 7 kg

Options

- Polytetrafluoroethylene (PTFE) diaphragm protector (Types 289A and 289U only)
- Wire-seal on closing cap (1 NPT Type 289L only)

1. The pressure/temperature limits in this Bulletin and any applicable standard limitation should not be exceeded.
2. Bubble-tight shutoff cannot be attained at settings below 5 psig / 0.35 bar with Fluorocarbon (FKM) O-ring seat.

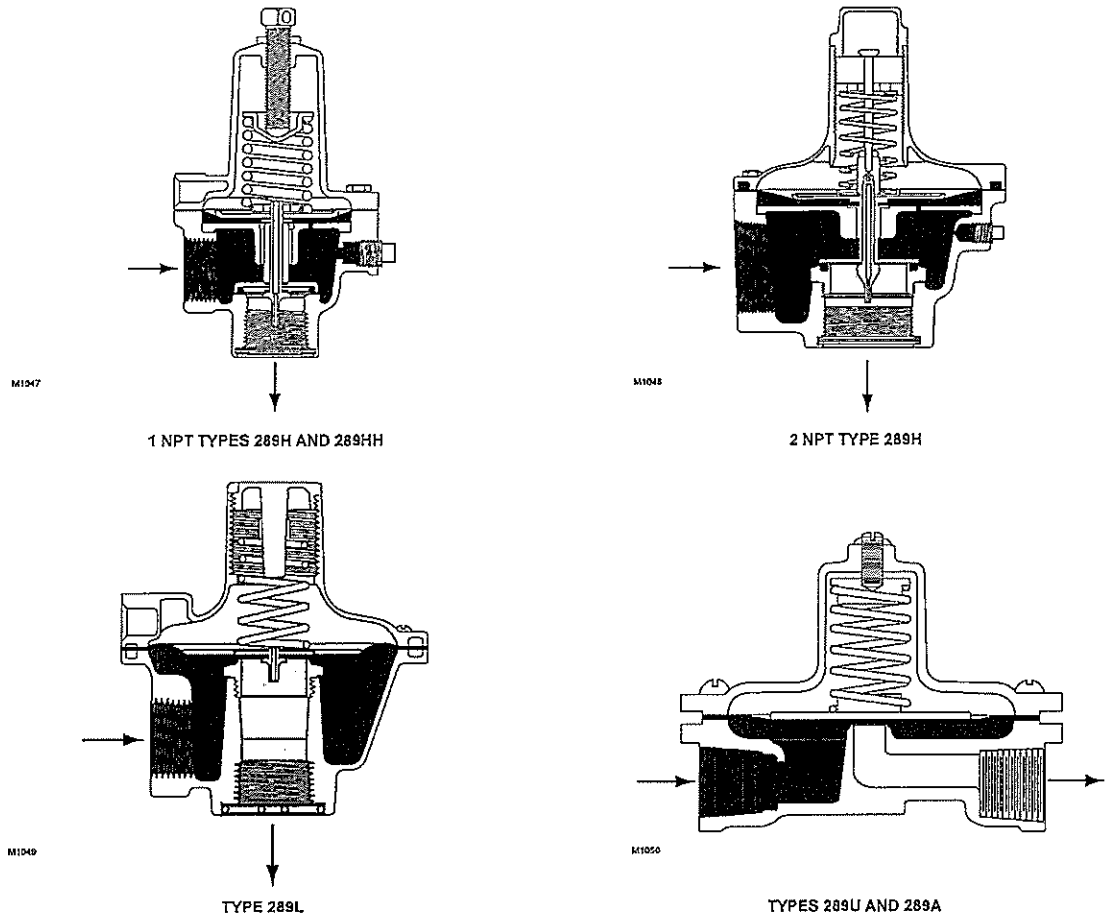
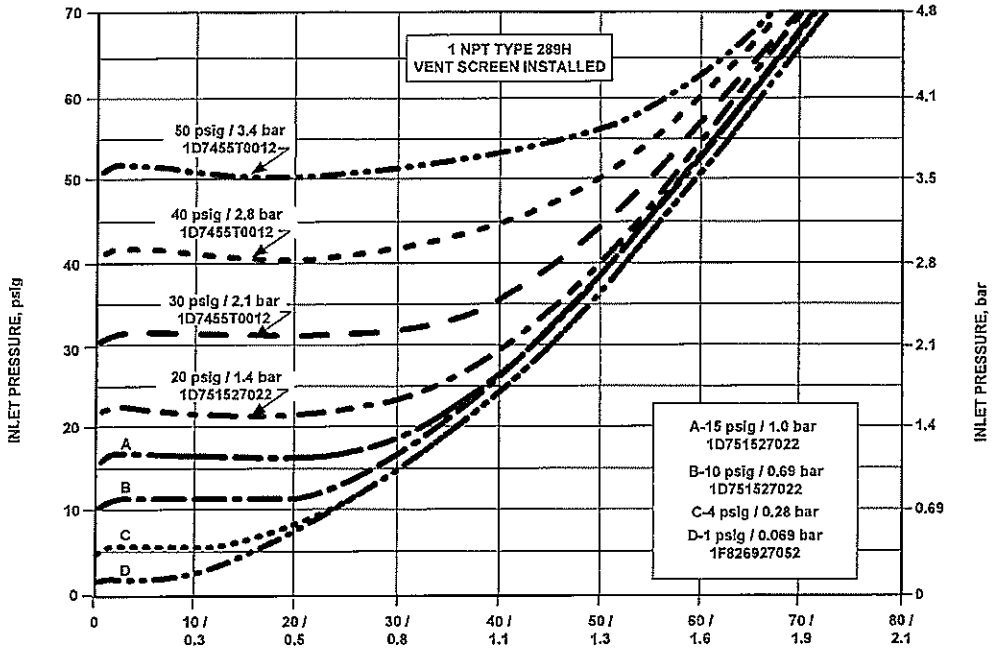


Figure 2. Types 289H, 289L, and 289U Operational Schematics

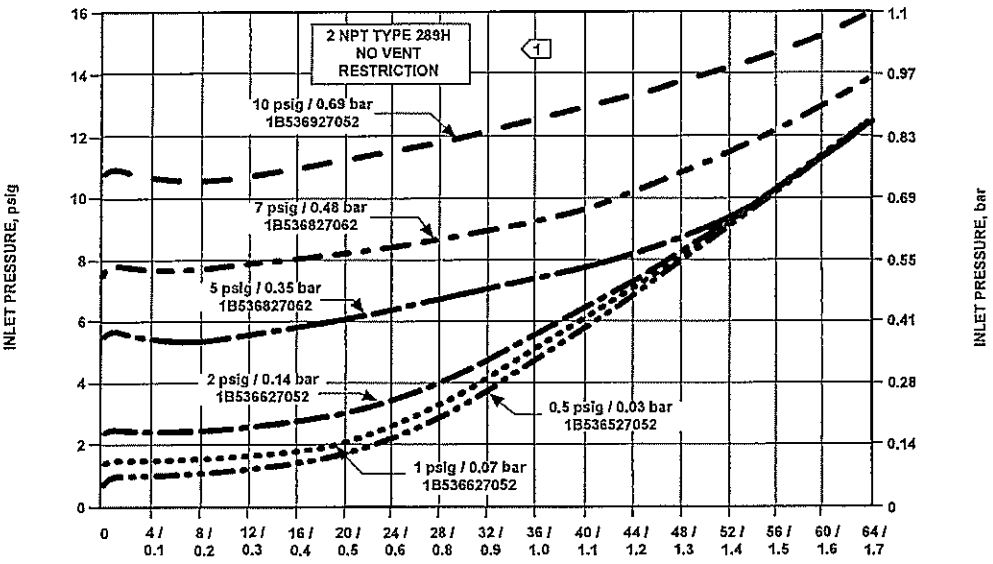
Table 1. Maximum Allowable Relief (Inlet) Pressure

AVAILABLE CONFIGURATION	BODY SIZE, NPT	SPRING PART NUMBER	COLOR CODE	SPRING RANGE (RELIEF PRESSURE SETTINGS)		MAXIMUM ALLOWABLE RELIEF (INLET) PRESSURE[1]	
Type 289A	1/4	0Z056327022 1B268227022	Silver Silver	3 to 13 psig 11 to 22 psig	0.21 to 0.90 bar 0.76 to 1.5 bar	45 psig	3.1 bar
Type 289H	1	1F826927052 1D892327022 1D751527022 1D7455T0012	Pink Red Silver Green	1 to 4.5 psig 4 to 15 psig 10 to 20 psig 15 to 50 psig	0.07 to 0.31 bar 0.28 to 1.0 bar 0.69 to 1.4 bar 1.0 to 3.5 bar	100 psig	6.9 bar
	2	1B536527052 1B536627052 1B536827062 1B536927052	Dark Blue Gray Dark Green Red Stripe	7 to 18-inches w.c. 0.5 to 2.25 psig 1.75 to 7 psig 4 to 10 psig	17 to 45 mbar 0.03 to 0.16 bar 0.12 to 0.48 bar 0.28 to 0.69 bar	25 psig	1.7 bar
Type 289HH	1	1D7455T0012	Green	45 to 75 psig	3.1 to 5.2 bar	100 psig	6.9 bar
Type 289L	3/4 or 1	13A7917X012 13A7916X012	Silver Red Stripe	10 to 18-inches w.c. 12 to 40-inches w.c.	25 to 45 mbar 30 to 99 mbar	7 psig	0.48 bar
Type 289U	1/4	0V060227022 0F058227022	Silver Silver	5 to 25-inches w.c. 20-inches w.c. to 3 psig	12 to 62 mbar 50 to 207 mbar	10 psig	0.69 bar

