107-35 MERRICK BVLD.

JAMAICA, NY

Interim Remedial Measure Work Plan

NYSDEC Site # 241227:
OER Project Number: 12TMP0001Q/12EH-N001Q

Prepared for:

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FEBRUARY 2020
(Revised April 2020)

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ACRONYMS AND ABBREVIATIONS

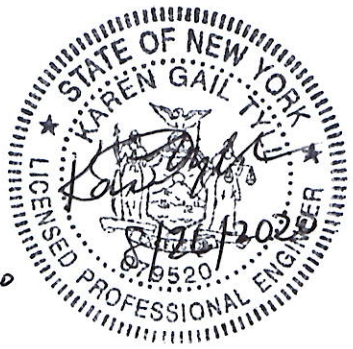
BCP	Brownfield Cleanup Program
cfm	cubic feet per minute
CSM	conceptual site model
DER	Division of Environmental Remediation
ft bgs	feet below ground surface
HASP	health and safety plan
"Hg	inches of mercury
IRM	interim remedial measure
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
PERC	tetrachloroethylene or perchloroethylene
PFD	process flow diagram
psig	pounds per square inch (gage)
PVC	polyvinyl chloride
RIR	remedial investigation report
scfm	standard cubic feet per minute
SCO	soil cleanup objectives
SF	square foot or square feet
SSDS	sub-slab depressurization system
SVE	soil vapor extraction
SVES	soil vapor extraction system
TCE	trichloroethylene
USGS	U.S. Geological Survey
VMP	vacuum monitoring points
VOC	volatile organic compound

CERTIFICATION

I, Karen Tyll, P.E., certify that I am currently a New York State registered professional engineer as defined in 6 NYCRR part 375 and that this Interim Remedial Measure (IRM) Pilot Test Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by a New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

Date signed and sealed:



Karen G. Tyll, P.E. 8/26/2020
NY License #079520

1.0 INTRODUCTION

Tyll Engineering and Consulting, P.C. (TEC) and Seacliff Environmental Geology, PC (Seacliff) have prepared this Interim Remedial Measure (IRM) Work Plan on behalf of 107-35 Merrick Corp. (Calmark) for the property located at 107-35 Merrick Boulevard, Jamaica, NY (NYSDEC Site No. 241227).

This Work Plan calls for the concurrent pilot testing and installation of a remediation system that will reduce/eliminate subsurface vapor contamination and mitigate soil vapor intrusion for future site occupants. The proposed remedial technology is soil vapor extraction (SVE). The pilot testing and subsequent SVE system (SVES) installation will be performed as an IRM.

IRMs address both emergency and non-emergency site conditions, which can be undertaken without extensive investigation and evaluation, to prevent, mitigate, or remedy environmental damage or the consequences of environmental damage attributable to a site.

TEC and Seacliff have proposed an initial system and concurrent pilot test to ensure the best possible design of the SVES and removal of contaminated vapors to below regulatory standards. We believe the system installed for the pilot test would be the final system. Once installed and pilot tested, the SVES will remain running to determine if any adjustments and/or add-ons are necessary.

1.1 Site Description

The site is located at 107-35 Merrick Boulevard in the Jamaica section of Queens and is identified as Block 10244 and Lot 224 on the New York City Tax Map. Figure 1 is a site location map. The Site is 21,282-square feet and is bounded by I.K. Auto Express to the north, a mixed-use building and church to the south, a residential home to the east, and a 7-story mixed use building and senior home to the west. There are no sensitive receptors such as schools, hospitals, and day care facilities within a 250 to 500-foot radius of the Site.

Currently, the site contains one building and yard occupied by a trucking tenant. The proposed future use of the site will be commercial which will consist of the expansion of the existing 3,800 square foot commercial building by an additional 8,150 square feet for a total square footage of 11,950. The building will be divided into two retail units, approximately 6,705 and 5,245 square feet. No basements or subgrade structures are planned, and no existing subgrade levels are present. Open areas at the front of the lot, will be utilized as a paved parking lot.

1.2 Physical Setting

The site is approximately 0.49 acres of level land situated in Jamaica, Queens, New York. The Site is mapped on the Jamaica, NY Quadrant 7.5 Minute Topographic Map, published by the USGS. Review of the topographic map indicates that the Site is located approximately 30 ft above sea level (National Geodetic Vertical Datum 1988).

The site is covered by asphalt pavement underlain by rocky fill to a depth of approximately 6 inches. Below the rocky fill is brown fine-grained sand grading into reddish-brown, stratified medium to coarse grained sands with sub-rounded quartz pebbles and sub-angular rock fragments. These sands are glacial outwash deposits and persist to at least to a depth of 20 feet bgs (below ground surface).

The regional groundwater flow is southerly and is confirmed based on measurements taken in June 2018. The average depth to groundwater is 13 to 15 feet bgs depending on the time of year. Because the well casing tops had to be cut down to prevent damage and accommodate the new tenant, re-surveying is necessary. Surveying and groundwater measurements will be conducted as part of this IRM to confirm the groundwater flow direction.

1.3 Site Environmental History

The Site was historically used as a knitting mill, a gasoline station, a home heating oil delivery operation, and a bus repair shop. These past uses are of environmental concern. Prior reports reviewed as part of an April 2014 Phase I ESA indicated that eleven 550-gallon underground gasoline storage tanks (USTs) and one 550-gallon heating oil UST were removed from the Site in 2007. A 4,000-gallon heating oil AST was removed in 2011.

The OER-required RI was conducted in 2018 to address the E-designation. Please refer to the RIR dated June 28, 2018 for the complete Phase I, RI methods, and data, and the proposed development plans. The May to June 2018 RI scope of work included the drilling and sampling of 10 soil borings with 22 soil samples collected for laboratory analysis; the installation and sampling of 7 groundwater monitoring wells: and the installation and sampling of 5 soil vapor implants.

The results of the 2018 RI were as follows:

- Soil samples collected during the OER required RI indicated no exceedances of Restricted Commercial (Track 2) SCOs. Tetrachloroethene (PERC) was detected in some of the RI soil samples but at concentrations significantly below Unrestricted or Track 1 SCOs.

- Groundwater samples collected during the RI indicated exceedances of New York Groundwater Standards for dissolved sodium and manganese (all 7 samples) and tetrachloroethene (PERC) in one sample (6.3 ug/l).
- Soil vapor samples collected during the RI showed elevated concentrations of PERC ranging from 1,080 ug/m^3 to 552,000 ug/m^3.

The highest concentration of PERC was detected at VP-3 (552, 000 ug/m^3) near the upgradient or northern property line (Figure 2). PERC vapor concentrations were lower but still elevated under the building slab (VP-4 and VP-5) and in the vicinity of the former gasoline USTs (VP-1). PERC concentrations were much lower at the downgradient or southern property line sampling point (VP-2).

