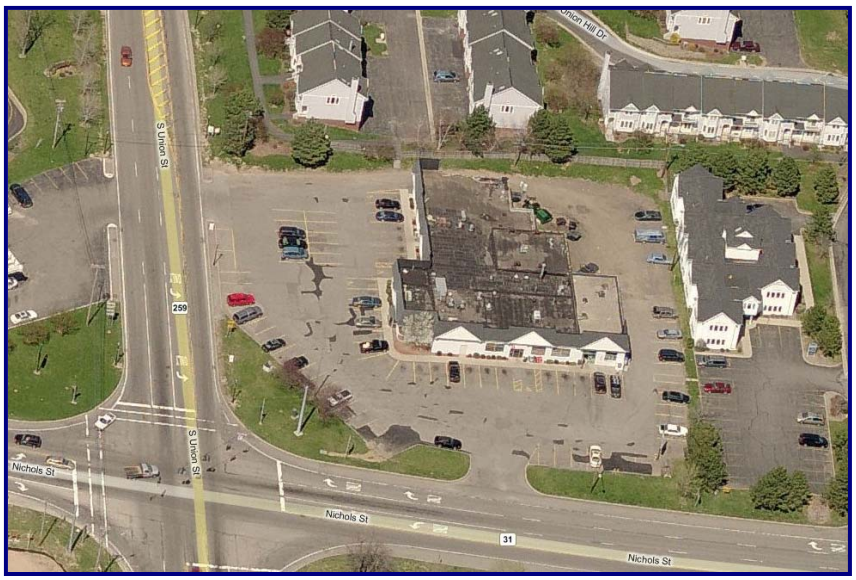
Active Subslab Depressurization System Work Plan

500 South Union Street Site
Spencerport, New York
BCP Site No. C828153

August 2010 0188-001-100

Prepared For:

Eyezon Associates, Inc.



TurnKey Environmental Restoration, LLC

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ACTIVE SUBSLAB DEPRESSURIZATION SYSTEM WORK PLAN

500 SOUTH UNION STREET SITE
BCP SITE NO. C828153
SPENCERPORT, NEW YORK

April 2010
Revised August 2010

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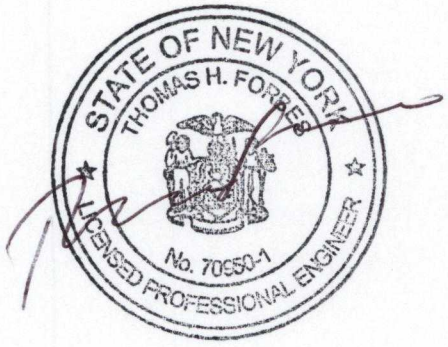

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ASD SYSTEM IRM WORK PLAN
500 South Union Street Site
BCP Site No. C828153

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ASD SYSTEM IRM WORK PLAN
500 South Union Street Site
BCP Site No. C828153

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APPENDICES

1.0 ASD SYSTEM DESIGN & INSTALLATION

1.1 Introduction

The Site is an approximate 1.2-acre property currently improved with an approximate 12,750 square foot a multi-tenant commercial building with tenants that include a drycleaner, a restaurant, a pizzeria, a salon and a deli. Based on the findings of two Phase I Environmental Site Assessments (ESAs), the Site was historically used agriculturally through the 1930's. A portion of the existing structure was constructed in the 1940's and used as a button factory. In the early 1970's, the Site was used as a dry cleaning facility as well as a hair salon and restaurant. During that time, an addition was added to the building. In 1989 a second addition was added to the building completing the present day structure.

Prior to 1986, spent filters from the dry-cleaning unit were disposed of in dumpsters located outside the building on the eastern portion of the Site. Subsurface Investigations completed in 1998 and 2008 identified the presence of chlorinated VOCs, specifically tetrachloroethylene (PCE) and its chemical breakdown products, in soil and groundwater on-Site. PCE is a common dry-cleaning solvent that was historically utilized on-Site. The distribution of PCE and other chlorinated VOCs in groundwater suggests that on-Site contamination may have originated from the area of the dumpsters into which spent dry cleaning filters were disposed. Currently, a Remedial Investigation/Alternatives Analysis is planned at the Site. This IRM work plan is prepared in association with the RI/AA Work Plan. This document presents the interim remedial measure (IRM) proposed scope of work and implementation procedures for the design and installation of an active subslab depressurization (ASD) system at the 500 South Union Street, Town of Ogden, Village of Spencerport, Monroe County, New York (S.B.L# 087.17-1-61) Site (see Figures 1 and 2). Eyezon Associates, Inc. (Eyezon) has been accepted into the Brownfield Cleanup Program (BCP) as a "volunteer". The Site is designated as the 500 South Union Street Site (BCP Site No. C828153).

1.2 General

An ASD system creates a low-pressure zone beneath a building slab using a powered fan connected via piping to create negative pressure beneath the building foundation. The

low pressure field prevents soil gas from entering the building. Generally, essential components of an ASD include:

- A layer of coarse sub-base aggregate beneath the slab.
- Extraction points beneath the slab across the building structure.
- A vent stack pipe from the extraction point(s) under the slab to the roof.
- A continuous operation fan equipped with a pressure gauge indicating the system is under negative pressure.
- Sealing of all major slab and foundation penetrations, including joints, cracks and utility and pipe penetrations.

The ASD system used for this project will be designed in accordance with the EPA design document entitled "Radon Prevention in the Design and Construction of Schools and Other Large Buildings" Third Printing with Addendum, June 1994 and the NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" dated October 2006. This design incorporates multiple extraction points depending on the results of pre-design field testing, each of which will be fitted with: a vertical piping vent stack and associated materials; an exhaust fan; a photohelic pressure gauge; and a system failure warning device. Additional detail concerning the system design and installation is presented below.

1.3 Pre-Design Field Testing

The design and installation of an effective ASD system within an existing structure requires numerous assumptions. However, the largest assumption is the actual and effective distance at which the proposed system will create a vacuum and influence the sub-slab pressure, thus capturing any potential sub-slab vapors. Therefore, pre-design field testing will be performed at the Site to determine the actual sub-slab communication conditions. To accomplish this, an approximate 5-inch hole will be cored through the slab in several strategic locations using a core drill and a 5-inch diamond coring bit (or similar). Each slab penetration will be cleaned out to create a small sub-slab void, thus incrementally increasing the surface area of the sub-slab aggregate. At a minimum, one testing location per tenant space will be selected.

Field personnel will then insert a testing assembly into each 5-inch slab penetration. This testing assembly applies a vacuum, measures the effective vacuum at the point of extraction, and allows an adjustable vacuum to simulate several different available fan products that would be installed in the actual system. Additional ¼-inch sampling points will then be drilled at various distance increments linearly from the 5-inch central location.

To perform the test, vacuum will be applied, the actual vacuum at the point of extraction will be recorded, and differential pressure (room ambient pressure minus the sub-slab pressure) will be measured and recorded at each ¼-inch sampling point using a DP-Calc Micromanometer Model 5815 (or similar). This process will be repeated for a range of vacuum levels. The radius of influence (i.e., distance negative pressure greater than -0.002 inches of H_2O is measured) for respective vacuum levels will be measured.

Upon completion of the testing described above, the holes will be sealed with concrete or polyurethane sealant and the area of the building where testing will occur will be properly ventilated before the tenant or general public can return to that area of the building. This precautionary step will make certain there are no lingering vapors in the area of the testing. Ventilation will include opening doors and windows and utilizing portable fan(s) to flush the building.

During the pre-design testing, an inventory of the building will be conducted to determine if natural draft combustion appliances are present. If natural draft combustion appliances are found to be present, back draft testing will be included in the post-installation test requirements.

Based on the results of the pre-design communication testing, the number and location of sub-slab extraction pits and in-line fans will be determined.

1.4 ASD System Design and Installation

Results of the pre-design field testing will be used to determine the final ASD system design, including the number of independently operating perimeter extraction points, exhaust fans, and vent stacks. A detail of a typical ASD design as implemented at other similar sites is presented in Figure 2.

TurnKey employs qualified environmental professionals and professional engineers that will oversee the design, installation and testing of the ASD system. Vapor extraction points (i.e. suction pits) will be constructed within the existing building slab. Dimensions of

the extraction points will be based on the results of the field testing, however an approximate 8-inch minimum depth will be utilized. Extraction points will be backfilled with crushed aggregate meeting Size #5 or equivalent specifications (ASTM C-33-90), which include a range of 0.5-1-inch diameter, with less that 10% passing through a ½-inch sieve and has a free void space of approximately 50%. At each extraction point, a Fan Tech Model FR 160 (or similar) (refer to Appendix A for specifications) will be installed inline with each vent pipe on the exterior of the building to produce a negative pressure in the sub-slab soil. Schedule 40 PVC piping (3-, 4- or 6-inch based on field testing results) will be utilized. Horizontal pipe runs will be pitched to promote drainage of any condensate away from the fan towards the extraction points. Slab penetration of the vent stack pipe from the extraction points will be sealed with polyurethane sealant. A Dwyer Model A3002 – Photohelic Gauge (or similar) (refer to Appendix B for specifications) will be mounted to each vent stack riser, with a Dwyer Model 166-6CF pitot tube (or similar) (refer to Appendix C for specifications). This photohelic gauge will measure and display the instantaneous negative pressure produced by the exhaust fan and indicate that the system is operational. A Federal Signal Model LP3T1 red indicator light (or similar) (refer to Appendix D for specifications) will be wired to the photohelic gauge for illumination if a pressure loss occurs.