1. This value indicates the relief pressure setting plus pressure build-up.



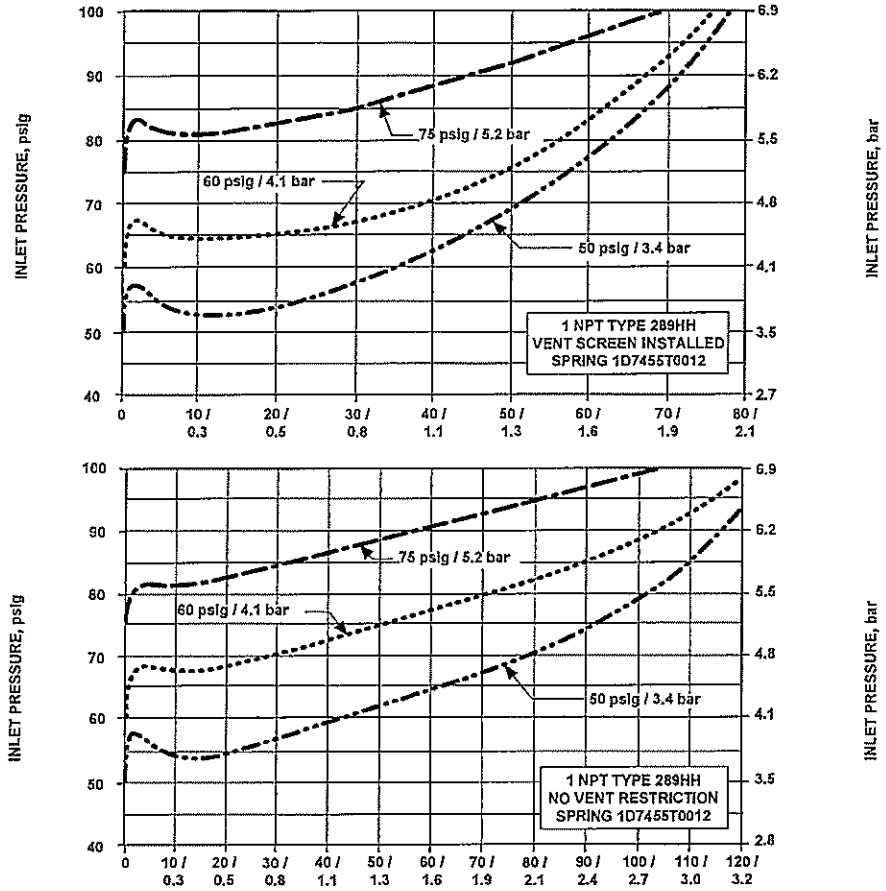
CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia AT 60°F / 1.01325 bar AT 0°C



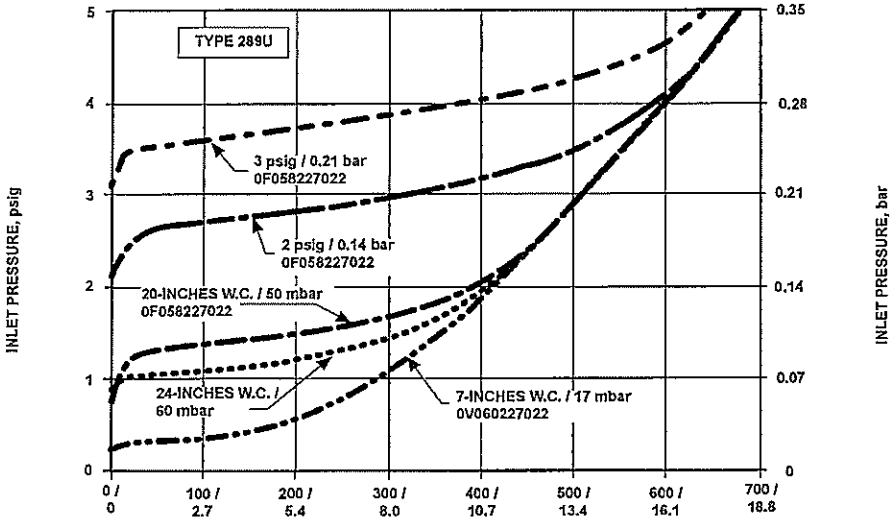
CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia AT 60°F / 1.01325 bar AT 0°C

NOTE:
1. LESS THAN A 5% CAPACITY LOSS CAN BE EXPECTED WITH THE VENT SCREEN INSTALLED ON THE 2 NPT TYPE 289H AT MAXIMUM FLOW.
2. WHEN SELECTING ANY RELIEF VALVE FOR INSTALLATION DOWNSTREAM OF THE REGULATOR, THE CAPACITY OF THE RELIEF VALVE SHOULD BE COMPARED WITH THE WIDE-OPEN CAPACITY OF THE REGULATOR.
3. BUBBLE POINT RELIEF SETTING AND SPRING PART NUMBER ARE NOTED ON EACH CURVE.
4. TO CONVERT TO EQUIVALENT CAPACITIES OF OTHER GASES, MULTIPLY VALUES OBTAINED FROM CURVE BY THE FOLLOWING FACTORS: AIR–0.78, PROPANE–0.628, BUTANE–0.548, NITROGEN–0.789.

Figure 3. Capacity Curves



CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia AT 60°F / 1.01325 bar AT 0°C



CAPACITIES IN 0.6 SPECIFIC GRAVITY GAS —
CUBIC FEET PER HOUR / Nm³/h—14.7 psia AT 60°F / 1.01325 bar AT 0°C

NOTE:
1. WHEN SELECTING ANY RELIEF VALVE FOR INSTALLATION DOWNSTREAM OF THE REGULATOR, THE CAPACITY OF THE RELIEF VALVE SHOULD BE COMPARED WITH THE WIDE-OPEN CAPACITY OF THE REGULATOR.
2. BUBBLE POINT RELIEF SETTING AND SPRING PART NUMBER ARE NOTED ON EACH CURVE.
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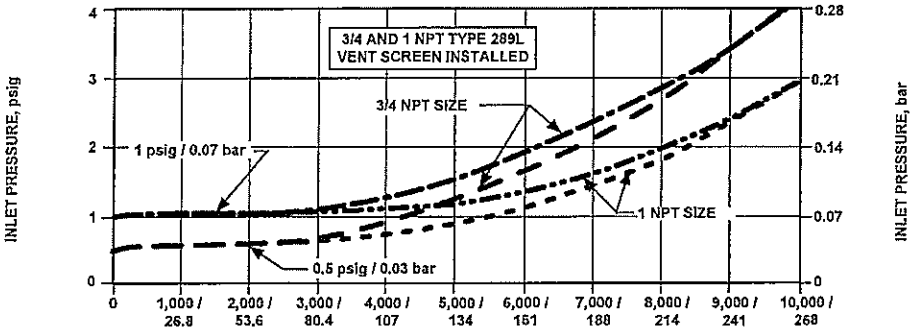
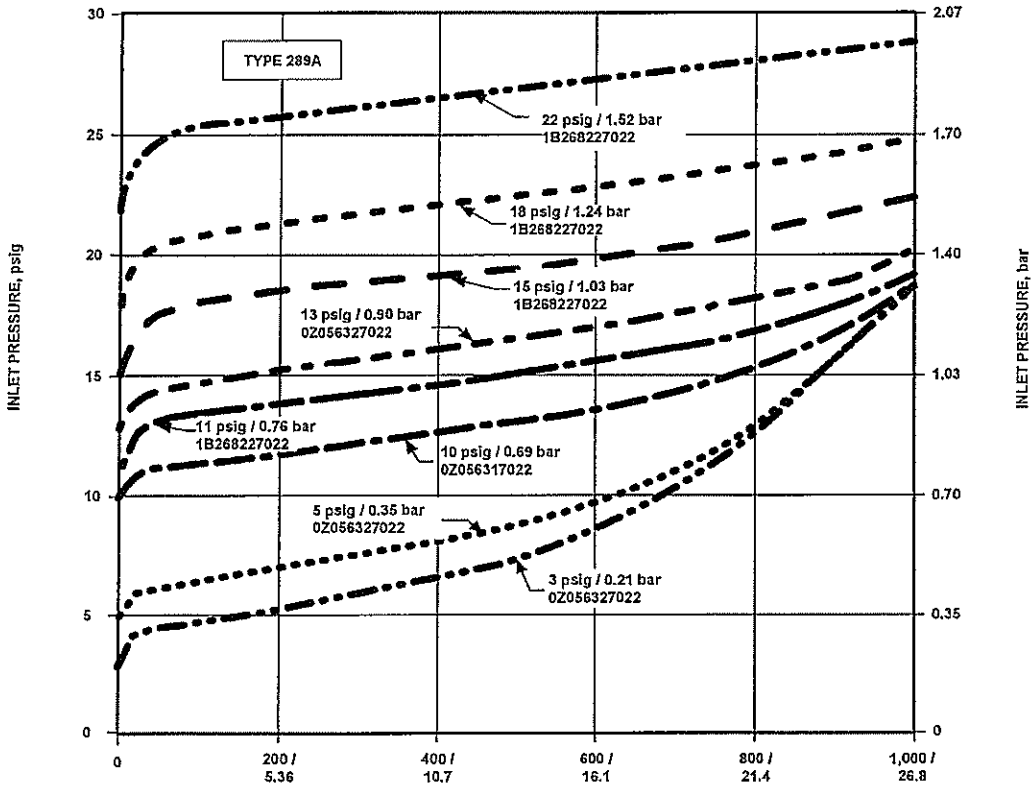
Figure 3. Capacity Curves (continued)



CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 PSIA AT 60°F / 1.01325 bar AT 0°C



CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia AT 60°F / 1.01325 bar AT 0°C

NOTE:
1. WHEN SELECTING ANY RELIEF VALVE FOR INSTALLATION DOWNSTREAM OF THE REGULATOR, THE CAPACITY OF THE RELIEF VALVE SHOULD BE COMPARED WITH THE WIDE-OPEN CAPACITY OF THE REGULATOR.
2. BUBBLE POINT RELIEF SETTING IS NOTED ON EACH CURVE.
3. TO CONVERT TO EQUIVALENT CAPACITIES OF OTHER GASES, MULTIPLY VALUES OBTAINED FROM CURVE BY THE FOLLOWING FACTORS: AIR–0.78, PROPANE–0.628, BUTANE–0.548, NITROGEN–0.789.

Figure 3. Capacity Curves (continued)

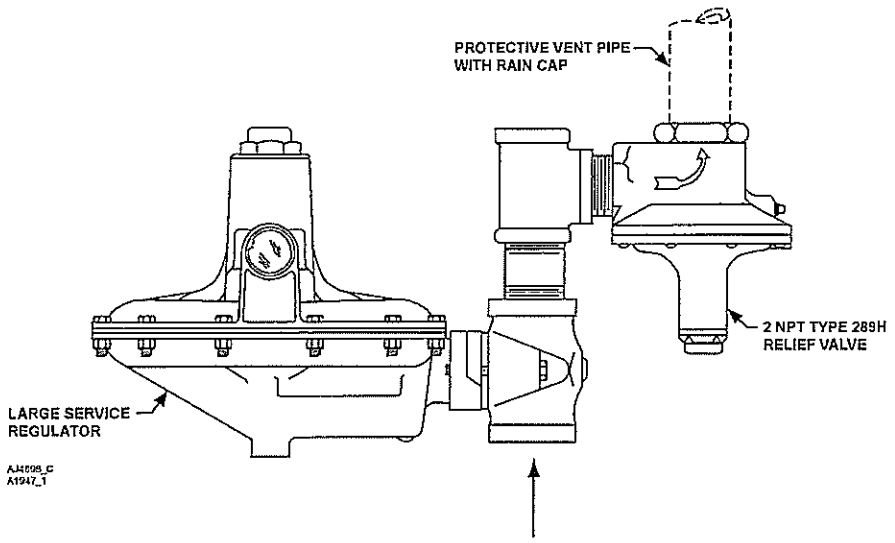


Figure 4. Typical Installation of a 289 Series Relief Valve

Installation

The 289 Series relief valves may be installed in any position. However, the outlet connection must be protected against the entrance of rain, snow, insects, or any other foreign material that may plug the outlet or affect the opening and closing of the valve (see Figure 4). If it is necessary to pipe away the outlet, remove the outlet screen (if one is present).

Flow through the valve must be as indicated by the flow direction arrow on the body (inlet connection is marked on some sizes).

The spring case vent on the 2 NPT Type 289H is tapped and plugged. This vent opening must remain plugged to allow the pitot tube booster to function.

Overpressure

Overpressure conditions in a regulating system may cause personal injury or equipment damage due to bursting of pressure-containing parts or explosion of accumulated gas. Check the system for damage if any of the maximum allowable relief (inlet) pressure ratings in Table 1 are exceeded.

Ordering Information

When ordering, specify:

1. Type number and size
2. Relief pressure range and setting desired
3. Type of gas (natural gas, air, etc.); list any factors such as impurities in the gas that may affect compatibility of the gas with valve trim parts
4. Temperature and specific gravity of the gas
5. Maximum relief (inlet) pressure and flow rate desired
6. Line size and end connection size of adjacent piping
7. For Types 289H and 289HH, specify material of diaphragm and O-ring seat; for 2 NPT Type 289H, specify material of orifice and pitot tube
8. Options desired, if any

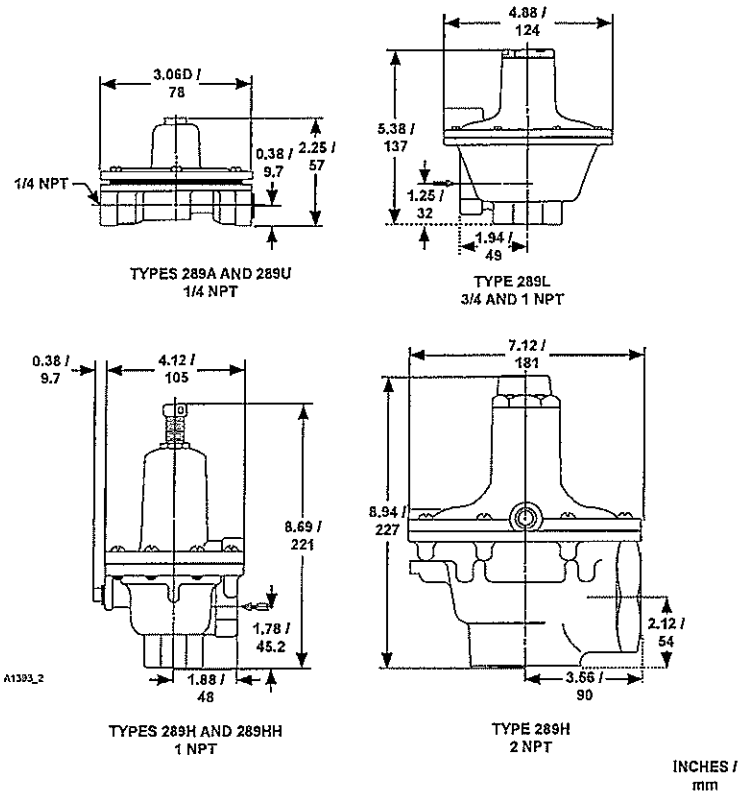


Figure 5. Dimensions

Industrial Regulators

Emerson Process Management
Regulator Technologies, Inc.

USA - Headquarters
McKinney, Texas 75069-1872, USA
Tel: +1 800 558 5853
Outside U.S. +1 972 548 3574

Asia-Pacific
Shanghai 201206, China
Tel: +86 21 2892 9000

Europe
Bologna 40013, Italy
Tel: +39 051 419 0611

Middle East and Africa
Dubai, United Arab Emirates
Tel: +971 4811 8100

Natural Gas Technologies

Emerson Process Management
Regulator Technologies, Inc.

USA - Headquarters
McKinney, Texas 75069-1872, USA
Tel: +1 800 558 5853
Outside U.S. +1 972 548 3574

Asia-Pacific
Singapore 128461, Singapore
Tel: +65 6770 8337

Europe
Bologna 40013, Italy
Tel: +39 051 419 0611
Gallardon 28320, France
Tel: +33 2 37 33 47 00

TESCOM

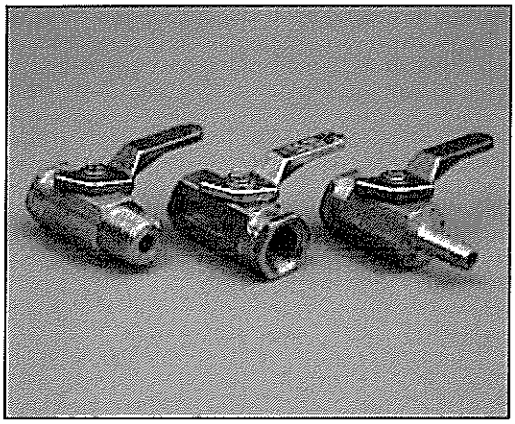
Emerson Process Management
Tescom Corporation

USA - Headquarters
Elk River, Minnesota 55330-2445, USA
Tels: +1 763 241 3238
+1 800 447 1250

Europe
Selmsdorf 23923, Germany
Tel: +49 38823 31 287

Asia-Pacific
Shanghai 201206, China
Tel: +86 21 2892 9499

For further information visit www.emersonprocess.com/regulators



Maximum Operating Pressure - 500 psi
Maximum Operating Temperature - 180 Degrees F
Ball Through Hole Diameter - .218

025 SERIES BALL VALVE

025 One-Way Ball Valve Design Considerations

The 025 Series One-Way Ball Valve compact design promotes multiple configurations to fit the exact end use application. The 025 Ball Valve Series is rated to 500 psi and will support flow and pressure only in the flow direction. The 025 Series has a one-piece body construction, stamped with directional flow arrows, to cover 1/4" NPT end configuration applications. The Zinc Die Cast Lever Handle is standard. Handles can be ordered Reversed - to lie over the outlet when the valve is in the open position. UL configurations are available and rated to 250 psi. UR configurations are available and rated to 500 psi.