The Site Characterization Work Plan or SCWP called for additional work tasks to supplement the Remedial Investigation (RI) conducted in 2018. The SCWP was approved by the NYSDEC and implemented in 2019.

The results of the 2019 Site Characterization are as follows:

Soil

Twelve additional soil samples were collected as per the SCWP. There was no visual/olfactory evidence of contamination nor were there any PID readings in any of the soil borings and associated samples. Soil samples were collected at varying depths, including the zone immediately above groundwater, especially in areas where vapor concentrations are elevated and where USTs had been removed.

Soil analytical results were compared to NYSDEC Part 375-6.8(a) Unrestricted Use Soil Cleanup Objectives. There was only one exceedance of one chemical in one soil sample. Acetone was detected in the 12 to 13 foot- deep sample in boring B-14 (just above groundwater) at a concentration of 0.61 mg/kg. The Unrestricted SCO for acetone is 0.05 mg/kg. PERC and petroleum constituents were detected in some of the soil samples but at concentrations significantly below their respective Unrestricted Use SCOs. 1,4 -dioxane was not detected in any of the 12 soil samples. These data are consistent with the 2018 OER RI data and do not indicate a current on-site source of soil contamination for PERC.

Groundwater

Nine groundwater samples were collected. PERC was the dominant compound detected above NYS Groundwater Standards. PERC exceeded the 5 -ppb standard in the samples collected from B-1 (13 ppb); B-2 (43 ppb), MW-3 (6.1 ppb); and MW-9 (10 ppb). B-2 is considered the “most” downgradient monitoring well onsite. MW-9 is considered the “most” upgradient well on-site.

PERC was detected in the off-site upgradient well sample, MW-11, at 0.19 ppb as well as in the off-site Merrick Boulevard sidewalk sample, MW-10, at 4.4 ppb. PERC was also detected at 4.4 ppb in the sample collected from MW-2 considered a downgradient on-site well. PERC concentrations were very low (less than 0.4 ppb) in the samples collected from B-5 (close to building), B-7 (northeast corner of site in building), and B-8 (northwest corner of site).

The only other compound detected above NYS Groundwater Standards was chloroform in the sample collected from MW-2 at 8.2 ppb. 1,4 dioxane was not detected in any samples. The PFAs that were analyzed in two monitoring well samples were not present at significant concentrations.

Soil Vapor

Eight soil vapor samples were collected. Soil vapor results were compared to the NYSDOH October 2006 Final Guidance for Evaluating Soil Vapor Intrusion Decision Matrices. Concentrations of PERC in on-site vapor samples remain elevated but are less than the May 2018 OER data.

The highest concentration of PERC was at VP-3 - 91,500 ug/m^3, compared to 552,000 ug/m^3 in May 2018. The PERC concentration in the recently installed deep vapor implant at that location, VP-3A, was 11,700 ug/m^3. The VP-3A vapor data combined with the MW-9 groundwater data appear to indicate that contaminated groundwater at that location is not the current cause for the shallow, elevated VP-3 PERC concentrations.

The other previously established vapor points also showed declines in PERC concentrations when compared to the May 2018 data. VP-1 (now 3610 ug/m^3 compared to 19,500 in 2018), VP-2 (577 ug/m^3 compared to 1080 in 2018), VP-4 (5050 ug/m^3 compared to 14,600), and VP-5 (3700 compared to 7060).

The soil vapor points installed as part of the SCWP include: VP-6 in downgradient corner of site (40.3 ug/m^3 PERC); the Merrick Boulevard sidewalk sample VP-7 at 1080 ug/m^3 PERC; and the upgradient off-site vapor implant installed on 107th Street (VP-8) indicated 1840 ug/m^3 .

Other compounds were detected above 100 ug/m3 in the vapor samples albeit at lower concentrations than PERC. These include petroleum compounds, acetone, and trichloroethene or TCE.

2.0 SCOPE OF WORK

A SVES introduces airflow through the unsaturated zone to volatilize contaminants for treatment via granulated activated carbon and eventual exhaust to the atmosphere. For this site, the SVES will also serve to create negative differential pressure beneath the existing and planned on-site building slabs relative to the pressure above the slab, thereby mitigating the infiltration of sub-slab vapors into the building.

This section presents the approach and methods for installing the components of a SVES and performing a pilot test to collect data and confirm the effectiveness of a final operational SVES. It is anticipated that the pilot tested SVES will likely end up being the final SVES.

A Health and Safety Plan (HASP) will be prepared prior to physical implementation of the Work Plan to provide specific guidelines and establish procedures to protect project personnel during the pilot test activities planned at the Site. The HASP will be reviewed and signed by each team member prior to the commencement of the work contained herein.

2.1 Purpose

The purpose of this IRM is to address and eliminate the high concentrations of PERC in subsurface vapor through the installation of a SVES. The areas of high concentration include the area of the identified vapor hotspot (VP-3) as well as the area adjacent to and under the on-site building.

2.2 Installation of SVES and Pilot Test

Under Seacliff oversight, P.G. Environmental Services Inc. (PGES) will install the two SVE extraction wells, SVE-1 and SVE-2, and two soil vapor vacuum monitoring/sampling points, VP-9 and VP-10 to complement the existing vapor points and ensure a comprehensive monitoring scheme. SVE-1 and SVE-2 will be 11 feet deep with the bottom 5 feet screened with four- inch diameter 0.20 slot PVC casing.

During drilling of the extraction wells, the soil cuttings will be screened with a photoionization detector (PID). Any soils exhibiting contamination will be collected into laboratory-supplied containers and will be sealed, labeled, and placed in a cooler containing ice (to maintain temperature approximately 4 degrees Celsius) and analyzed for NYSDEC Part 375 Total Compound List (TCL) VOCs via Environmental Protection Agency (EPA) Method 8260C. PGES will obtain a public utility mark out of the property prior to starting.

The SVES will consist of the two vertical soil vapor extraction wells, a 2.5-HP GAST Regeneair Blower, a Pentek moisture knockout drum, a Solberg 2” inlet filter, a granulated activated carbon

(GAC) drum provided by TIGG, associated piping, valves, and pressure gauges. Specifications for the SVE equipment can be found in Appendix A.

The two additional vacuum monitoring points (VP-9 and VP-10) will be installed at the locations shown on Figure 3 and will be approximately 15 feet and 45 feet away from each vapor extraction well to complement the existing vapor monitoring points (VP-1 through VP-8).

The two extraction wells will be connected to the blower by individual pipes which will be trenched underground and routed to the SVES equipment housed in a shed (location to be determined in field but we are aware of a concrete pad near the northwest corner of the building and that may be used).

The SVES will have sampling ports before and after the GAC treatment system for sampling to determine efficacy of the treatment. The pressure gauges on each extraction line will be installed before the two wells (within the shed) are manifolded and routed to the SVES. The vent pipe of the SVES will be at least four feet off the building roof top with a gooseneck and a screen cover to prevent any animals or debris from disrupting operation.