1.5 IRM ASD System Schedule

- September 2010 – Pre-Design Field Testing
- September/October 2010 – ASD System Final Design and Component Selection
- October/November 2010 – ASD System Installation
- November 2010 – ASD System Performance Testing
- December 2010 – IRM ASD System Post-Construction Report

Upon completion of the pre-design field testing, there will be a period of approximately 4 to 6 weeks prior to the installation of the ASD system. This period will be used to design the full-scale ASD system. As described in Section 1.3, the holes will be

sealed and the areas ventilated to protect worker and public health until the system installation.

2.0 POST INSTALLATION CONFIRMATION TESTING

2.1 General

The ASD System will be tested to determine the system's effectiveness and proper installation. Post-installation testing will be conducted within 60 days of system installation. The following steps will be performed and documented.

2.2 Visual Inspection/Startup

All system components above the sub-slab will be installed by a professional mechanical/plumbing contractor and visually inspected by TurnKey personnel during installation. With the depressurization system operating, smoke tubes may be used to check for leaks through floor joints and at suction points. Any leaks will be identified, noted, and repaired prior to continuing with testing and confirmation. In addition, fan breakers will be manually tripped to verify indicator light illumination.

2.3 ASD System Vacuum Confirmation Testing

A field test will be conducted to confirm the negative pressure created beneath the slab. Approximate ¼-inch diameter holes will be drilled through the concrete slab and into the sub-slab aggregate at points furthest from the depressurization pits that are accessible. As the system is being constructed in an existing finished and predominantly occupied building, exact locations of vacuum confirmation test holes within the building will be field located to minimize damage to the finished flooring and minimize disruption to the operating businesses. A minimum of 10 test holes will be recorded for the ASD system.

Sub-slab communication testing will commence with the ASD fans off, and pressure readings from each testing point will be recorded. With the depressurization system fan operating, the vacuum will be measured using a handheld digital micro-manometer or comparable instrument at the test locations. If adequate depressurization is not occurring (-0.002 inches of H_2O or less) the following procedures will be enacted:

- All testing procedures will be repeated to ensure proper testing protocol; and,
- The client will be informed of inadequate vacuum results.

Troubleshooting of the system will then be completed, including the following:

- Confirmation of fan operation;
- Inspection of and sealing of all major entry routes and penetrations (if necessary);
- Location of potential sub-slab barriers;
- Inspection of aggregate used (new building); and,
- Inspection of the HVAC system and determination whether the HVAC system has a negative effect on the performance of the ASD system.

Upon completion of troubleshooting as described above, if re-testing of sub-slab vacuum indicates insufficient communication the following measures will be considered:

- Adjustment of the HVAC system; and/or,
- Installation of additional suction points.

Results of the communication testing will be included in the IRM ASD System Post-Construction Report.

After post-installation field testing, the test holes will be sealed and the areas ventilated to protect worker and public health until the system installation as described in Section 1.3.

3.0 ASD SYSTEM OPERATION, MAINTENANCE, & MONITORING

Upon installation of the ASD system, an IRM report certified by a licensed New York professional engineer will be submitted to the NYSDEC and NYSDOH. This will be a standalone document.

3.1 ASD System Operation

This ASD system has been designed for continuous operation with minimal maintenance and/or operational oversight. It is imperative however, that the system is inspected monthly and annually to ensure consistent and optimal operation.

Near each suction point, a magnehelic gauge will be mounted approx. 5 feet above finished floor to the column at which the vent stack is attached. When the ASD system is operational, the magnehelic gauge will display the effective sub-slab (negative) pressure.

A "normal" operating pressure will be established by recording the displayed pressure approximately 4 hours after initial system start-up. Another reading will be taken and recorded after approximately 1 week of operation to check if significant change in pressure readings is observed relative to the initial "normal" operating pressure. If there is a significant pressure difference from the "normal" operating pressure, additional weekly inspections will be made until the pressure stabilizes, for up to four weeks. If readings do not stabilize within four weeks (1 month) or a significant change in pressure readings is observed after system stabilization, the owner and/or other party responsible for the system will be notified.

3.2 Monthly Inspections

On a monthly basis, the pressure at each vent stack will be read and recorded to ensure that the fan is maintaining adequate negative pressure and system components will be visually inspected. Any large fluctuations or trends in pressure will be documented and brought to the attention of the owner or other responsible party. Visible leaks in piping and/or the concrete slab will be identified and noted for repair. Changes in use of the space, modifications to the system, building renovations, and/or significant non-running time will be documented on the Monthly Inspection Log provided in Appendix E.

3.3 Annual System Inspection

An annual system inspection and report documenting that the system is performing properly and remains effective will be completed by a responsible party identified by the site owner. The annual report will contain the monthly logs, as well as an annual inspection checklist provided in Appendix E. The annual inspection will include:

- Visual inspection of system components.
- Inspection of the exhaust fan for signs of abnormal operation or bearing failure (service and/or replacement if necessary)
- Discharge location inspection to verify no air intake has been located nearby vent pipe.
- Inspection of the HVAC system to determine if it is being maintained and operated as designed.
- Slab inspection for cracks (resealing if necessary) at the extraction points and within the building.
- Manual breaker trip to verify indicator light illumination.

3.4 Annual Reporting

Eyezon will submit to the NYSDEC annually a Periodic Review Report (PRR) that will include:

- A certification from a Professional Engineer that the remedial systems are functioning as intended and remain protective of human health and the environment.
- The monthly and annual inspection logs.
- A summary of any required maintenance or adjustments to the ASD system.
- An as-built of the ASD system with any modification highlighted.

3.5 System Failure Protocols

In the event that the system is not working properly, the red warning light located at each extraction point will illuminate indicating that there is insufficient vacuum in the associated vent pipe. The following protocol will be followed:

- The building owner/operator and head maintenance person will be contacted immediately.
- The date and time recorded.
- The warning device identified.
- The fans and gauges will be inspected to confirm operation; if a circuit breaker was tripped causing the fan to cease operation, the circuit breaker will be reset.
- System components will be visually inspected for signs of damage or dysfunction.

If the system failure is not remedied, the building owner/representative should contact a qualified engineer or other person with experience in ASD systems to inspect the system and take the necessary measures to place the system back in service within two weeks of system failure. The details of the system failure and what measures were taken to place the system back in service will be included in the monthly log and annual certification.

3.6 Troubleshooting

If the fan fails to operate, check the following:

1. Check motor lead wiring, capacitor leads and incoming supply leads to insure definite contact.
2. If possible, use a meter to test for continuity across the fan motor leads. In order to do this, the capacitor must be disconnected (do not test the capacitor - it will not meter continuity). If motor leads show continuity, consult factory for a replacement capacitor or replace fan.

Appendices A through D include troubleshooting information for system components.

3.7 Maintenance

Since the fan bearings are sealed and provided with an internal lubricating material, no additional lubrication is necessary. Appendices A through D include maintenance information for system components.

4.0 HEALTH AND SAFETY

Installation of the sub-slab vapor control system will comply with all OSHA, state and local standards or regulations relating to worker safety and occupational vapor exposure, and all system installation workers will have completed 40-hour Hazwoper training. The installation Contractor will prepare a revised Health and Safety (H&S) Plan to supplement the existing site H&S Plan submitted as part of the Remedial Investigation Work Plan. In addition to the provisions provided in the previous H&S plan, the revised plan will address all applicable requirements under 29CFR 1926, including the following specific or uniquely applicable requirements for the safety and protection of vapor control workers:

- The installation Contractor will have a worker protection plan on file that is available to all employees and is approved by any state or local regulating agencies that require such a plan;

- The Contractor will ensure that appropriate safety equipment such as hard hats, face shields, ear plugs, steel-toe boots and protective gloves are available on the job site during cutting, drilling, grinding, polishing, demolishing or other activity associated with vapor control projects;

- All electrical equipment used during the installation of the subject project will be properly grounded. Circuits used as a power source should be protected by Ground Fault Circuit Interrupters (GFCI);

- When work is required at elevations above the ground or floor, the installation Contractor will ensure that ladders or scaffolding are safely installed and operated;

- The Contractor will ensure that respiratory protection conforms with the requirements in the NIOSH Guide to Industrial Respiratory Protection;

- Where combustible materials exist in the specific area of the building where sub slab vapor control work is to be conducted, and the Contractor is creating

temperatures high enough to induce a flame, the installation Contractor will ensure that fire extinguishers suitable for type A, B, and C fires are available in the immediate work area;