Example:	Inlet End	Outlet End	Seal	Handle	Plating
	1/4 FNPT	1/4 MNPT	Buna-N	Steel	ENP

SMC Part Number: 025-4F4M-B,SH,ENP

The handle will lie over the Inlet port when the valve is in the open position. SMC Part Numbers are a description of the valve as read left to right, Inlet to Outlet.
Example: 025-4F4M-B,SH,ENP = 1/4 FNPT Inlet x 1/4 MNPT Outlet

025 Series Options

Material Options Brass Body, Nickel Plated Brass Ball, Teflon® Seats, Stainless Handle Screw

Seal Options Buna-N, Ethylene Propylene, Fluoroelastomer (Viton®), Neoprene

Body Options

- 1/4 Female x 1/4 Female NPT
- 1/4 Female x 1/4 Male NPT
- 1/4 Female x 1/8 Female NPT
- 1/4 Female x 1/8 Male NPT
- 1/4 Female x 1/4 Hose Barb
- 1/4 Female x 11/16-16 Male
- 1/4 Female x 7/16-24 Female
- 1/4 Female x 1/4 Female Flare
- 1/4 Female x 3/8 Compression

Handle Options Zinc Die Cast Lever (Standard), Zinc Die Cast Lever with Red Vinyl Sleeve, Steel Lever, Steel Lever, Round Handle, Steel Lever, Steel Lever with Red Vinyl Sleeve, Round Zinc Die Cast Handle, Black Nylon T-Handle, Blue Nylon Knob, .312 x 1" Stem, Screw Slot Headed Ball

Plating Options Electroless Nickel, Black Zinc

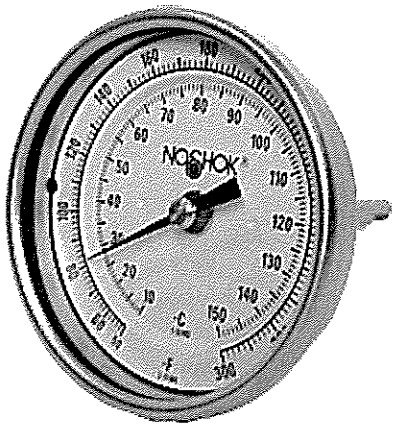
SMC will quote alternate materials or customize our standard products when quantities ensure competitive pricing.
Contact Customer Service at (651) 653-0599, FAX - (651) 653-0989, E-Mail - info@specialtymfg.com

Select A Model 110 Dial Size

20-110
2 Inch

30-110
3 Inch

3 Inch Dial Size



Size & Model Number: 30-110
NPT Connection Size & Type: 1/2" NPT Back Connection
Model Specifications: Stock Model Specifications
Standard Ranges Dual Scale: -100 °F to 150 °F
through 200°F to 1000 °F
-70 °C to 70 °C through
100 °C to 540 °C
Dial Configurations: Dual Scale Fahrenheit / Celsius
Options & Accessories: Regularly Stocked Options & Accessories
Special Ordering: Contact Us for Details on Custom Thermometers
Standard Stem Length 2 1/2 in through 24 in

STANDARD TEMPERATURE RANGES

Dual Scale Dial Units

Outer Scale Options: **Fahrenheit**

Inner Scale Options: **Celsius**

Standard Ranges

RANGE - FAHRENHEIT	FIG. INT.	DIV.	RANGE - CELSIUS	FIG. INT.	DIV.
-100 °F to 150 °F	20 °F	2 °F	-70 °C to 70 °C	10 °C	1 °C
-40 °F to 120 °F	20 °F	2 °F	-40 °C to 50 °C	10 °C	1 °C
25 °F to 125 °F	10 °F	1 °F	-5 °C to 50 °C	5 °C	1/2 °C
0 °F to 140 °F	10 °F	1 °F	5 °C to 50 °C	5 °C	1/2 °C
0 °F to 200 °F	20 °F	2 °F	-15 to 90 °C	10 °C	1 °C
0 °F to 250 °F	20 °F	2 °F	-20 °C to 120 °C	10 °C	1 °C
20 °F to 240 °F	20 °F	2 °F	-5 °C to 115 °C	10 °C	1 °C
50 °F to 300 °F	20 °F	2 °F	10 °C to 150 °C	10 °C	1 °C
50 °F to 500 °F	50 °F	5 °F	10 °C to 260 °C	20 °C	2 °C
150 °F to 750 °F	100 °F	10 °F	65 °C to 400 °C	50 °C	5 °C
200 °F to 1000 °F	100 °F	10 °F	100 °C to 540 °C	50 °C	5 °C

30.110 STOCK MODEL SPECIFICATIONS

Case	304 Stainless Steel
Connection	1/2" NPT Brass Center Back Connection
Bezel	304 Stainless Steel Electropolished
Crystal	Instrument Glass
Stem	304 Stainless Steel
Accuracy	±2% Low Point - ±1% Midpoint - ±2% High Point
Pointer	Black Finish
Dial	Aluminum, White Background, Dual Scale, Black Celsius Scale and Black Fahrenheit Scale

STANDARD STEM LENGTHS

Length	MM	63.5	101.6	152.4	225.6	304.8	381.0	451.2	690.6
	Inches	2 1/2	4	6	9	12	15	18	24
ORDER CODE		025	040	060	090	120	150	180	240

OPTIONS AND ACCESSORIES

Connections:	In addition to our standard 1/4" or 1/2" NPT connection, 3/8' NPT is available. If a special connection is required then Contact Us for Details on Custom Connections.
Special Dials	Special ranges and dials with company names, company logs, part numbers, telephone numbers or almost any custom layout is available. Single scale °F or °C available upon request. Check for availability.
Crystals	Laminated safety glass crystals are available on all 3" & 5" NOSHOK Bimetal Thermometers. Plexiglas crystals are available on all NOSHOK Bimetal Thermometers, however, they should not be used where case temperature exceeds 300 °F (150 °C)

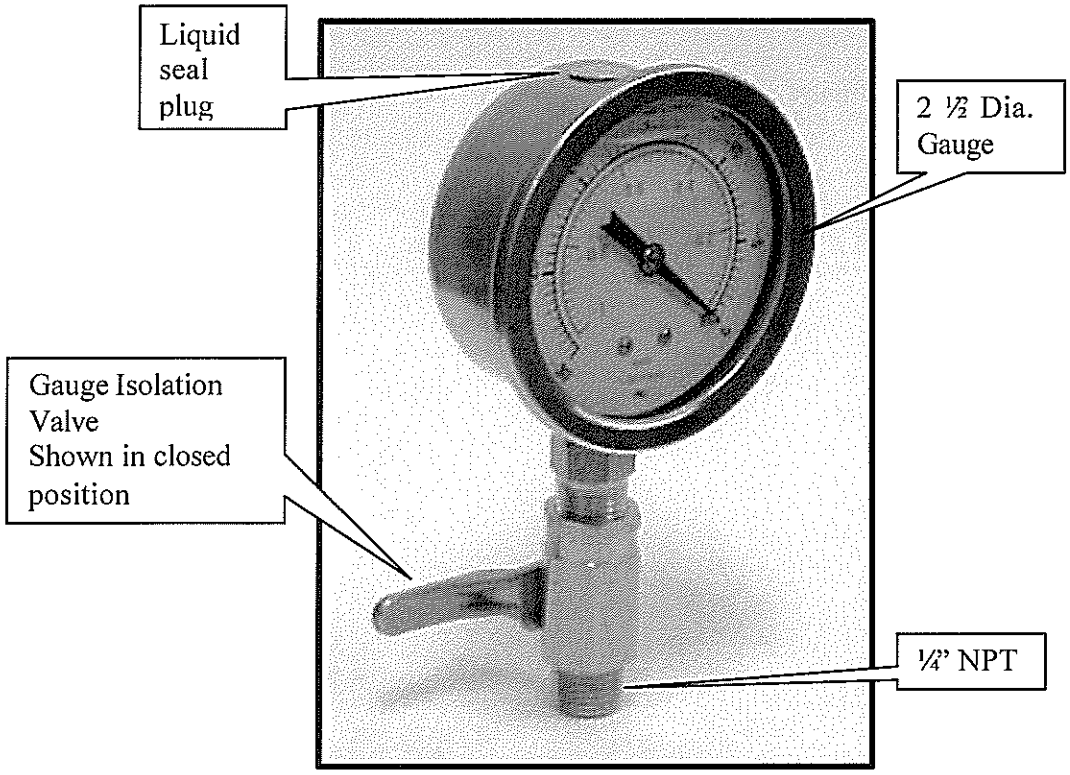
J. E. GASHO & ASSOCIATES, INC.