2.3 Pilot Testing Details

The pilot test will be completed after the installation of two SVE extraction wells and two vapor monitoring points. Existing vapor monitoring points (VP-1 through VP-8) will be used, as well, for the pilot testing. Baseline pressure measurements will be collected at the two extraction wells, SVE-1 and SVE-2 and at each VMP immediately prior to startup of the system.

A 2.5 hp GAST Regenair Regenerative blower will be attached to the newly installed extraction points. The SVE system will be turned on and a pilot test performed to identify the operational parameters for the SVES and to determine if any adjustments will be necessary. During the pilot test, the adequacy of the SVES will be determined by completing a subsurface air communication test which will determine the operational parameters and appropriateness of the SVES as configured for mitigation of soil vapor in the area of the VP-3 hotspot and building areas as well as the radius of influence by measuring the pressure in the monitoring points throughout the Site with a Magnahelic manometer. Once the pilot test is performed, TEC/Seacliff will identify if any adjustments will be necessary.

The regenerative blower will be configured to apply vacuums of 1"Hg, 2"Hg, and 4"Hg inches of mercury ("Hg) of vacuum (specifications for the proposed blower are included in Appendix A). Multiple short duration phases of the pilot test will be conducted, each with the different vacuums applied to the extraction wells.

The resulting pressure in the extraction wells and vapor monitoring points will be measured using a micromanometer or manometer at each location and the airflow will be measured using an anemometer at the blower exhaust. We anticipate collecting measurements every five minutes for the first half-hour, then every fifteen minutes the next one and one-half hours, and then every thirty minutes until the end of the test.

The frequency and duration of measurements will depend on the subsurface conditions. There are no minimum criteria for acceptable pressure or airflow at the monitoring points or extraction wells, since airflow which is demonstrated by the pressure measurements at each point, is the primary driver of soil vapor extraction success and even lower magnitude vacuum measurements will be useful during evaluation of the results.

Although a carbon drum will be initially installed, a vapor sample would be collected from the extraction well sampling port (pre-carbon) during the pilot test to confirm the best possible vapor phase treatment for an operating SVES. The vapor sample will be analyzed for VOCs via EPA Method TO-15 as well as moisture content. These data will facilitate the design of the vapor-phase treatment, as needed.

At the end of the SVE pilot test, the system would be left on to operate.

2.4 Extraction Well and Monitoring Point Details

The extraction wells will be four inches in diameter and screened from 5 to 15 feet bgs. The vacuum monitoring points (VMP) will be one-inch diameter and screened from 4.5 to 5 feet bgs.

The extraction and vacuum monitoring wells will be constructed of schedule 40 PVC. The annular space around the wells will be filled with clean sand from the end of the boring to six inches above the top of the screen. Above the sand, the annulus will be filled with bentonite to within one foot of the ground surface (where appropriate). The borehole will be completed with concrete to grade and a protective well cover installed.

3.0 SVES OPERATION

TEC and Seacliff will evaluate the data from the pilot test to ensure the SVES system as pilot tested will be effective. The pilot testing will have determined the following:

- System curve
- Final Blower(s) selection
- Effectiveness of the SVE well layout
- Effectiveness of vacuum monitoring well layout
- Pipe sizing and connections
- Additional vapor-phase treatment, if needed

3.1 System Operation

The SVES will have two main purposes -one to extract vapor from under the building and one to address the VP-3 hotspot in the adjacent parking area. Figure 3 depicts these two SVE "branches".

The final SVES system is anticipated to address residual PERC and related constituents below the building. The SVE system will also affect the parking lot subsurface adjacent to the building to recover contaminated vapors and prevent vapor movement off-site. Both "branches" will support the soil vapor intrusion mitigation.

Once the SVES is operational, the system could be modified with the eventual changeover to an SSDS in mind.

3.2 System Monitoring

TEC and Seacliff will prepare an O&M manual that will describe the operation and maintenance of the SVES. The owner and/or tenant will assume responsibility for making sure the system is running daily and will notify TEC immediately if it is not.

TEC/Seacliff will sample the system pre- and post- carbon on a six- month schedule to determine the success of the system as well as determine if a treatment (carbon) change is necessary. TEC will keep the NYSDEC informed on a monthly basis as to the operation of the SVES.

4.0 SCHEDULE

Below is a schedule for the above scope of work. We understand from NYSDEC that no public comment period is anticipated and that we can proceed immediately upon NYSDEC approval.

TEC will notify NYSDEC one week prior to conducting the pilot test. Based upon current knowledge of the site, the following schedule, subject to change, is proposed:

Task	Task Duration
NYSDEC/NYSDOH Approval of IRM WP	0
Mobilization/Coordination with Owner and Tenant.	4 Weeks
Install Extraction Wells, Piping, and Monitoring Points.	4 Days
Allow Well Seals to Set and Allow Wells to Equilibrate.	1 Week
Conduct SVE Pilot Test.	2 Days
Design Final SVES.	2 Weeks
Coordination with Owner and Tenant / Procurement / Contracting.	2 Weeks
Final System Installation.	2 Weeks
System Start-up & Balancing.	1 Week
Prepare Construction Completion Plan/ O and M Plan for System.	6 Weeks