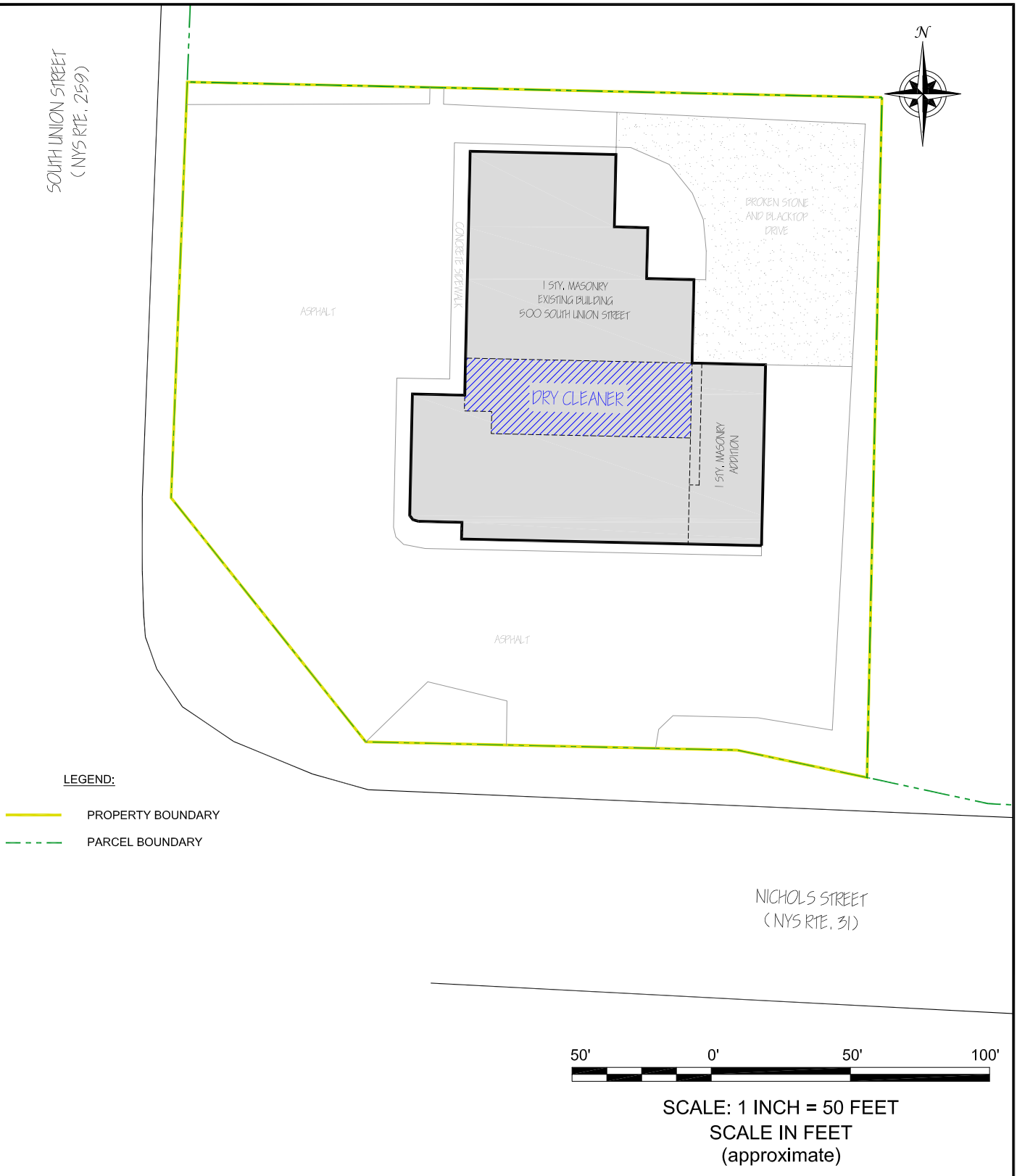
- In any planned work area where the Contractor or Consultant believes friable asbestos may exist and be disturbed, vapor control work will not be conducted until a determination is made by a properly trained or accredited person that such work will be undertaken in a manner which complies with applicable asbestos regulations; and,

- When sub-slab vapor control work requires the use of sealants, adhesives, paints, or other substances that may be hazardous to health, Contractors will provide employees with the applicable Material Safety Data Sheets (MSDS) and explain the required safety procedures.

FIGURES

F:\CAD\TurnKey\Eyezon Associates\ASD IRM Work Plan\Figure 1; Site Plan (April 2010).dwg

FIGURE 1



TurnKey Environmental Restoration, LLC

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PROJECT NO.: 0188-001-100

DATE: APRIL 2010

DRAFTED BY: BCH

SITE PLAN

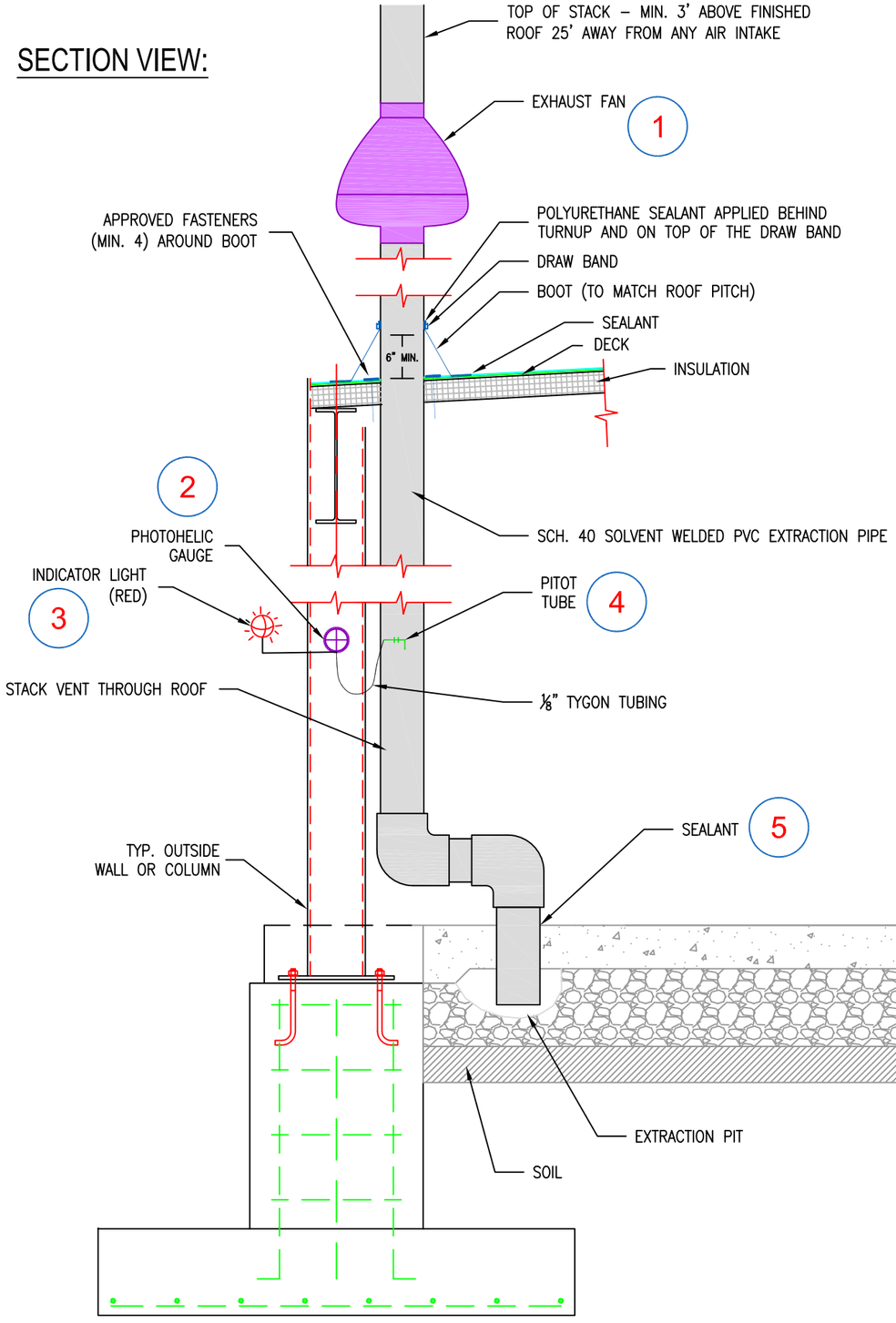
ASD IRM WORK PLAN

500 SOUTH UNION STREET SITE
SPENCERPORT, NEW YORK
BCP SITE NO. C828153

PREPARED FOR

EYEZON ASSOCIATES, INC.

SECTION VIEW:



NOTES:

1. FANTECH MODEL FR 160. 115 VOLT 71 RATED WATTS CONT. DUTY
2. DWYER MODEL A3002 PHOTOHELIC GAUGE; MOUNT ON COLUMN AT 5 FEET ABOVE FINISHED FLOOR. WIRED TO LOCAL OUTLET, INDEPENDENT OF FAN CIRCUIT BREAKER.
3. FEDERAL SIGNAL MODEL LP3T1 OR EQUIVALENT NON–FLASHING INDICATOR LIGHT WIRED TO PHOTOHELIC GAUGE FOR ILLUMINATION DURING PRESSURE LOSS. INDICATOR LIGHT SHALL BE COMPATIBLE WITH PHOTOHELIC GAUGE.
4. DWYER MODEL 166–6CF ⅛" NPT PITOT TUBE WITH COMPRESSION FITTINGS
5. POLYURETHANE SEALANT APPLIED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS TO SEAL ALL GAPS. USE OF SILICONE SEALANTS IS NOT PERMITTED.