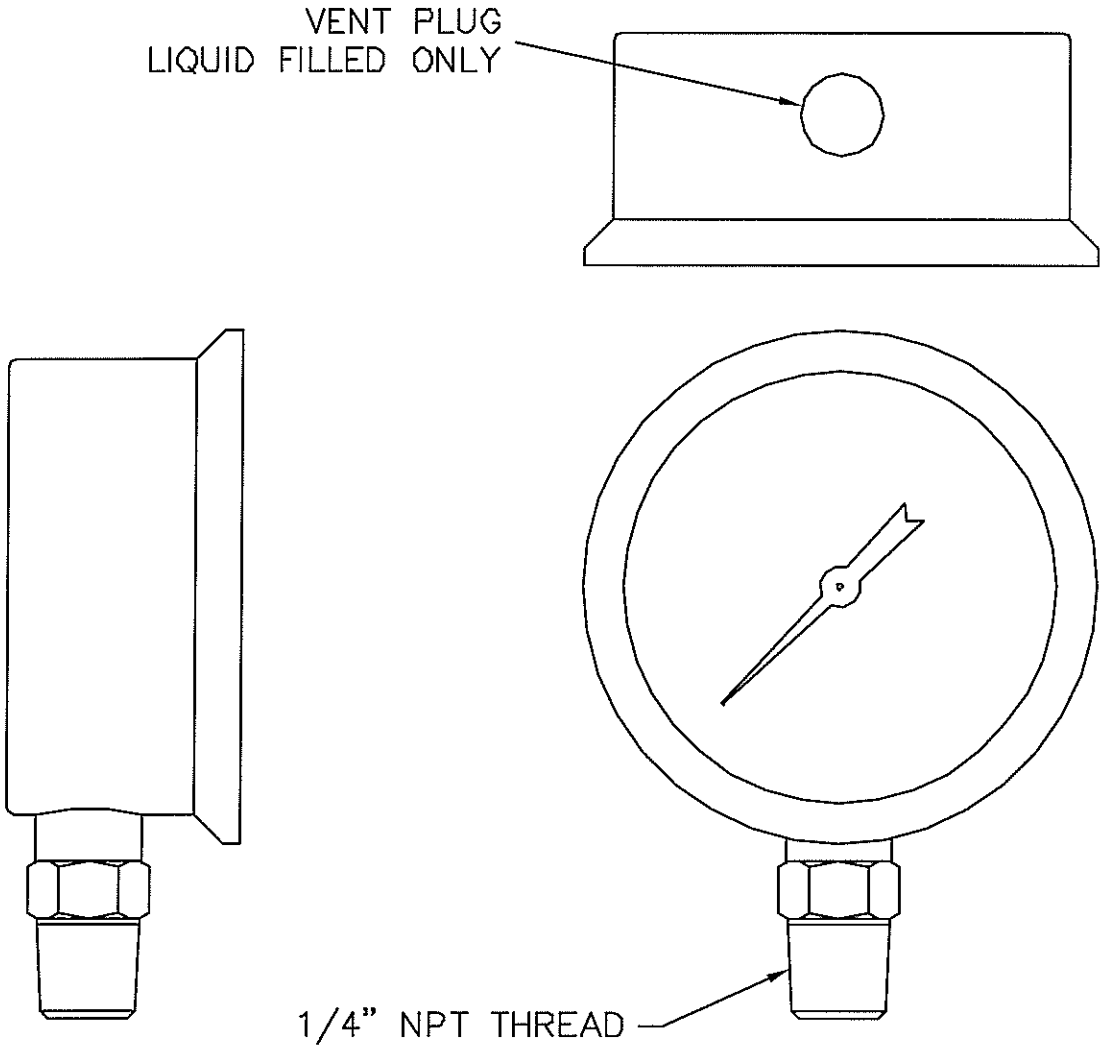
Authorized Manufacturer's Representative
Air / Gas Moving Equipment
460 W. GAY STREET
WEST CHESTER, PA 19380
PHONE: 610-692-5650 FAX: 610-692-5837

Pressure and Vacuum Gauges

We use both standard gauges and liquid filled gauges from a variety of manufacturers. Gauges are installed on our packages with gauge isolation valves (gauge cocks) part number BRS-VA-025-4F4M-BT. The gauge isolation valve can be used as a snubber while reading the gauge by opening it slightly. To protect gauges from damage due to shocks or pulsations in the system, gauge isolation valves should be closed except when the gauge is being read.

Liquid filled gauges may display incorrect readings due to variations in atmospheric pressure. To determine if a gauge is subject to this condition, the liquid filled cavity should be temporarily vented to atmosphere. Most liquid filled gauges have a seal plug in the liquid filled cavity. Remove this plug to allow the cavity to be vented to atmosphere. In some instances the case can be lightly squeezed to burp it. Replace the plug.





25.0.015PSI

NOMINAL SIZE
- 25 = 2.5in
- 40 = 4.0 in.

TYPE
- 0 = NON-FILLED
- 1 = LIQUID FILLED

RANGE

NOTES:
1. WE USE BOTH STANDARD GAUGES & LIQUID FILLED GAUGES FROM A VARIETY OF MANUFACTURERS
2. STANDARD RANGES:
   PRESSURE: 0–6 PSI & 0–160 IWC
   0–15 PSI
   0–30 PSI
   VACUUM: 0–12 IN. HG. & 0–160 IWC
   0–30 IN., HG.

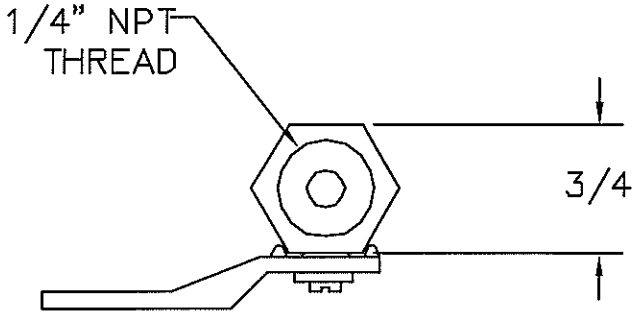
REV.	DATE	DESCRIPTION

DRAWN BY: M. WITTE | DATE: 8–18–00
APPROVED BY: | DATE:
DIMENSIONS IN INCHES
SCALE | TOLERANCE | ANGULAR TOLERANCE | MATERIAL | WEIGHT
SHEET 1 OF 1

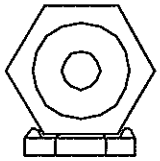
J. E. GASHO & Assoc., Inc.
460 W. GAY ST.
WEST CHESTER, PENNSYLVANIA 19380

PRESSURE GAUGE NUMBERING SYSTEM

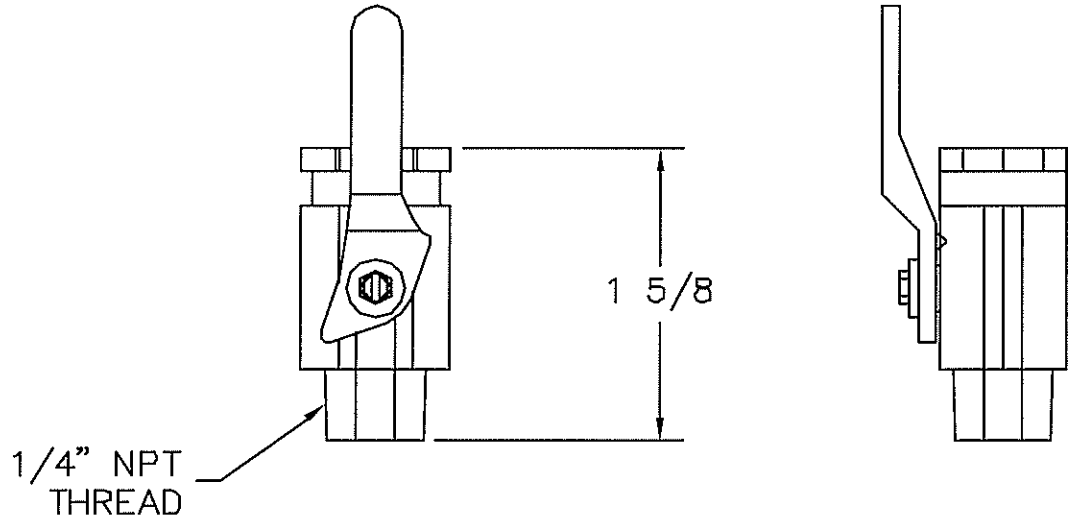
—



PLAN VIEW – CLOSED



PLAN VIEW – OPEN



REV.	DATE	DESCRIPTION

DRAWN BY: M. WITTE	DATE 8–17–00
APPROVED BY:	DATE
DIMENSIONS IN INCHES	
SCALE	
TOLERANCE	ANGULAR TOLERANCE
MATERIAL	WEIGHT
SHEET 1 OF 1	

J. E. GASHO & Assoc., Inc.
460 W. GAY ST.
WEST CHESTER, PENNSYLVANIA 19380

GAUGE ISOLATION VALVE
SMC
VA BRS 025–4F4M–BT

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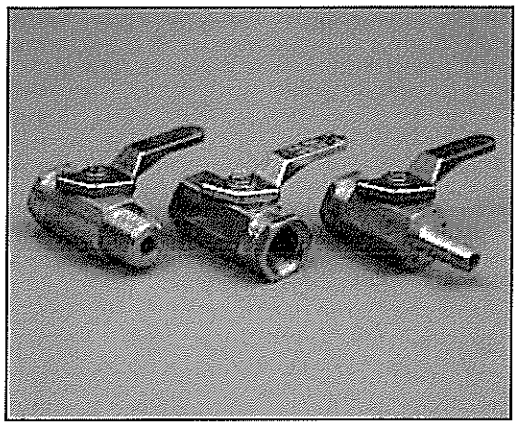