5.0 PROJECT CONTACT LIST

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6.0 BIBLIOGRAPHY

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Figures

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Cell # (631) 742-6948

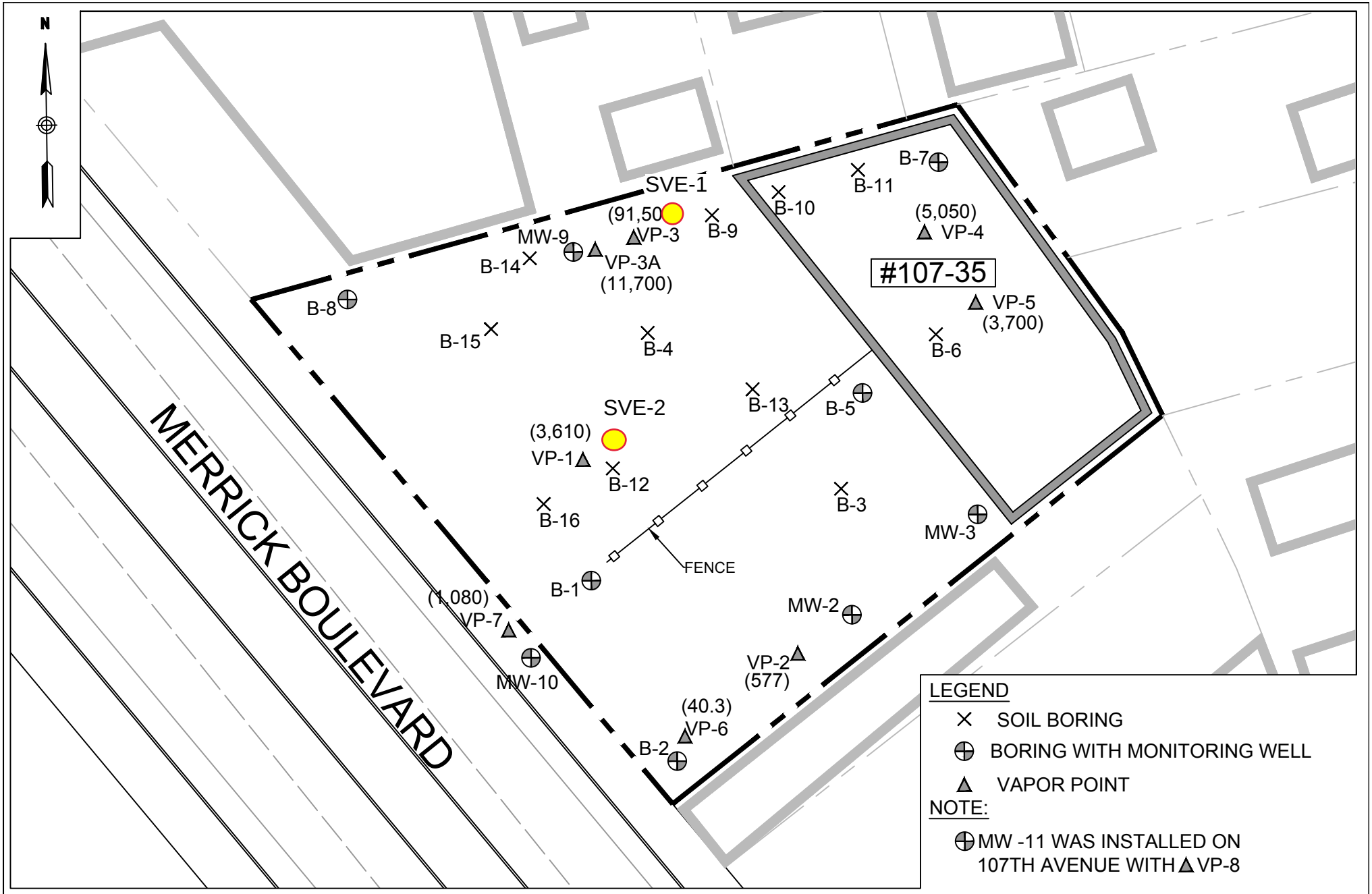
TITLE:

PROJECT LOCATION MAP

107-35 Merrick Boulevard
Queens, NY

DWN:	SCALE:	DATE:	PROJECT NO.:
LR	N.T.S	06-06-18	107-35
CHKD:	APPD:	REV.:	NOTES:
JDM	JDM	-	-

FIGURE NO.: 1



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Concentrations of PERC in Soil Vapor -ug /m^3

107-35 Merrick Blvd, Queens
New York

DWN:	SCALE:	DATE:	PROJECT NO:
-	1:60	06-30-2019	-
CHKD:	APPD:	REV:	NOTES:
JMD	JMD	-	-

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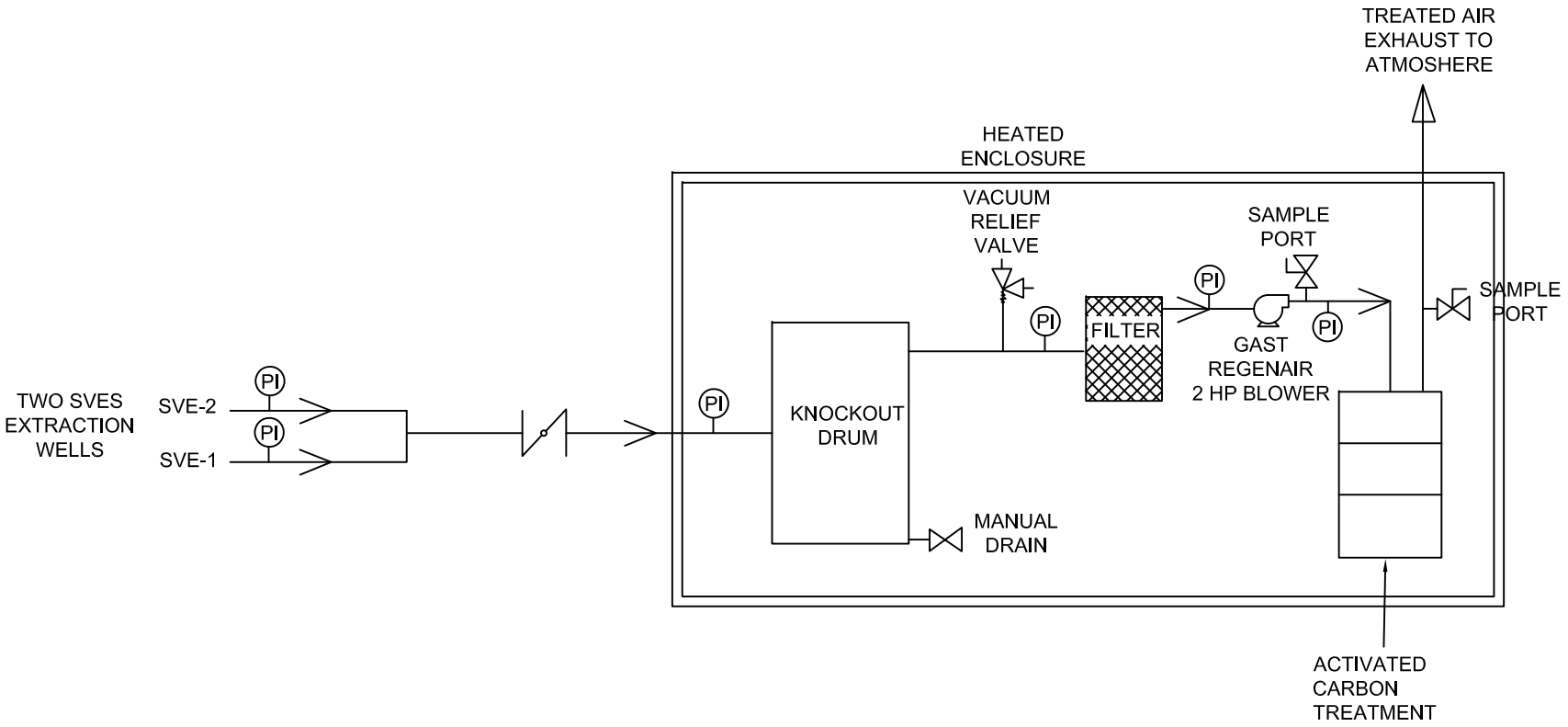