DATE: APRIL 2010
DRAFTED BY: BCH

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BUFFALO, NY 14218
(716) 856-0635

TURNKEY ENVIRONMENTAL RESTORATION, LLC

JOB NO.: 0188-001-100

ASD SYSTEM ASSEMBLY DESIGN

ASD IRM WORK PLAN

500 SOUTH UNION STREET SITE
SPENCERPORT, NEW YORK
BCP SITE NO. C828153
PREPARED FOR
EYEZON ASSOCIATES, INC.

FIGURE 2

APPENDIX A

EXHAUST FAN PRODUCT INFORMATION

Fantech

NOVEMBER 2009

FR SERIES
INLINE EXHAUST FANS

Fantech's versatile FR Series Inline Fans provide the ideal answer for a variety of air movement problems in residential and commercial applications. The fans feature a plastic housing constructed of UL-recognized, UV protected thermo-plastic resin. This tough protective shell allows the fan to be mounted in outdoor and wet locations*. FR fans feature external rotor motors that have proven dependable year after year. Fan is fully caulked to prevent moisture from entering the housing.

Applications

FR fans can be used for multiple point exhaust applications, crawl space venting or make-up air supply. They are also widely used as booster fans to move air from one room or area to another.

ENERGY STAR

Look for the Energy Star Rated Models in Performance Data Chart on back page

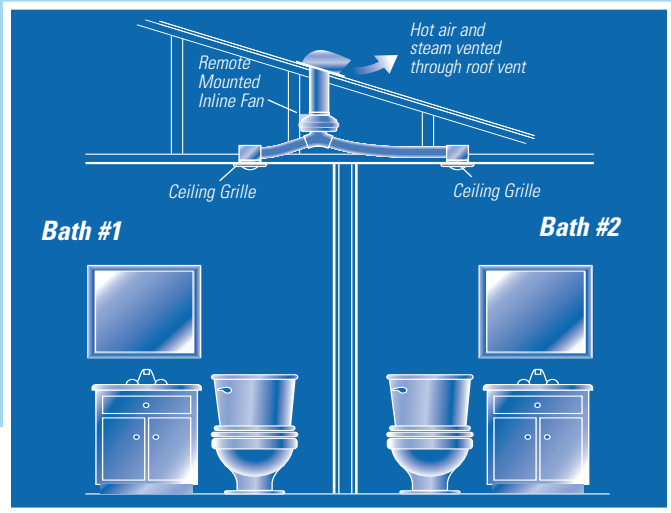
c UL us

C SP US

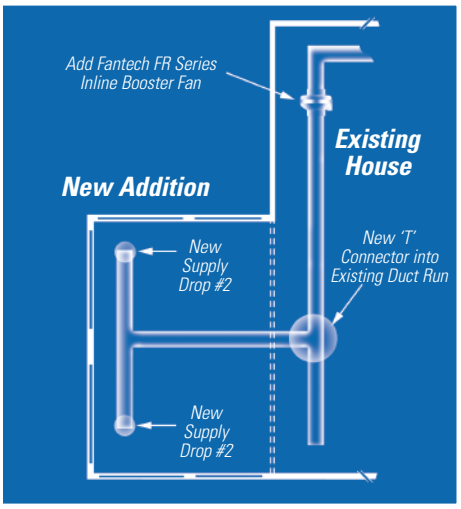
2100 HVI CERTIFIED

FIVE YEAR WARRANTY

DUAL BATH APPLICATIONS - COMMERCIAL OR RESIDENTIAL

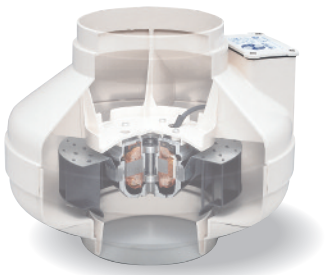


NEW ADDITION



EASY TO INSTALL.
LOADED WITH FEATURES:

- Prewired and supplied with a mounting bracket for easy installation
- UL Listed; CSA Certified
- Approved for residential and commercial applications and for wet locations
- Suitable for airstream temperatures up to 140° F
- Easy connection using external wiring box with waterproof gasket
- 137-649 CFM
- 4" to 10" duct diameters
- 100% speed controllable
- Five-year factory warranty



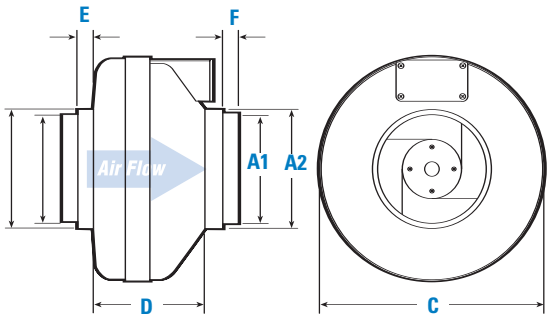
Fantech external rotor motor

** The FR Series is not manufactured to operate with water running through the motor compartment, or to be used in applications where the fan would be buried underground. A UL-recognized waterproof conduit should be used for all outdoor applications to prevent moisture entry via knockout in wiring box.*

FR SERIES

INLINE EXHAUST FANS

DIMENSIONAL DATA



Model	†A1	A2	C	D	E	F
FR 100	4	5	9½	6⅛	⅞	⅞
FR 110	4	5	9½	6⅛	⅞	⅞
FR 125	–	5	9½	6⅛	⅞	–
FR 140	6	6¼	11¾	5⅞	1	⅞
FR 150	6	6¼	11¾	5⅞	1	⅞
FR 160	6	6¼	11¾	5⅞	1	⅞
FR 200	8	10	13¼	6¼	1½	1½
FR 225	8	10	13¼	6¼	1½	1½
FR 250	–	10	13¼	6¼	1½	–

All dimensions in inches.
† Duct connections are ⅛" smaller than duct size.

FIVE YEAR WARRANTY

2100 HVI CERTIFIED

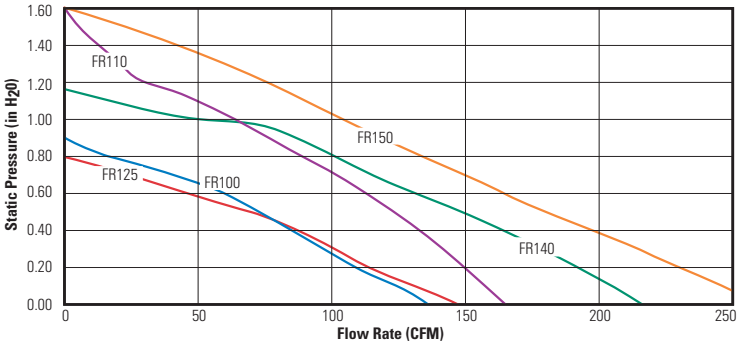
c UL us

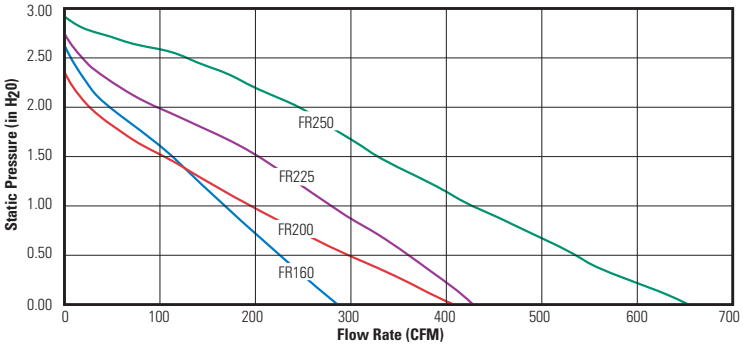
c SA us

ENERGY STAR

Look for the Energy Star Rated Models in Performance Data Chart.

AIR PERFORMANCE GRAPHS





PERFORMANCE DATA

Fan Model	Energy Star	RPM	Voltage	Rated Watts	Wattage Range	Max. Amps	Static Pressure in Inches W.G. 0"	.2"	.4"	.6"	.8"	1.0"	1.5"	Max. Ps	Duct Dia.
FR 100	✔	2950	120	21.2	13 – 22	0.18	137	110	83	60	21	—	—	0.9"	4"
FR 110	—	2900	115	80	62 – 80	0.72	167	150	133	113	88	63	4	1.60"	4"
FR 125	✔	2950	115	18	15 – 18	0.18	148	120	88	47	—	—	—	0.79"	5"
FR 140	✔	2850	115	61	47 – 62	0.53	214	190	162	132	99	46	—	1.15"	6"
FR 150	✔	2750	120	71	54 – 72	0.67	263	230	198	167	136	106	17	1.58"	6"
FR 160	—	2750	115	129	103 – 130	1.14	289	260	233	206	179	154	89	2.32"	6"
FR 200	✔	2750	115	122	106 – 128	1.11	408	360	308	259	213	173	72	2.14"	8"
FR 225	✔	3100	115	137	111 – 152	1.35	429	400	366	332	297	260	168	2.48"	8"
FR 250	—	2850	115	241	146 – 248	2.40	649	600	553	506	454	403	294	2.58"	10"

Performance shown is for installation type D - Ducted inlet, Ducted outlet. Speed (RPM) shown is nominal. Performance is based on actual speed of test.
Performance ratings do not include the effects of appurtenances in the airstream.