Maximum Operating Pressure - 500 psi
Maximum Operating Temperature - 180 Degrees F
Ball Through Hole Diameter - .218

025 SERIES BALL VALVE

025 One-Way Ball Valve Design Considerations

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Example:	Inlet End	Outlet End	Seal	Handle	Plating
	1/4 FNPT	1/4 MNPT	Buna-N	Steel	ENP

SMC Part Number: 025-4F4M-B,SH,ENP

The handle will lie over the Inlet port when the valve is in the open position. SMC Part Numbers are a description of the valve as read left to right, Inlet to Outlet.
Example: 025-4F4M-B,SH,ENP = 1/4 FNPT Inlet x 1/4 MNPT Outlet

025 Series Options

Material Options Brass Body, Nickel Plated Brass Ball, Teflon® Seats, Stainless Handle Screw

Seal Options Buna-N, Ethylene Propylene, Fluoroelastomer (Viton®), Neoprene

Body Options

- 1/4 Female x 1/4 Female NPT
- 1/4 Female x 1/4 Male NPT
- 1/4 Female x 1/8 Female NPT
- 1/4 Female x 1/8 Male NPT
- 1/4 Female x 1/4 Hose Barb
- 1/4 Female x 11/16-16 Male
- 1/4 Female x 7/16-24 Female
- 1/4 Female x 1/4 Female Flare
- 1/4 Female x 3/8 Compression

Handle Options Zinc Die Cast Lever (Standard), Zinc Die Cast Lever with Red Vinyl Sleeve, Steel Lever, Steel Lever, Round Handle, Steel Lever, Steel Lever with Red Vinyl Sleeve, Round Zinc Die Cast Handle, Black Nylon T-Handle, Blue Nylon Knob, .312 x 1" Stem, Screw Slot Headed Ball

Plating Options Electroless Nickel, Black Zinc

SMC will quote alternate materials or customize our standard products when quantities ensure competitive pricing.
Contact Customer Service at (651) 653-0599, FAX - (651) 653-0989, E-Mail - info@specialtymfg.com

SMALL COMPACT INLET VACUUM FILTERS

"CSL" Series 3/8" - 3" FPT

APPLICATIONS & EQUIPMENT

- Vacuum Pumps & Systems – P.D., Side Channel, Rotary Vane, Screw, Piston
- Vacuum Packaging Equipment
- Vacuum Lifters
- Blowers - Side Channel & P.D.
- Intake Suction Filters
- Pneumatic Conveying Systems
- Soil Venting/Remediation
- Remote Installations for Piston & Screw Compressors
- Printing Industry
- Factory Automation Equip
- Leak Detection Systems
- Woodworking
- Medical Industry

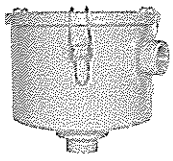
FEATURES & SPECIFICATIONS

- **Vacuum level**: Typically $1x10^{-3}$ mmHg ($1.3x10^{-3}$ mbar)
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron
- Brazed fittings for **High** vacuum duty
- Stainless steel torsion clips for durability
- Low pressure drop
- Positive engagement O-ring seal system
- Fully-drawn one piece canister
- **Large** dirt holding capacity and **Easy** field cleaning, especially when mounted horizontally or inverted
- Rugged all steel construction w/baked enamel finish
- Various media
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 10" - 15" H_2O over initial delta P
- Pressure drop graphs available upon request

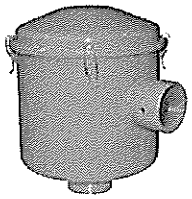
OPTIONS (Inquiries Encouraged)

- Vacuum gauge available
- Dome hood for high holding capacity
- Available in ***Stainless Steel***
- Epoxy coated housings
- Activated carbon prefilter for odor
- Support brackets
- Alternate top-to-canister fastening system for low pressure or pulsating systems

CONFIGURATION

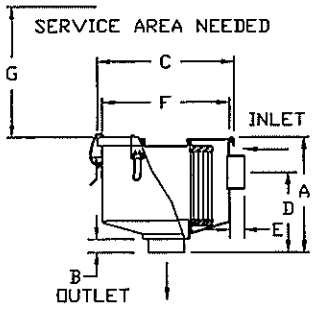


CSL 824-851 Series



CSL 239/238 Series

DRAWING



Dimension tolerance ± 1/4"

I = Industrial Duty S = Severe Duty

	with Polyester Element	with Paper Element	FPT Inlet & Outlet	DIMENSIONS - inches A	B	C	D	E	F	G	Rated Flow SCFM Nominal Rating	Element Rating	Approx. Wt. lbs
I	CSL-825-038HC	CSL-824-038HC	3/8"	3 5/8	9/16	3 3/4	1 7/8	9/16	3 1/2	3	18	25	0.88
I	CSL-825-050HC	CSL-824-050HC	1/2"	3 5/8	9/16	3 3/4	1 7/8	9/16	3 1/2	3	18	25	0.88
I	CSL-843-050HC	CSL-842-050HC	1/2"	4 3/8	9/16	5 7/8	2 1/2	9/16	5	3 1/4	20	55	3
I	CSL-825-075HC	CSL-824-075HC	3/4"	3 3/4	9/16	3 3/4	1 7/8	9/16	3 1/2	3	24	25	0.88
S	CSL-843-075HC	CSL-842-075HC	3/4"	4 3/8	9/16	5 7/8	2 1/2	9/16	5	3 1/4	25	55	3
I	CSL-843-100HC	CSL-842-100HC	1"	4 3/8	3/4	5 7/8	2 5/8	3/4	5	3 1/4	35	55	3
S	CSL-849-100HC	CSL-848-100HC	1"	6 1/2	3/4	7 5/16	4 1/4	3/4	6 13/16	5 1/4	40	115	5
I	CSL-843-125HC	CSL-842-125HC	1 1/4"	4 3/8	3/4	5 7/8	2 5/8	3/4	5	3 1/4	55	55	3
S	CSL-849-125HC	CSL-848-125HC	1 1/4"	6 1/2	3/4	7 5/16	4 1/2	3/4	6 13/16	5 1/4	60	115	5
I	CSL-849-150HC	CSL-848-150HC	1 1/2"	6 1/2	3/4	7 5/16	4 1/2	3/4	6 13/16	5 1/4	80	115	5
I	CSL-851-200HC	CSL-850-200HC	2"	10 1/4	3/4	8 3/4	5	3/4	7 5/8	9 1/4	175	290	15
I	CSL-851-250HC	CSL-850-250HC	2 1/2"	10 1/2	1 1/4	8 3/4	5 1/2	1 1/4	7 5/8	9 1/4	210	290	15
I	CSL-239-300C*	CSL-238-300C*	3"	15 3/4	2 7/8	13 1/4	8 7/8	2 7/8	12	11	300	570	33

*1/4" taps standard on inlet and outlet

1151 Ardmore Ave. • Itasca, IL 60143 USA
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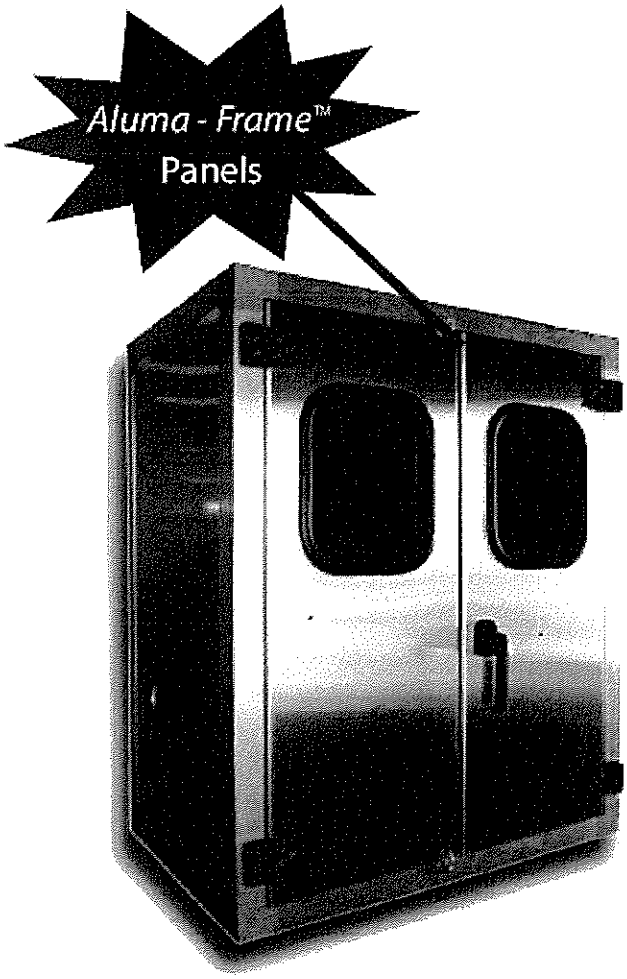
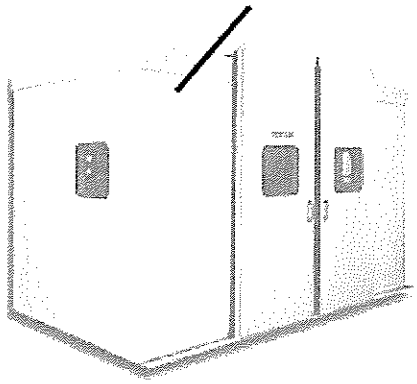
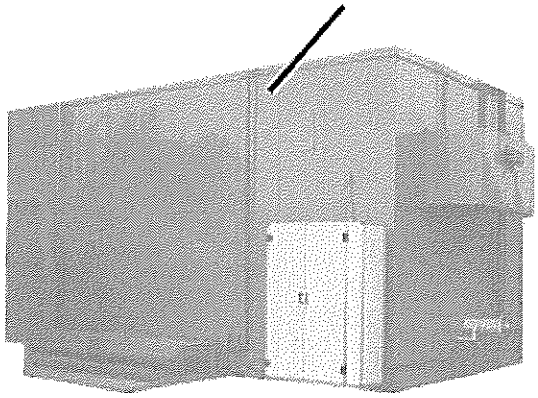
Looking For the Most Versatile Enclosures...