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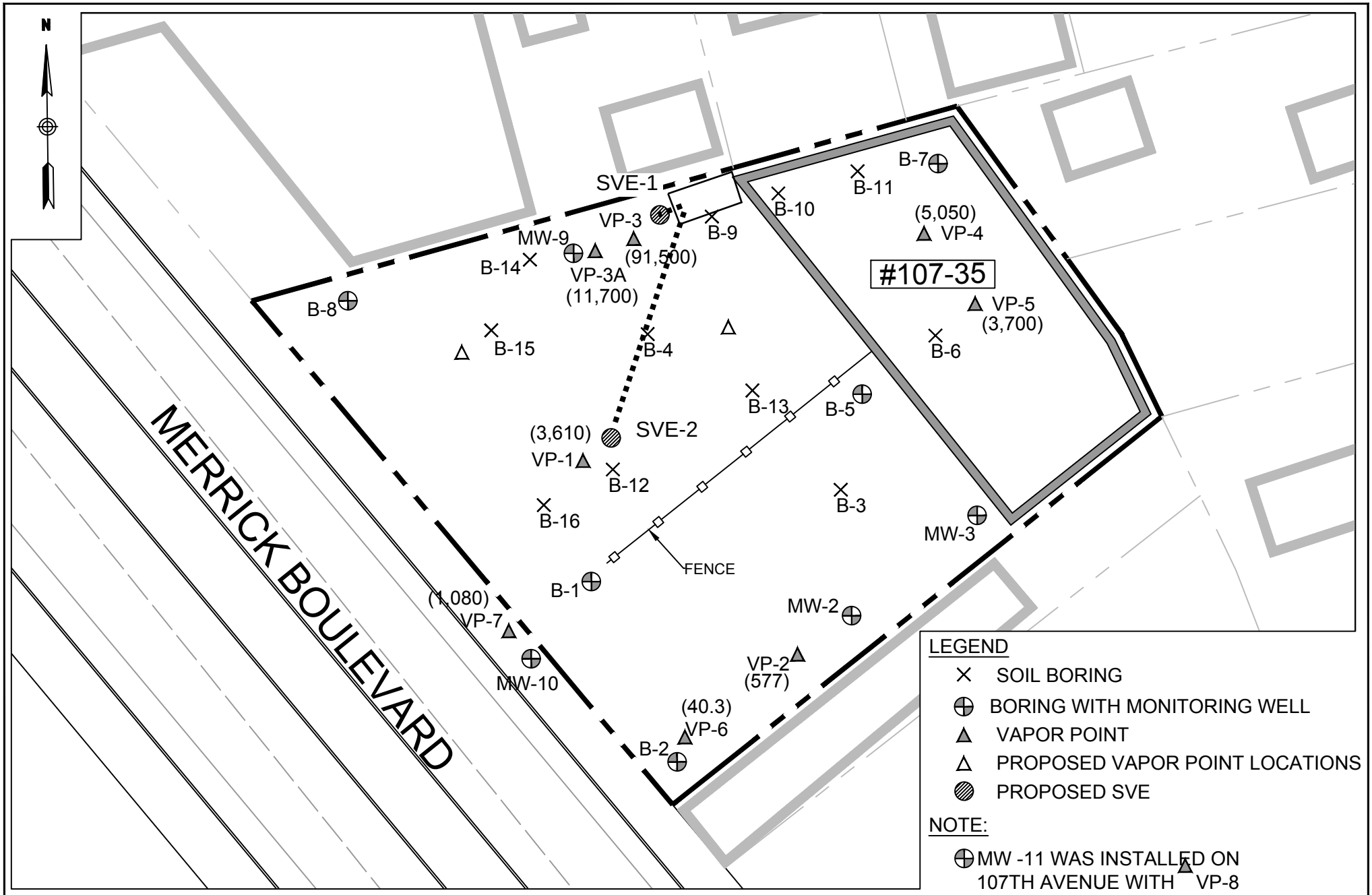
TITLE:

CONCEPTUAL SVE LAYOUT DIAGRAM

107-35 MERRICK BLVD.
QUEENS, NY

DRAWN:	SCALE:	DATE:	PROJECT NO.:
-	NTS	2-3-2020	CAL1801
CHECKED:	APPROVED:	REVISION:	NOTES:
KT	KT	-	-

FIGURE NO.: 3



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Proposed Locations for SVE Pilot Test

107-35 Merrick Blvd, Queens
New York

DWN:	SCALE:	DATE:	PROJECT NO:
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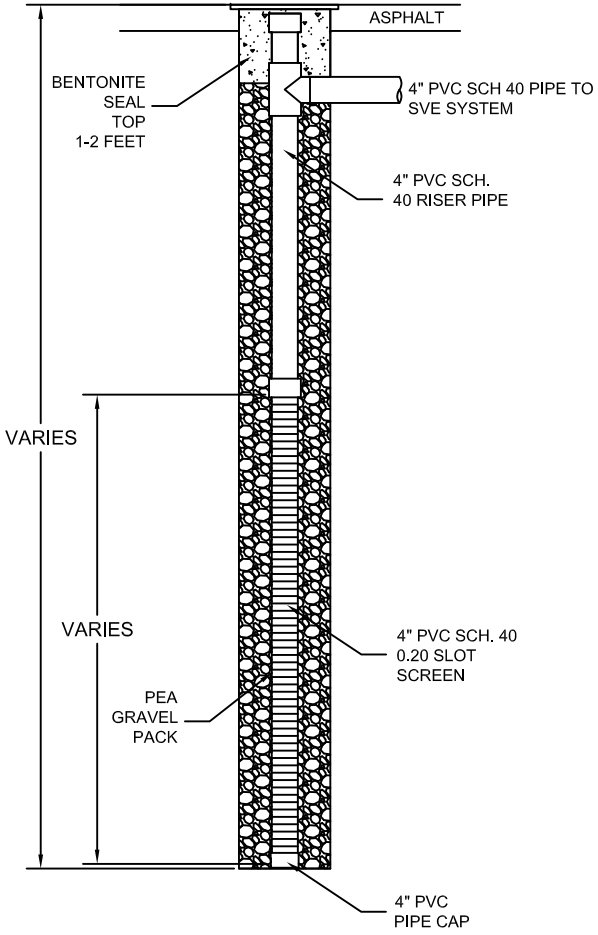
4			



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TITLE:

SOIL VAPOR EXTRACTION WELL DETAILS

107-35 MERRICK BLVD.
QUEENS, NY

DRAWN:	SCALE:	DATE:	PROJECT NO.:
-	NTS	4-21-2020	CAL1801
CHECKED:	APPROVED:	REVISION:	NOTES:
KT	KT	-	-

FIGURE NO.: 5

Appendix A

SVE System Equipment Documentation

Models R5125-2, R5325A-2, R5325B-1

Max. pressure – 65 inH_2O (60 Hz), 50 inH_2O (50 Hz)
Max. vacuum – 60 inH_2O (60 Hz), 47 inH_2O (50 Hz)
Max. air flow – 160 CFM (60 Hz), 133 CFM (50 Hz)