Fantech

United States 10048 Industrial Blvd. • Lenexa, KS 66215 • 1.800.747.1762 • www.fantech.net
Canada 50 Kanalflakt Way • Bouctouche, NB E4S 3M5 • 1.800.565.3548 • www.fantech.net

Item #: 450399
Rev Date: 111009

APPENDIX B

PHOTOHELIC GAUGE PRODUCT INFORMATION

Series A3000 Photohelic® Differential Pressure Switch/Gage

Specifications - Installation and Operating Instructions

The PHOTOHELIC® Series A3000 is a versatile 2-in-1 instrument combining a time-proven Magnehelic® differential pressure gage with low/high pressure switches. It is designed to measure and control positive, negative or differential pressure of air or other non-combustible, non-corrosive gases. Gage reading is unaffected by switch operation. Switch set points are easily adjusted with knobs located on gage face. Applied pressure and switch set points are fully visible at all times. Deadband is one pointer width, less than 1% of full scale. Each set point controls a DPDT relay and both relays can be interlocked to provide variable deadband control.

SPECIFICATIONS

GAGE SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Accuracy: ±2% of full scale at 70°F (21.1°C). ±3% on -0 and ±4% on -00 models.
Pressure Limits: -20" Hg. to 25 psig (-0.677 to 1.72 bar). MP option; 35 psig (2.41 bar), HP option; 80 psig (5.52 bar). 36003S – 36010S; 150 psig (10.34 bar). 36020S and higher;1.2 x full scale pressure.
Temperature Limits: 20 to 120°F.
(-6.67 to 48.9°C) Low temperature option available.
Process Connections: 1/8″ female NPT.
Size: 4″ (101.6 mm) dial face, 5″ (127 mm) O.D. x 8-1/4″ (209.55 mm).
Weight: 4 lb (1.81 kg).

SWITCH SPECIFICATIONS

Switch Type: Each setpoint has 2 Form C relays (DPDT).
Repeatability: ±1% of full scale.
Electrical Rating: 10A @ 28 VDC, 10A @ 120, 240 VAC.
Electrical Connections: Screw terminals. Use 167°F (75°C) copper conductors only.
Power Requirements: 120 VAC, 50/60 Hz; 240 VAC & 24 VAC Power optional.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Adjustable knobs on face.
Agency Approvals: Photohelic® UL: File No. E38121, Vol. 1, Sec. 4; CSA: File No. LR22541-34; CE: EN 61000-6-2: 1999, EN 6100-3-2: 2000, EN 61000-3-3: 2000.
Optional Explosionproof enclosure does not possess an agency approval.

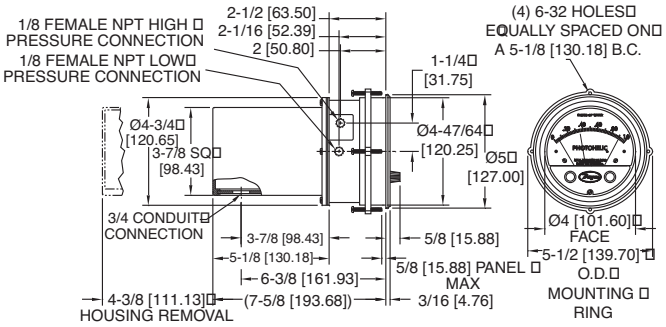


Fig. A

NOTE: Detailed dimension drawings are available from our Customer Service Dept. for PHOTOHELIC® switch/gages as installed in two optional enclosures. For weatherproof housing, request no. 13-700132-00. /For explosion-proof housing, request no. 13-700113-01.

INSTALLATION

1. Location: Select a clean, dry, vibration-free location where ambient temperatures will be between 20 and 120°F (-6.67 and 48.9°C). Tubing supplying pressure to the instrument can be practically any length but long runs will increase response time slightly.

2. Position: The PHOTOHELIC® Switch/Gage is factory calibrated for use with scale in a vertical plane. Operation at other angles may affect accuracy and/or require zero adjustment. Most models can be specially calibrated at the factory for other positions if specified at time of ordering. Ranges below 1″ W.C. must be used only with scale vertical.

3. Mounting: The PHOTOHELIC® is normally mounted before making electrical connections. The electrical enclosure is removable at any time regardless of mounting method.

(A) Panel Mounting: Normal mounting is flush or through panel as shown in Fig. B. Allow 4-3/8″ (111.13 mm) clearance behind the unit for removal of electrical enclosure. Make a 4-13/16″ (122.24 mm) diameter hole in panel. Insert the PHOTOHELIC® unit from front of panel and slip mounting ring over case from behind with stepped side facing rear. Fit the snap ring into narrow groove at back edge of the bezel. Thread four 6-32 x 1-1/4″ mounting screws into tapped holes in mounting ring and seat it against snap ring. Tighten screws against back of panel. See Fig. B.

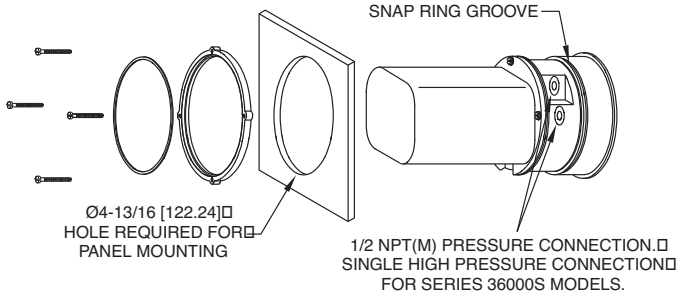


Fig. B

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

(B) Surface Mounting with Remote Relays: Where it is preferred to mount the amplifier-relay unit separate from the gage assembly, the gage is mounted as shown in Fig. B (without amplifier-relay package) or surface mounted as shown in Fig. C. Use the dimensions in Fig. D to locate holes.

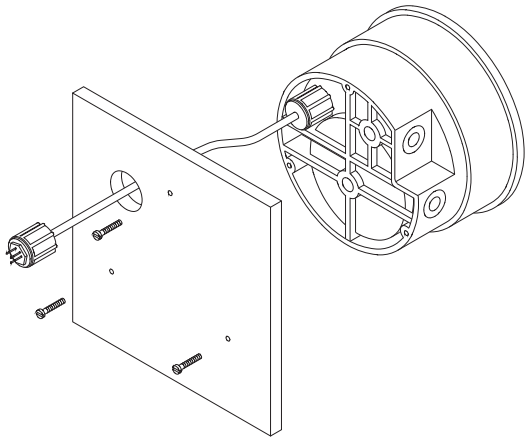


Fig. C

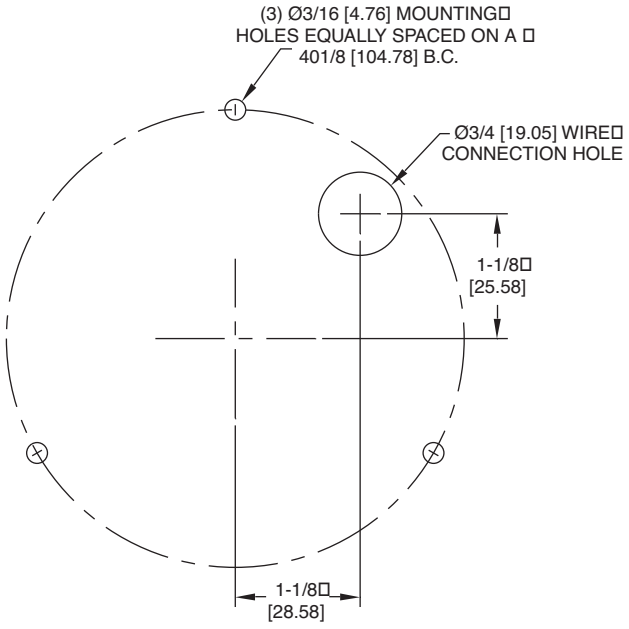


Fig. D

(C) Remote Relays Mounting: On factory supplied RMR (remote mounted relay) units, the amplifier-relay package will be furnished attached to a mounting plate as shown in Fig. E. Use the hole layout in Fig. F for this option. A five foot cable assembly is included for connecting the two components. Longer cable lengths are available from the factory.

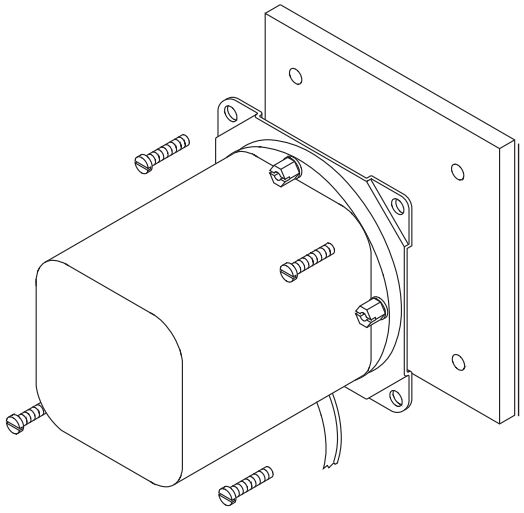


Fig. E

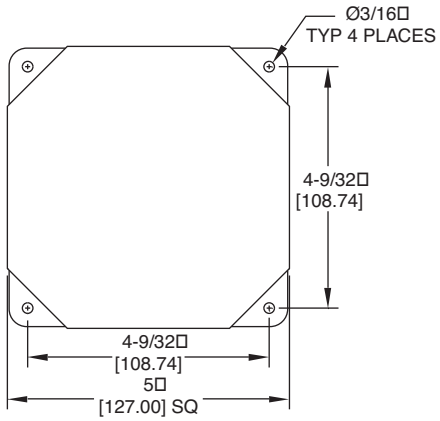


Fig. F

4. Pneumatic Connections & Zeroing: After installation but before making pressure connections, set the indicating pointer exactly on the zero mark, using the zero adjust screw located at the bottom of the front cover. Note that this adjustment can only be made with the high and low pressure taps both open to atmosphere.