Quick Removable Panels

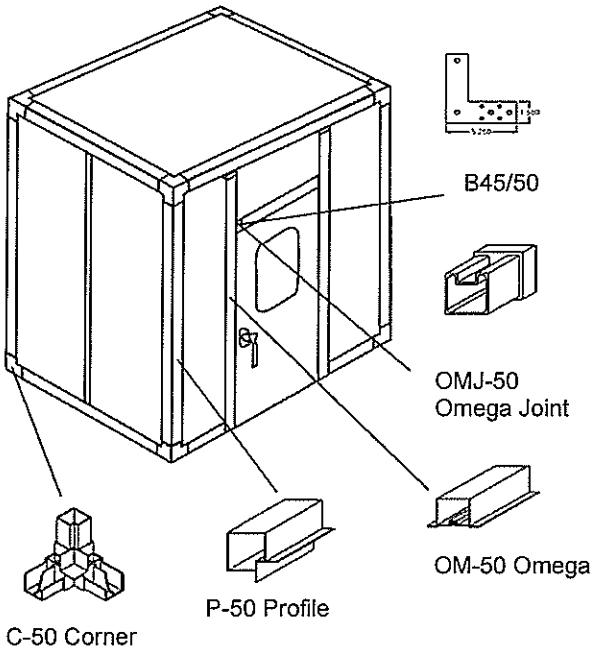


Modular Acoustical Panels



... Call the Experts at ArtUSA Industries

You've done everything you can to create a highly functional and aesthetic manufacturing environment. The enclosures you use should enhance rather than detract from your manufacturing facility. That's why it makes sense to put ArtUSA on your team. At ArtUSA we've been specializing in the design and manufacturing of machine enclosures for over 25 years. We understand how to control noise, splash, mist, dirt and other environmental factors. Our experience includes a variety of different applications such as screw machines, stamping presses, machining centers, grinding machines, lathes and cut-off saws to name a few. So if you are a machine tool user, you can get the highest quality, best looking, custom designed enclosures from ArtUSA Industries, allowing you to concentrate your efforts on producing the highest quality products. For complete information and assistance, call today.



Options:

- STC Rated Panels up to 55 dBA
- Mylar, Polyethylene or Fiberglass Cloth Lining
- Framed Cutouts/Openings
- Primer or Finish Paint
- Multiple Gauge Construction
- Variety of materials available
- Custom Designs per You Acoustical/Thermal Requirements
- Multiple Insulation Materials and Densities
- Available in Quick Removable Panels

Thermal Performance:

Individual panels will have a "U" factor 0.07 and an entire panel enclosure will have a 0.14

Fire Hazard Rating:

Standard acoustical fill will have the following UL Fire Hazard Ratings as per ASTM E-84:
Flame Spread -15 / Fuel Contributed -0 / Smoke Developed -0

Acoustical Performance* - Standard Construction

Sound Transmission Loss (ASTM E-90-81)				*All acoustical tests were performed and reported by an Independent Accredited Acoustical Laboratory. Copies of test reports furnished upon request.			
Octave Band Center Frequency (Hz)	125	250	500	1000	2000	4000	STC
4" Panel (TL in dB)	22	29	40	48	54	60	41
2" Panel (TL in dB)	21	24	35	43	52	57	37

Sound Absorption Coefficients (ANSI/ASTM C243-81 and E795)							
Octave Band Center Frequency (Hz)	125	250	500	1000	2000	4000	NRC
4" Panel	.86	1.09	1.22	1.06	1.05	1.04	1.10
2"Panel	.31	.82	1.19	1.12	1.07	1.06	1.11

ArtUSA 2" S-45 A-F-MW Alum A Frame Enclosure Specification

1. Enclosure shall be designed to be a tight fitting to the perimeter/envelope of the equipment. A 2" clearance shall be provided between the enclosure and the equipment on all sides and the top.

2. Each sound enclosure should be factory assembled and skidded. The enclosure shall be designed to incorporate: forced air ventilation with acoustically treated air intake for ventilation.

3. The enclosure frame shall be made of a heavy-duty aluminum square tubing frame that allows at least one wall and roof panel to be removable without utilizing any screws. A three directional slip fit aluminum corner fitting piece shall be provided at each of the eight corners to connect all aluminum frame pieces together.

4. Acoustical panels shall have 16 gauge galvanized steel channel provided for bottom caps and top caps and opening.

5. Acoustical Panels:

    a. Wall and roof panels shall have exterior skin of 16-gauge aluminum.

    b. 2" absorption material. 6#/cu.ft. bagged in a 2-mil polyethylene bag and all edges of bag to be heat-sealed.

    c. 22-gauge perforated galvanized steel inner liner.

6. All doors should be provided with acoustic seals on all four sides with , stainless steel, or nylon hinges and handles.

7. Acoustical seal strips provided between panels and aluminum frame and aluminum frame and the floor.

8. All RP panels to be easily removable via a quick release retainer clamps.

9. Panel Acoustical Performance shall have been tested by an independent laboratory and achieve an STC=37 & NRC=1.0

2" Panelized Enclosure Specification

ArtUSA Aluminum Sound Enclosure Specification

1.0 General

Acoustical Panel Enclosures shall be insulated double-wall construction and shall be provided as indicated on drawings by a recognized manufacturer with published standards of construction and technical performance. The manufacturer shall have produced a standard factory-fabricated panel system and components for at least 5 years. Performance of the fabricated and installed system shall conform to all specifications listed herein.

2.0 Materials

2.1 Acoustical Metal Panels

A. All panels and their components shall be pre-fabricated, sectional, all metal-clad, modular and designed for easy and accurate field assembly. The panels and components shall not be susceptible to damage due to extended exposure to vibration, air temperature or humidity with the passage of time.

B. Panel Construction

1. All panels shall be (2) inches thick, as noted on drawings, with a solid aluminum exterior shell and a perforated/solid galvanized steel type G90 interior shell. The panels shall be connected together by means of slip fit connection and held together rigidly by the use of self-drilling sheet metal screws and or retaing clips.

2. The panel shell framing members and internal reinforcements shall be welded, screwed and/or riveted together to form a metal-sheathed panel of sufficient strength

for maximum operating loads specified in the structural performance section of these specifications.

3. The solid exterior outer aluminum shell thickness shall be 18 ga. minimum and the interior perforated galvanized steel shell shall be 22-ga. minimum thick.

4. Where perforated materials are indicated, all perforations shall be an open area of no less than 23 percent.

5. All panel internal and external reinforcing members shall be minimum 18 ga.

6. Each panel shall be filled with sound-absorbing materials that are inert, mildew-resistant, vermin-proof, and incombustible.

C. Panel Components and Installation

1. All accessory trim items shall be of 18 ga. minimum aluminum and shall be furnished in factory-standard lengths to be field cut to specified dimensions. Location and quantity of sheet metal screws and trim requirements shall be in accordance with the manufacturer's installation details.

2. Base channel shall be installed on a level and structurally sound surface.

3. All external panel connectors trim items, accessories, base channel/panel interfaces/base channel/floor interfaces, and other sections as noted on the drawings shall be sealed with an acoustical sealant that shall not harden and prevent disassembly in the future.

D. Structural Performance

1. Any special external panel loading conditions including wind, snow and equipment shall be provided for as per specifications.

2. Under the indicated loading conditions, the entire enclosure system shall be self-supporting and/or will be supported as per the specifications. The installer shall furnish and assemble all structural members in strict accordance with drawings and manufacturer's installation details.

3. Under the above loading conditions, the assembled acoustical structure shall not exhibit any panel joint deflection in excess of L/240, where L is the unsupported span length of any panel section in the erected structure.

E. Acoustical Performance

The manufacturer shall provide certified testing data indicating sound absorption and transmission loss characteristics of the panel assembly.

F. Accessory Items

Doors, windows, electrical systems, ventilating systems, accessory components, etc., shall be provided in accordance with drawings.

G. Manufacturer

All materials shall be provided by ArtUSA Noise control Products, Inc.