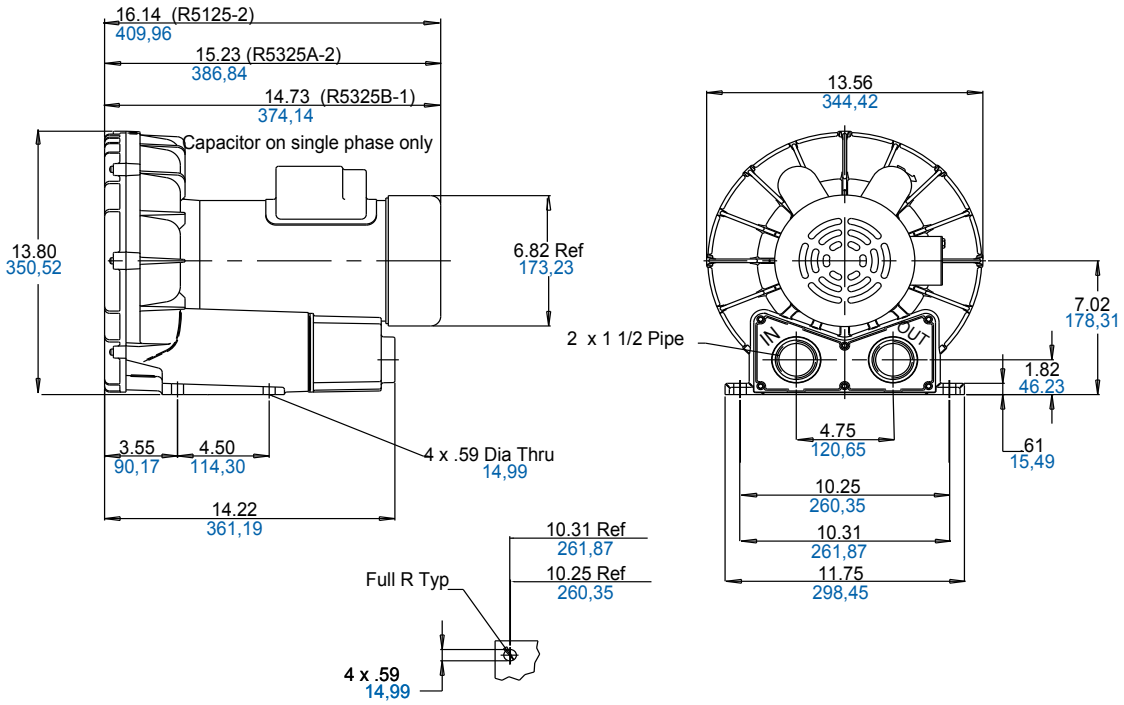
PRODUCT FEATURES

- Rugged construction, low maintenance
- Oilless operation
- UL and CSA approved TEFC motors with permanently sealed ball bearings
- Automatic restart thermal protection on single phase motors
- Aluminum blower housing, impeller, and cover
- Can be mounted in any plane
- Inlet and outlet have internal muffling

RECOMMENDED ACCESSORIES

- Pressure gauge AE133
- Inlet Filter AJ126D (pressure)
- Vacuum gauge AJ497
- Inline filter AJ151E (vacuum)
- Muffler AJ121D
- Relief valve AG258
- Liquid separator RMS200 (vacuum)
- Foam replacement kit K903

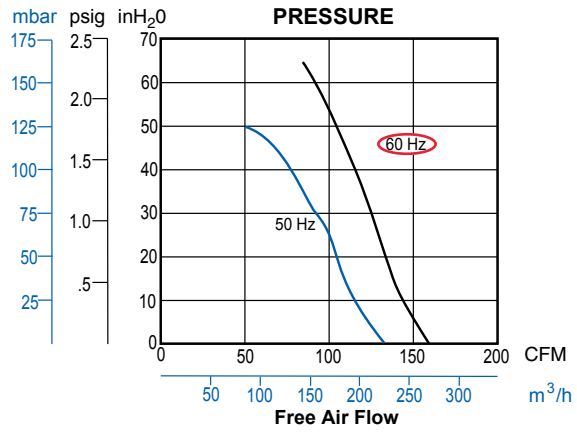
Product Dimensions (inches, mm)

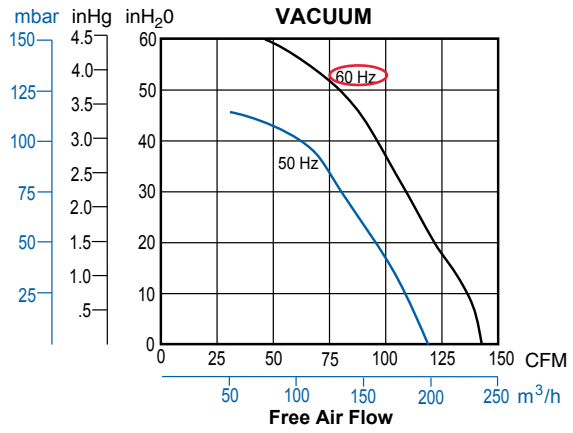


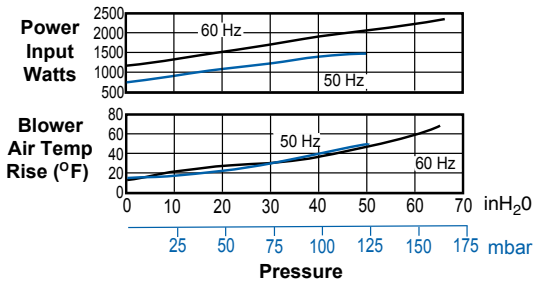
Product Specifications

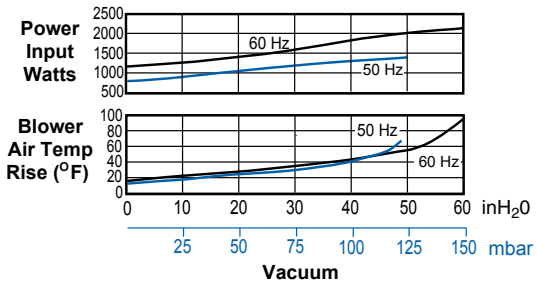
MODEL NUMBER		R5125-2	R5325A-2	R5325B-1
Motor Enclosure		TEFC	TEFC	TEFC
HP/kW	60 Hz	2.5/1,9	2.5/1,9	2.5/1,9
	50 Hz	1.5/1,1	1.85/1,38	-
Voltage	60 Hz	115/208-230-1	208-230/460-3	575-3
	50 Hz	110/220-240-1	190-220/380-415-3	-
Amps	60 Hz	21/12-10	6.9-6.9/3.45	2.9
	50 Hz	16.5/8.6	6.6-6.7/3.3-3.5	-
Starting Amps	60 Hz	58 @ 230V	58 @ 230V	23.4
	50 Hz	42 @ 230V	23 @ 380V	-
Insulation Class		F	B	B
Recommended NEMA Starter Size		1/0	0/00	0
Net Weight (lbs/kg)		76/34,5	65/29,5	65/29,5