Connect the high and low pressure taps to positive, negative, or differential pressure sensing points. Use 1/4″ diameter metal or other instrument tubing and 1/8″ NPT adapters at the PHOTOHELIC® pressure switch/gage. Adapters for rubber or soft plastic tubing are furnished with the instrument for use where this type of connection is preferred.

If the PHOTOHELIC® is not used to sense differential pressure, one of the pressure taps must be left open to atmosphere. This will allow the reference pressure to enter. In this case, installation of a Dwyer No. A-331 Filter Vent Plug or similar fitting in the reference pressure tap is recommended to reduce the possibility of dust entering the instrument.

NOTE: If the PHOTOHELIC® switch/gage is over pressured, pointer may “jump” from full scale back to zero and remain there until the excess pressure condition is relieved. Users should be aware of possible false zero pressure indications under this condition.

ELECTRICAL CONNECTIONS

1. Cover: The amplifier-relay unit has an easy to remove housing. Remove the three (3) screws as shown in Fig. G and slide the housing off. Make all the electrical connections before reinstalling and refastening the housing.

2. Conduit: Electrical access to the connection box portion of the relay housing is by bottom opening for 3/4″ conduit. Use of flexible conduit is recommended. It should be supported from the panel or other suitable surface to prevent the wiring system from exerting undue strain on the instrument. See Fig. G.

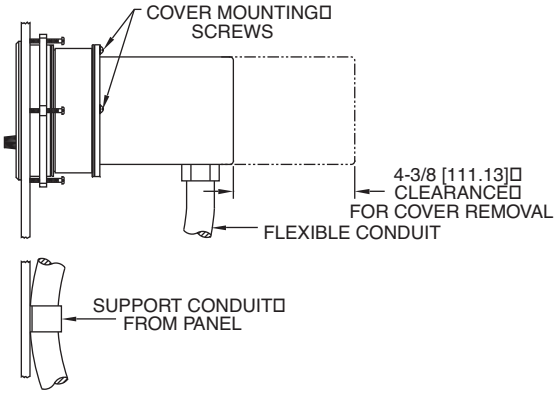
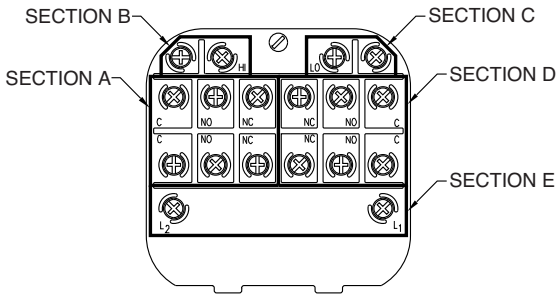


Fig. G

3. Terminal or Connection Board Layout: In Fig. H "Terminal Board," Section A contains the connections for the load or slave relay actuated by the high or right set point. This relay is a double pole, double throw type. The two right connections are normally closed, the two middle connections are normally open, and the left connections are the common pair. The relay is in its normal or De-Energized position when pressure is below the right hand set point.

Section D is exactly the same as **Section A** except that its load or slave relay is controlled by the low or left set point. The De-Energized position is below the left hand pointer set point.

Section B contains the external connections to the holding coil circuit for the high or right set point relay and **Section C** contains similar connections for the low or left set point relay. The function and use of these connections varies somewhat depending on the circuit style of the instrument. See paragraphs 5 and 6 for details.



CAUTION: Do not apply electrical current to terminals in Sections B and C.

Fig. H

Section E contains the power connections for the control unit transformer primary. The transformer in turn supplies reduced voltage power for the LED, phototransistor, amplifier unit, and load relay pull in and hold coils. Connections must always be made to this section in order to put the unit in operation. Standard units are designed for 120 VAC input to the transformer. Special units are also available for other voltages.

Separate Ground Wire attachment is provided for by a No. 6-32 screw on the mounting bracket near the conduit opening. An additional ground wire connection is located on the side of the gage body for use when the amplifier-relay unit is mounted remotely.

Single Set Point instruments are furnished with the right or high set point components and circuitry in place. These are connected to Sections A and B of the terminal board. The left or low set point components are omitted.

4. Circuit Style: The PHOTOHELIC® is available with several factory installed optional internal circuits. They are identified as to style by a label shown in Fig. J. This label is mounted prominently on the terminal board of each instrument. The letter H denotes a circuit in which the relay can be made to latch or remain energized after pressure increase to its set point.

The letter L denotes a circuit in which the relay can be made to latch or remain de-energized after pressure decrease to its set point. Two letters are required to fully identify a dual set point unit. Thus, circuit style HH, which is standard, is a dual set point circuit which has provisions for latching on pressure increase to either set point. Single relay unit or L for the special low latch unit. Units for use with other than standard 120 VAC will be so indicated on the label.

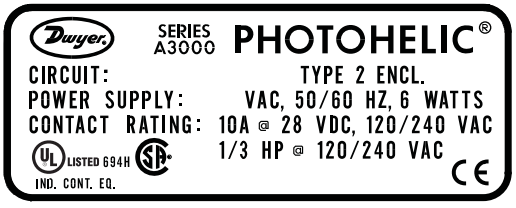
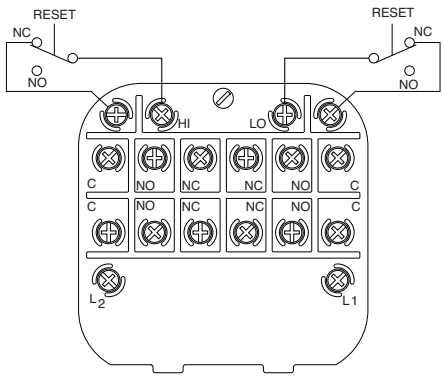


Fig. J

5. Dual Set Point Automatic Reset: Circuit Style HH is used for simple on-off switching applications. To place in service, connect load circuits to the appropriate terminals in Section A (Fig. H) for the right set point and Section D for the left set point. Note that the N.O. contacts are open when the gage pressure pointer is to the left of the set point pointers. No connections are necessary in Sections B and C. Make external ground connections as required and connect power to Section E for the control unit. To use circuit style LL for automatic reset, a jumper wire must be installed between the two terminals in Sections B and/or C.

6. Dual Set Point Manual Reset: Circuit Style HH may also be used for manual reset applications where it is required to maintain contact on either relay following pressure increase above its set point. Load or signal connections are made to the appropriate terminals in Sections A and D (as in paragraph 5 above). Connect terminals in Sections B and C through normally closed switches or push buttons as shown in Fig. K. Use of "dry-circuit" type switches such as a Dwyer Part No. A-601 with paladium, gold, etc. or rotary wiping action type contacts is recommended. Make external ground connections as required and connect power to Section E for the control unit.

Circuit style LL is used for manual reset applications which require that contact be maintained following pressure decrease below the set point. Load connections are made to the appropriate terminals in Sections A and D. A normally open type manual reset switch such as Dwyer Part No. A-601 is connected to the terminals in Sections B and C. The circuit must be "armed by momentarily closing the switch while the black pointer is to the right of the set point. From that point on, the circuit will latch on pressure decrease below the set point and remain latched on pressure increase until manually reset with the optional switch.



CAUTION: Do not apply electrical current to terminals in Sections B and C.
Manual Reset with Circuit HH

Fig. K

7. Dual Set Point Automatic and Manual Reset Combinations: Circuit Style HH may be used with either set point wired and operating as in paragraph 5 above and the other set point wired and operating as in paragraph 6.

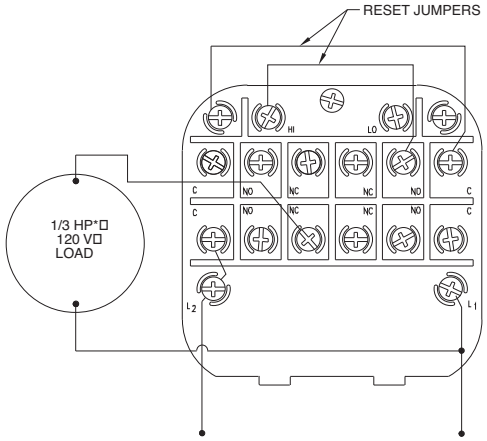
8. High Low Limit Control - Dual Set Point: Circuit Style HH may be used to control fans, dampers, pumps, etc., between the set points of a PHOTOHELIC®. To accomplish this, use one set point relay to reset the other as shown in the wiring diagram Fig. L. In this typical application, the load (for instance a fan) would be connected to the N.C. contacts for the right set point relay Section A (Fig. H). On pressure rise to the right set point, its relay would pull in and hold even though pressure might then fall below that set point . I the pressure continued to fall to the left set point, its relay would automatically be DE-ENERGIZED, return to its normal position and in so doing, open the holding coil circuit from Section B (Fig. H). The right set point relay would thus be reset and the cycle could repeat.

9. Dual Set Point Special Purpose Circuits: Circuit Style LL may be used where manual reset following maintained contact on pressure decrease to either set point is required. Circuit Styles HL and LH are combination units. For special combinations of features, special units, and detailed instructions regarding their use, consult the factory.