Twin City Fan & Blower

A Twin City Fan Company

5959 Trenton Lane · Minneapolis, MN 55442-3238
Phone (763) 551-7600 · Fax (763) 551-7601 · www.tcf.com

ISO 9001 CERTIFIED

Customer: W/A
Job Name: IES Fan Selections
Job ID: 110101

January 14, 2011

Fan Description		Fan Performance		Motor Data	
Tag	DCRD095E	CFM	1,200	HP	1/8
Quantity	1	Operating SP (in.wg)	0	RPM	1650
Type	DCRD	Standard SP (in.wg)	N/A	Voltage	115V
Size	095B	RPM	1628	Phase	1
Width	N/A	Tip Speed (fpm)	4,635	Hz	60
Arrangement	N/A	Oper. BHP	0.13	Enclosure	ODP
Class	N/A	Standard BHP	0.13	Efficiency	Std. Eff./EPACT*
Rotation	N/A	Outlet area (sq. ft)	1.15	Frame	0
Discharge	N/A	Outlet Velocity (fpm)	1,043		
Wheel diameter (in.)	10.88	Temperature (°F)	70		
Drive method	60 Hz direct drive	Altitude (ft)	0		
Percentage width	100%	Density (lb/ft³)	0.075		
Percentage diameter	100%	Max RPM for Class	1665		
		Static Efficiency	N/A		
		Mechanical Efficiency	10.22		

Accessories Included

DCRD 095B Package	Net 43 lb.
Birdscreen - Galvanized	0 lb.
Disc Switch-Unfused (NEMA 1), Shipped Loose	0 lb.
1/8 HP, 1650 RPM, 115V, 1Ph, 60Hz, ODP, Std. Eff./EPACT*, 0	0 lb.
Total Weight	43 lb.

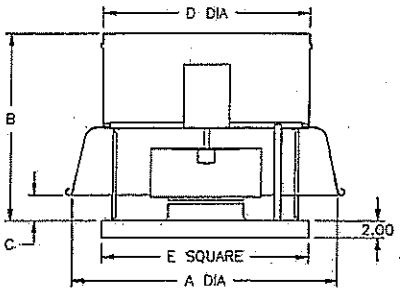
* Where Applicable, Std. Eff. Motors meet EPACT Requirements.

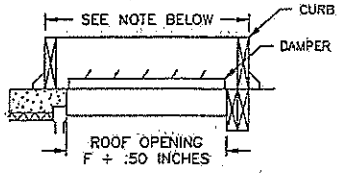
Twin City Fan Companies, Ltd.
Member of Air Movement and Control Association
5959 Trenton Lane - Minneapolis, MN 55442-3238

DIRECT DRIVE CENTRIFUGAL ROOF EXHAUSTER

DCRD SERIES

DCRD SIZE	A	B	C	D	E INSIDE	DAMPER SIZE (F)	STANDARD CURB SIZE	AVG. SHIP WT, (LB,)
060B/070B	18.50	15.63	2.06	15.12	17.00	10 x 10	15.5 x 15.5	30
080B								32
085B/090B/095B	21.00	19.31	2.63					43
100B		17.31						48
120B	27.88	22.38	3.63	22.00	20.00	14 x 14	18.5 x 18.5	50
130B		23.25	4.44		24.00	18 x 18	22.5 x 22.5	65
140B		23.50	4.69					67
150B	31.06	26.75	4.63	24.00				77
160B		27.25	5.19					82
170B	39.63	29.25	4.06	30.00	30.00	24 x 24	28.5 x 28.5	95
180B	39.63	30.25	5.06					100





NOTE: OUTSIDE DIMENSION OF ROOF CURB SHOULD BE 1" TO 1.50" LESS THAN INSIDE CURB CAP DIMENSION "E", DEPENDING ON THICKNESS OF FLASHING MATERIAL USED. IF CURB HINGES ARE USED, SPECIFY 1.50" DIFFERENCE.

FEATURES

- HEAVY-GAUGE, CORROSION RESISTANT, SPUN ALUMINUM HOUSING AND CURB CAP.
- EXTERNAL, WATERTIGHT WIRING POST (EMT) PROVIDED FOR ELECTRICAL CONDUIT.
- .50" x .50" HEAVY-GAUGE GALVANIZED BIRDSCREEN STANDARD.
- FIELD WIRING JUNCTION BOX STANDARD WITH UNIT.
- DISCONNECT SWITCH STANDARD.
- CLASS B INSULATED MOTOR.
- MOTOR PREWIRED TO JUNCTION BOX AND DISCONNECT SWITCH.
- UNIT MOUNTING HOLES IN CURB CAP PREPUNCHED.
- ALL UNITS AND ODP MOTORS AVAILABLE WITH SPEED CONTROL (115V).
- MOTOR COVER, SKIRT AND DEEP INLET VENTURI DESIGN PROTECT AGAINST SNOW AND RAIN ENTRY INTO BUILDING.
- NON-OVERLOADING ALUMINUM WHEEL DYNAMICALLY AND STATICALLY BALANCED.
- THERMALLY PROTECTED MOTOR STANDARD (SINGLE PHASE MOTORS).
- HIGH EFFICIENCY PSC TYPE MOTOR PROVIDED FOR ALL UNITS WITH SPEED CONTROL.
- ALL MOTORS PROVIDED WITH PERMANENTLY LUBRICATED BALL BEARINGS.
- MOTOR AND FAN WHEEL ARE ISOLATED FROM UNIT STRUCTURE, REDUCING NOISE TRANSMISSION INTO DUCTWORK.

FAN SPECIFICATIONS					MOTOR SPECIFICATIONS					
QTY.	MODEL NO.	CFM	SP	FAN RPM	HP	RPM	VOLTS	PH	HZ	ENCL.
	DCRD095E	1200	0		1/8	1650	115	1	60	ODP

TAG: _____

CUSTOMER: _____

/REP

PROJECT: _____

SUBMITTED: _____

APPROVED: _____

ACCESSORIES:

BIRDSCREEN (GALV. STD.)

DISCONNECT SWITCH (STD.)

TCF RESERVES THE RIGHT TO SUBSTITUTE MATERIAL OR CHANGE PRODUCT SPECIFICATIONS.

TCF CERTIFIES THAT THE DCRD SERIES SHOWN HEREIN IS LICENSED TO BEAR THE AMCA SEAL. THE RATINGS SHOWN ARE BASED ON TESTS AND PROCEDURES PERFORMED IN ACCORDANCE WITH AMCA PUBLICATION 211 AND AMCA PUBLICATION 311 AND COMPLY WITH THE REQUIREMENTS OF THE AMCA CERTIFIED RATINGS PROGRAM.

c UL us ALL DCRD MODELS ARE AVAILABLE U.L. 705 LISTED. FOR ELECTRICAL. FILE NO. E155680.

NOTE: cULus LISTING AVAILABILITY IS DEPENDENT ON MOTOR AND ACCESSORIES SELECTED.

JEC 04/30/08	ORDER NUMBER	REV.
D-4051B		

PWGC
Strategic Environmental Engineering Solutions

APPENDIX D

OM&M FORMS

PWGC
Strategic Environmental Engineering Solutions

SSVM System Monitoring Form

Parameter	SSVM 1 Model Shop	SSVM 2 Oracle Training	SSVM 3 Tool Crib	SSVM 4 Facilities Storage
VFD Frequency	Hz	Hz	Hz	Hz
Motor Speed (at VFD)	RPM	RPM	RPM	RPM
Current (at VFD)	Amp	Amp	Amp	Amp
Temperature (at blower)	°F	°F	°F	°F
Vacuum (at Blower)	In. W.C.	In. W.C.	In. W.C.	In. W.C.

Note: Compare Values to Table 1 - Settings and Operating Ranges in SSVM OM&M Manual.

Comments:

P.W. Grosser Consulting, Inc • P.W. Grosser Consulting Engineer & Hydrogeologist, PC
630 Johnson Avenue, Suite 7 • Bohemia, NY 11716
PH 631.589.6353 • FX 631.589.8705 • www.pwgrosser.com
New York, NY • Syracuse, NY • Seattle, WA

PWGC
Strategic Environmental Engineering Solutions

SSVM Communication Testing Form

Monitoring Point	Location	Vacuum	Monitoring Point	Location	Vacuum
MP-1	Compactor Room	in. W.C.	TMP-1	Facilities Storage	in. W.C.
MP-2	Facilities Storage	in. W.C.	TMP-2	Compressor Room	in. W.C.
MP-3	Mail Room	in. W.C.	TMP-3	Loading Dock	in. W.C.
MP-4	Facilities / EH&S	in. W.C.	TMP-4	Storage Room	in. W.C.
MP-5	Repro-graphics	in. W.C.	TMP-5	Model Shop	in. W.C.
MP-6	Materials Lab	in. W.C.	TMP-6	Alodine Room	in. W.C.
MP-7	Oracle Room	in. W.C.	TMP-7	Metrology Room	in. W.C.
MP-8	Model Shop	in. W.C.	TMP-8	Metrology Room	in. W.C.
MP-9	PIF Lab	in. W.C.	TMP-9	Model Shop	in. W.C.
MP-10	Model Shop	in. W.C.	TMP-10	Model Shop	in. W.C.
			TMP-11	Mail Room	in. W.C.

Comments: _____

_____

_____

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