Product Performance







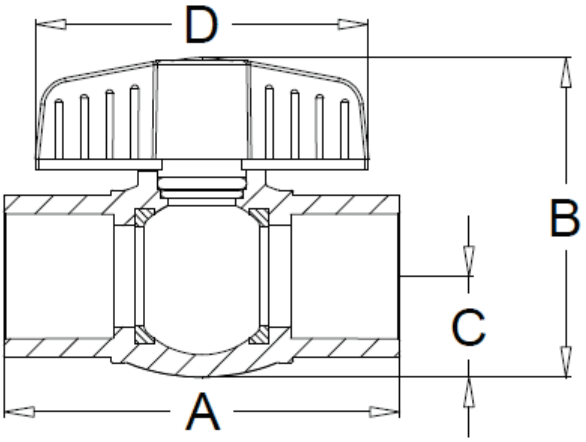


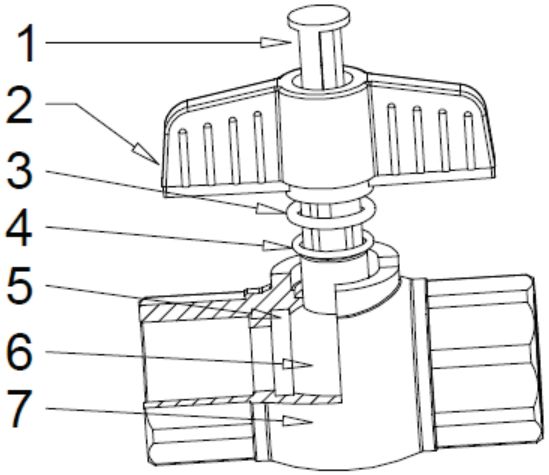
770 White PVC Ball Valve • Spec Sheet

Sizes 1/2” - 2”

FEATURES & BENEFITS

- ISO 9002
- 150 PSI @ 73 Deg. F.
- White Color
- NSF Approved
- Fits Sch. 40 & Sch. 80 Pipe
- Threaded or Solvent Ends
- Threaded Ends Comply With ANSI B1.20.1
- Solvent Ends Comply With ASTM D2466





DIMENSIONS

Part # Threaded	Part # Solvent	Size	A	B	C	D
770T03	770S03	1/2”	3.16	2.46	0.71	2.74
770T04	770S04	3/4”	3.61	2.98	0.87	3.01
770T05	770S05	1”	4.19	3.39	1.06	3.53
770T06	770S06	1-1/4”	4.76	3.80	1.21	3.54
770T07	770S07	1-1/2”	5.13	4.32	1.46	4.42
770T08	770S08	2”	5.93	5.36	1.83	5.53

MATERIAL SPECIFICATIONS

No.	Part	Material
1	Cap	ABS
2	Handle	ABS
3	O-Ring	EPDM
4	O-Ring	EPDM
5	Seat (2)	PTFE
6	Ball	PC + ABS
7	Body	PVC

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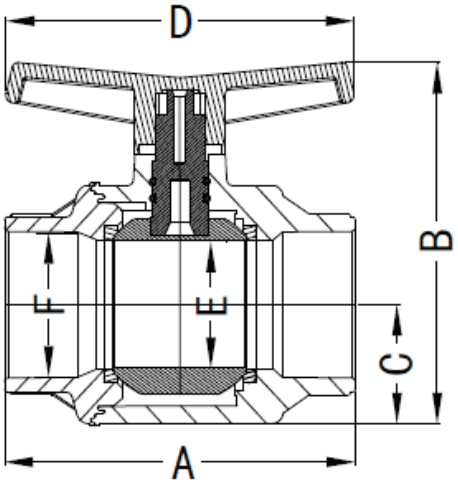
NEW YORK PO Box 27, Rt. 22, Brewster NY 10509 • Toll Free: 800-431-2082 • Fax: 845-278-9056
WEB: **www.matco-norca.com** EMAIL: **mail@matco-norca.com**

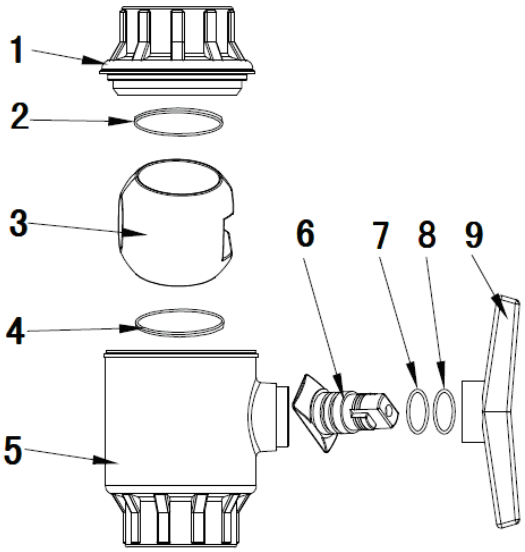
770 White PVC Ball Valve • Spec Sheet

Sizes 2-1/2" - 4"

FEATURES & BENEFITS

- ISO 9002
- 150 PSI @ 73 Deg. F.
- White Color
- NSF Approved
- Fits Sch. 40 & Sch. 80 Pipe
- Threaded or Solvent Ends
- Threaded Ends Comply With ANSI B1.20.1
- Solvent Ends Comply With ASTM D2466





DIMENSIONS

Part # Threaded	Part # Solvent	Size	A	B	C	D	E	F
770T09	770S09	2-1/2"	7.48	7.68	2.26	7.09	2.62	2.87
770T10	770S10	3"	8.66	8.86	2.66	9.05	3.06	3.49
770T11	770S11	4"	10.24	10.24	3.35	10.04	4.03	4.49

MATERIAL SPECIFICATIONS

No.	Part	Material
1	Nut	PVC
2, 4	Seat (2)	PTFE
3	Ball	PVC
5	Body	PVC
6	Stem	PVC
7, 8	O-Ring (2)	EPDM
9	Handle	ABS

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TIGG 5CC 0408

Virgin Vapor Phase Coconut Based Activated Carbon

www.TIGG.com

DESCRIPTION

TIGG 5CC 0408 is a granular activated carbon made from coconut shell. The combination of high activity level and selective transport and adsorption pores accommodates adsorbates of varied molecular size. This activated carbon also contains the high energy adsorption pores which are vital to attaining ultra high removal of low molecular weight volatile organic compounds.

TYPICAL PROPERTIES	TIGG 5CC 0408
U.S. Sieve, 90 wt% min	4 x 8
CCl_4 Number, min	60
Iodine Number, mg/g, min	1150
Apparent Density, (dense packing)	
g/cc	0.41 – 0.42
lbs/ft^3	26
Moisture - wt% max (as packed)	3
Hardness No. - min	98

TYPICAL APPLICATIONS

This activated carbon can be used to:

- Capture solvents
- Remove VOC's from:
  - Tank vents
  - Air stripper off gas
  - Soil venting
  - Remediation of excavated soil

Standard packaging of the activated carbon is in 55 pound bags or 1100 pound supersacks.