10. Single Set Point PHOTOHELIC®: The single set point PHOTOHELIC® is furnished with the right set point only. Terminals in Sections A and B (Fig. H) are connected to this relay. Circuit Style SRH is wired for automatic reset as in paragraph 5 above. Manual reset is accomplished by adding a normally closed reset switch or push button to the circuit as described in paragraph 6 above.

11. Single Set Point Special: Manual reset after actuation on falling pressure can be obtained by using Circuit Style SRL. Consult the factory for special units and detailed instructions regarding their use.

12. Placing in Service: In normal operation each relay is de-energized when the pressure applied to the instrument is below its set point. Special low-latching units will ordinarily have to be reset before placing on the line in normal operation.



***Note:** For larger motors, use the Photohelic® in a maintained contact, 120 Volt Control or Push Button Circuit of the motor starter.

Fig. L

13. Failure Mode: The PHOTOHELIC® circuit design provides certain protection in the event of a loss of pressure or electrical power. In either case, both relays will de-energize, returning to their normal "zero pressure" state. The exceptions to this are models with center zero ranges. Because the relays on all standard models are always energized when the indicating (black) pointer is to the right of their respective set points, the relay action on loss of pressure will depend on set point position, since either of them could be located to the left of zero. As an example; if the left pointer were set at -2 in. w.c. and negative pressure was -3 in. w.c., a loss of that pressure would allow the black pointer to return to the center and thus cause the low set point relay to energize.

If the LED should burn out, only the left-low relay will de-energize. The right-high relay will react as if pressure were above its set point and will remain energized even though pressure might be below that setting. In this situation, only termination of electrical power will allow the right-high relay to de-energize.

MAINTENANCE AND SERVICE

Dwyer PHOTOHELIC® Switch/Gages are precision instruments, expertly assembled and calibrated at the factory. They require no lubrication or periodic servicing. If the interior is protected from dust, dirt, corrosive gases and fluids, years of trouble-free service may be expected. Zero adjustment should be checked and reset occasionally to maintain accuracy. The PHOTOHELIC® 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 (RGA) number before shipping.

Printed in U.S.A. 6/08 FR# 13-440202-04 Rev. 4

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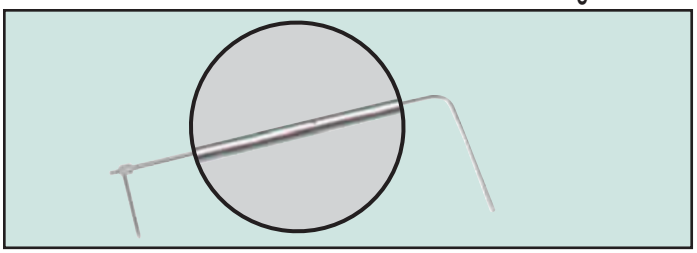
APPENDIX C

PITOT TUBE PRODUCT INFORMATION

Series 160

Stainless Steel Pitot Tubes

ASME Design Meets AMCA and ASHRAE Codes



Standard Model 160 Pitot Tube

Ideal for use with our precision manometers and air velocity gages, Dwyer® Pitot Tubes are constructed from corrosion resistant stainless steel for a lifetime of service. ASME design meets AMCA and ASHRAE specifications for maximum accuracy over a wide variety of flow conditions. No correction factors required as ASHRAE tip design yields a calibration factor of 1. ASHRAE design needs no calibration! Permanent, stamped insertion depth graduations on sides of 160 series facilitate accurate positioning. Static pressure port is parallel to sensing tube allowing quick, easy alignment of tube with air flow. Low sensitivity to misalignment gives accurate reading even when tube is misaligned up to 15 degrees. Various standard sizes are available for use in ducts as small as 4˝ dia. or as large as 36 ft dia. A universal model fits user supplied 3/4˝schedule 40 (standard) pipe in any length. Several convenient mounting options are available for permanent installations.

- No calibration needed.
- Precisely located, burr-free static pressure holes.
- Hemispherical tip design, best for accuracy if imperfectly aligned and nearly impossible to damage.
- Long lasting 304 SS construction.
- Silver soldered connections for leak-proof operation.
- Coefficient of "1."
- 5/16˝ models rated to 1500°F.
- Extended static connection helps guide tip within recommended 15° of air flow direction.
- Inch graduations on sides of 160 series to quickly determine exact insertion depth.
- Dwyer® Air Velocity Calculator, direct reading flow charts and instructions included.
- Use 1/8˝ models in ducts as small as 4˝, 5/16˝ models in ducts 10˝ or larger.
- Optional mounting gland or split flange make permanent installation fast and simple.

Series 160 is designed to meet:
- ASME "Fluid Meters" 6th Ed.
- ANSI/AMCA 210-99
- ANSI/ASHRAE 51-1999
- British Standard 1042

A-158 Split Flange Mounting

ACCESSORIES

No. A-158 Split Flange Mounting can be added to any Dwyer® No. 160 Standard Pitot Tube. Cadmium plated steel. Gasket is pattern for mounting holes. Secure flange loosely to tube, adjust tube depth and tighten screws. Gasket of 1/16˝ Neoprene fits tightly around tube and against duct for leak-proof seal. Nuts, washers included.

No. A-159 Mounting Gland — No. A-159 Mounting Gland — Versatile adapter slips on any Series 160, 5/16˝ standard Pitot tube made after Dec. 1990. Two-part stainless steel fitting slides over tube and provides permanent, secure mounting. Where duct interior is accessible, use the washers and jam nut supplied. For blind applications or in thicker materials, use model A-156 flange mounting plate. Once tube is adjusted to proper depth and angle, tighten smaller hex bushing to lock position. Graphite bushing inside assures leak-proof seal even at higher temperatures. TFE bushing also available. **NOTE:** For full insertion with this fitting, order next longer Pitot tube.

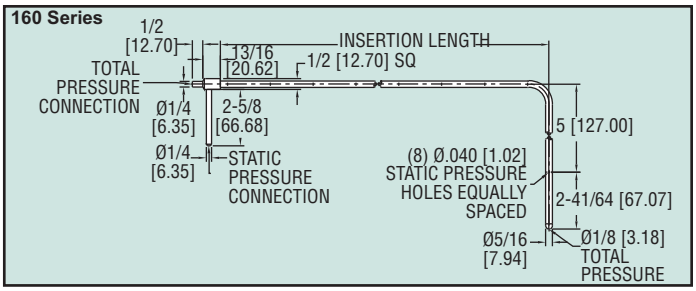
No. A-397 Step Drill. For fast, convenient installation of Pitot tubes in sheet metal ducts. No center punch needed; automatic de-burring. Drills six sizes from 3/16˝-1/2˝ in 1/16˝ increments.

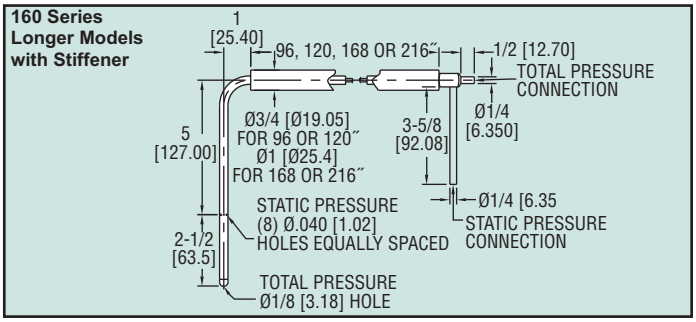
A-159 Mounting Gland is used for both duct mounting and flange mounting. To flange mount, the A-159 must be used with the A-156 flange mounting plate.

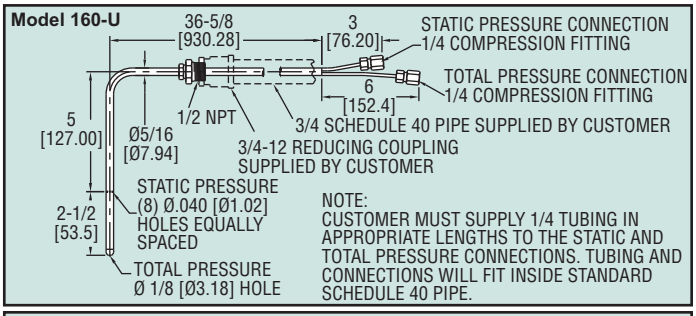
A-159 Duct Mounting Gland with 1/2˝ male NPT

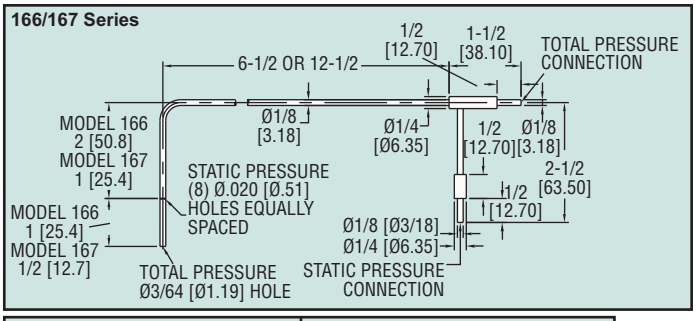
A-156 Flange Mounting Plate with 1/2˝ female NPT

A-397 Step Drill









Standard 5/16˝ Diameter	
Model	**Insertion Length**
160-8	8-5/8˝
160-12	12-5/8˝
160-18	18-5/8˝
160-24	24-5/8˝
160-36	36-5/8˝
160-48	48-5/8˝
160-60	60-5/8˝
Universal Model for 3/4˝ Pipe	
Model	**Insertion Length**
160-U	*

Longer Length w/ Stiffener	
Model	**Insertion Length**
160-96	96˝
160-120	120˝
160-168	168˝
160-216	216˝
Pocket Size 1/8˝ Diameter	
Model	**Insertion Length**
166-6	6˝
166-12	12˝
167-6	6˝
167-12	12˝

ACCESSORIES & OPTIONS

A-156, Flange Mounting Plate 1/2˝ female NPT
A-158, Split Flange
A-159, Mounting Gland
A-397, Step Drill
Compression Fitting, mounting option for Series 166/167. Add -CF suffix (166-6-CF).

*Universal model for permanent installation and connection to metal tubing. Make any length Pitot tube with 3/4˝ schedule 40 pipe, 3/4˝ to 1/2˝ reducing bushing and 1/4˝ metal tubing.

APPENDIX D

INDICATOR LIGHT PRODUCT INFORMATION

StreamLine® Low Profile Steady Burning Light

Models LP3MI, LP3PI, LP3TI

COMPACT, ECONOMICAL AND FLEXIBLE

- Available in 24VDC and 120VAC
- T-mount, integrated 1/2 - inch pipe mount or 1/2 - inch male pipe mount
- Incandescent lamp included
- Five dome colors
- Screw-on lens
- Type 4X enclosure
- Optional wire guard
- UL and cUL Listed and CSA Certified

Federal Signal introduces the Model LP3I low profile steady burning light. The Type 4X light is available in five colors: amber, blue, clear, green, and red.

The LP3I is offered in three mounting configurations. LP3PI features an integrated 1/2-inch NPT pipe mount. LP3MI features an integrated 1/2-inch male pipe mount. The "T-mount" LP3TI has a popular 2-hole design for wall or flush mounting.

Both the LP3MI and LP3TI include a surface gasket to complete the Type 4X installation. All LP3I units feature a threaded screw-on lens. The LP3I comes in two voltages: 24VDC and 120VAC.

A 15-watt incandescent lamp is included with all units. The lamp features a standard double-contact bayonet base readily available when replacement is required.

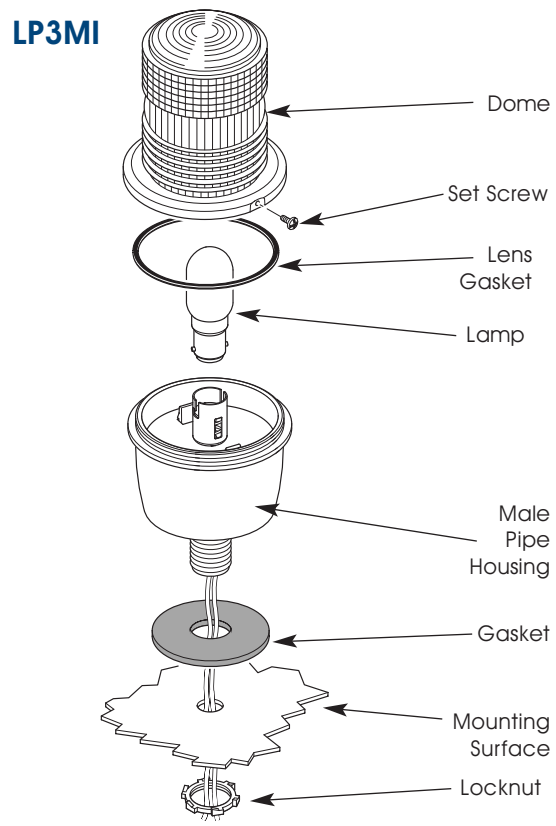
Like all Streamline® products, the LP3I is designed with OEM applications in mind. It is economical, easy to install and attractive. Careful consideration has been given to the relationship between lamp shape and lens design for maximum light output.

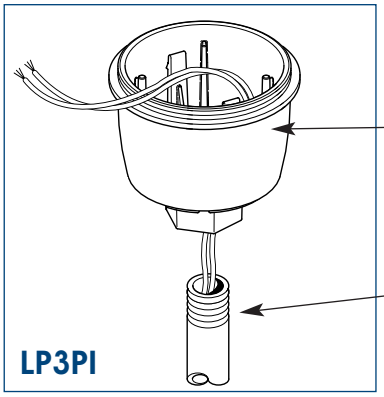
When your application calls for a compact signal with unparalleled reliability, Federal Signal's Streamline products are the clear choice.

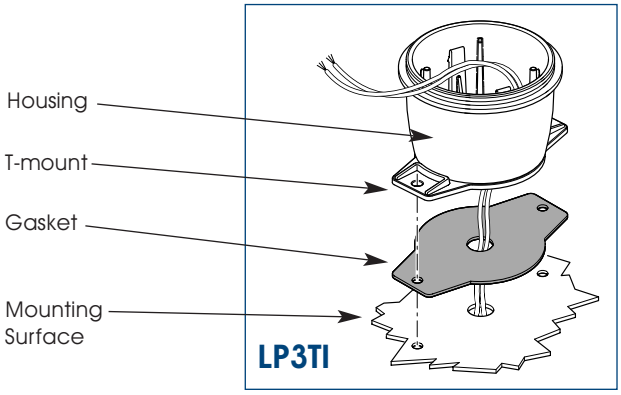
Model	Voltage	Power	Operating Current
LP3I	24VDC	15-watts	0.67 amps
LP3I	120VAC	15-watts	0.13 amps

5 yr FEDERAL SIGNAL WARRANTY

STREAMLINE® LOW PROFILE STEADY BURN LIGHT (LP3MI/LP3PI/LP3TI)







SPECIFICATIONS

Operating Temperature:	-31°F to 150°F	-35°C to 65°C
Net Weight:	7.3 oz.	206.96 g
Shipping Weight:	8.5 oz.	240.98 g
Diameter:	3.13"	7.95 cm
Height (from bottom):		
LP3PI	5.7"	14.48 cm
LP3MI	5.8"	14.7 cm
LP3TI	5.1"	12.95 cm

* Optimal hours under ideal conditions.

HOW TO ORDER

- Specify model, voltage and color
- Specify options (wire guard - LP3G)
- Please refer to Model Number Index LP3I beginning on page 373

REPLACEMENT PARTS

Description	***Part Number***	***Description***	***Part Number***
Lens, Amber	K8589063A	Lamp, 120VAC	K8107194A
Lens Blue	K8589063A-01	Lamp, 24VDC	K8107227A
Lens, Clear	K8589063A-02	Gasket, LP3TI	K8589012A
Lens, Green	K8589063A-03	Gasket, Lens	K8589013A
Lens, Red	K8589063A-04		

APPENDIX E

OPERATIONS & MAINTENANCE LOGS

Active Sub-Slab Depressurization System
Monthly Operation & Maintenance Log

Project Name:	Project No.:
Project Location:	Client:
Preparer's Name:	Date/Time:

Notes:

Monthly Operating Status:

System(s) currently running? ☐ yes ☐ no

Has the system been off-line in the past month? ☐ yes ☐ no

If yes, please list the dates and brief description why (i.e. maintenance, part replacement, etc.):

What is the current Vacuum reading? [ ]

Visual Inspection:

Any piping disconnected?	☐ yes	☐ no
Any cracks visible in piping?	☐ yes	☐ no
Any new cracks visible in slab floor?	☐ yes	☐ no
Magnehelic guage reading 0?	☐ yes	☐ no

If yes to any question above, please provide more information below.

Active Sub-Slab Depressurization System
Monthly Operation & Maintenance Log

Change in Occupancy / Use of Space:

Please indicate general use of floor space? _____

Has this general use changed in the past month? ☐ yes ☐ no

If yes, please explain:

System Modifications:

Have any modifications been made to the Sub-Slab Depressurization System? ☐ yes ☐ no

If so, please list with date:

Active Sub-Slab Depressurization System
Annual Operation & Maintenance
Certification Checklist

Project Name:	Project No.:
Project Location:	Client:
Preparer's Name:	Date/Time:

Notes:

System Information

Has monthly system inspection been completed regularly?	☐ yes	☐ no
Are last 11 inspection logs attached for the past 12 months?	☐ yes	☐ no

What is the current Vacuum reading? ☐

System Updates, Maintenance, Part Replacement

Active Sub-Slab Depressurization System
Annual Operation & Maintenance
Certification Checklist

Change in Occupancy / Use of Space:

Please indicate general use of floor space? _____

Has this general use changed in the past year? ☐ yes ☐ no

If yes, please explain:

Building Renovations:

Have any building renovations taken place in the last month? ☐ yes ☐ no

If yes, please provide more information below, and sketch any basement floor plan modifications on the floor plan sketch below.

System Modifications:

Have any modifications been made to the Sub-Slab Depressurization System? ☐ yes ☐ no

If so, please list with date:

Active Sub-Slab Depressurization System
Annual Operation & Maintenance
Certification Checklist

Floor Plan Sketch:

Draw a plan view sketch of the basement of the building. Indicate Sub-Slab Depressurization system location. Please also note and include, any alterations to the system, locations of visible cracks and/or repairs needed, and changes or alterations to the usage of this space.