Wet drained activated carbon adsorbs oxygen from the air. Therefore, when workers need to enter a vessel containing wet activated carbon, they should follow confined space/low oxygen level procedures. Activated carbon dust does not present an explosion hazard.

1. Bottom Connection
2. Back Connection

Description & Features:

- Highly accurate reading of low pressures
- Brass or stainless steel wetted parts
- Ranges from 15" H_2O/oz to 10 psi
- Over-pressure protection on some models (OP)
- ASME B40.100 compliant
- CRN registered
- 5 year warranty

Applications:

- Suitable for measuring gaseous media both corrosive and non-corrosive
- Used to measure natural gas pressure as well as air flow indication and leak detection
- Vacuum pumps, air compressors, air filters, gas burners, vacuum ovens, suction regulators and respirators

Specifications	Stainless Steel Internals	Brass Internals
Dial	2.5" (63mm), 4" (100mm), 4.5" (115mm) and 6" (150mm), white aluminum with black and red markings	2.5" (63mm), 4" (100mm), 4.5" (115mm) and 6" (150mm), white aluminum with black and red markings
Case	2.5" (63mm), 4" (100mm): AISI 304 SS 4.5" (115mm), 6" (150mm): Aluminum, painted black	2.5" (63mm), 4" (100mm): Steel, painted black 4.5" (115mm), 6" (150mm): Cast aluminum, painted black
Lens	2.5" (63mm): Polycarbonate 4" (100mm): Styrene-acrylonitrile resin 4.5" (115mm), 6" (150mm): Glass	2.5" (63mm), 4" (100mm): Polycarbonate 4.5" (115mm), 6" (150mm): Glass
Ring	2.5" (63mm), 4" (100mm): No ring 4.5" (115mm), 6" (150mm): Aluminum	2.5" (63mm): No ring 4" (100mm): Steel 4.5" (115mm), 6" (150mm): Aluminum
Socket	AISI 316 SS	Brass
Connection	1/4" NPT standard	1/4" NPT standard
Diaphragm Element	AISI 316 SS	Phosphor bronze
Movement	AISI 316 SS	2.5" (63mm): Engineering plastic upper and lower plate with brass pinion and sector; 4" (100mm), 4.5" (115mm), 6" (150mm): Brass
Pointer	Aluminum, anodized black	Aluminum, anodized black
Welding	TIG	Solder/brazed
Working Pressure	75% of full scale value	60% of full scale value (fluctuating) 75% of full scale value (static)
Over-pressure Limit	30% of full scale value	30% of full scale value, up to 200% with over-pressure protection (OP) option
Ambient/Process Temperature	-40°F to 150°F (-40°C to 65°C)	-40°F to 150°F (-40°C to 65°C)
Accuracy	±1.6% of full scale	±3-2-3% ANSI/ASME Grade B
Enclosure Rating	IP52	IP52
Warning (brass internals only)	N/A	⚠ **WARNING:** This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Order Codes (products in bold are normally stock in North America)

Dial Size	2.5" (63mm)			4" (100mm)				4.5" (115mm)			
Case Material	Steel		SS	Steel			SS	Aluminum			
Connection	1/4" Bottom	1/4" Back (CB)	1/4" Bottom	1/4" Bottom	1/4" Back (CB)	1/4" Back (CB)	1/4" Bottom	1/4" Bottom	1/4" Back (CB)	1/4" Bottom	1/4" Back (CB)
Capsule, Movement, Socket	Brass		SS	Brass		SS		Brass		SS	
0/15" water (vac)	PLP300V	PLP340V	PLP350V	PLP310V	PLP4230V	PLP4240V	PLP4200V	PLP4250V	PLP4290V	PLP4260V	PLP4300V
0/32" water (vac)	**PLP301V**	PLP341V	PLP351V	PLP311V	PLP4231V	PLP4241V	PLP4201V	PLP4251V	PLP4291V	PLP4261V	PLP4301V
0/55" water (vac)	PLP302V	PLP342V	PLP352V	PLP312V	PLP4232V	PLP4242V	PLP4202V	PLP4252V	PLP4292V	PLP4262V	PLP4302V
0/100" water (vac)	PLP304V	PLP343V	PLP353V	PLP313V	PLP4233V	PLP4243V	PLP4203V	PLP4253V	PLP4293V	PLP4263V	PLP4303V
0/200" water (vac)	PLP303V	-	PLP356V	-	-	-	-	-	-	-	-
0/15" water/oz	**PLP300**	**PLP340**	PLP350	PLP310	PLP4230	PLP4240	PLP4200	PLP4250	PLP4290	PLP4260	PLP4300
0/32" water/oz	**PLP301**	**PLP341**	PLP351	PLP311	PLP4231	PLP4241	PLP4201	PLP4251	PLP4291	PLP4261	PLP4301
0/55" water/oz	**PLP302**	**PLP342**	PLP352	PLP312	PLP4232	PLP4242	PLP4202	PLP4252	PLP4292	PLP4262	PLP4302
0/100" water/oz	**PLP304**	**PLP343**	PLP353	PLP313	PLP4233	PLP4243	PLP4203	PLP4253	PLP4293	PLP4263	PLP4303
0/200" water/oz	**PLP303**	PLP346	PLP356	PLP316	PLP4236	PLP4246	PLP4206	PLP4256	PLP4296	PLP4266	PLP4306
0/5 psi/kPa	**PLP305**	**PLP344**	PLP354	PLP314	PLP4234	PLP4244	PLP4204	PLP4254	PLP4294	PLP4264	PLP4304
0/10 psi/kPa	**PLP306**	PLP345	PLP355	PLP315	PLP4235	PLP4245	PLP4205	PLP4255	PLP4295	PLP4265	PLP4305

Dial Size	6" (150mm)			
Case Material	Aluminum			
Connection	1/4" Bottom	1/4" Back (CB)	1/4" Bottom	1/4" Back (CB)
Capsule, Movement, Socket	Brass		SS	
0/15" water (vac)	PLP4310V	-	PLP4320V	-
0/32" water (vac)	PLP4311V	-	PLP4321V	-
0/55" water (vac)	PLP4312V	-	PLP4322V	-
0/100" water (vac)	PLP4313V	-	PLP4323V	-
0/15" water/oz	PLP4310	-	PLP4320	PLP4360
0/32" water/oz	PLP4311	PLP4351	PLP4321	PLP4361
0/55" water/oz	PLP4312	-	PLP4322	-
0/100" water/oz	PLP4313	PLP4353	PLP4323	PLP4363
0/200" water/oz	PLP4316	-	PLP4326	-
0/5 psi/kPa	PLP4314	PLP4354	PLP4324	PLP4364
0/10 psi/kPa	PLP4315	PLP4355	PLP4325	PLP4365

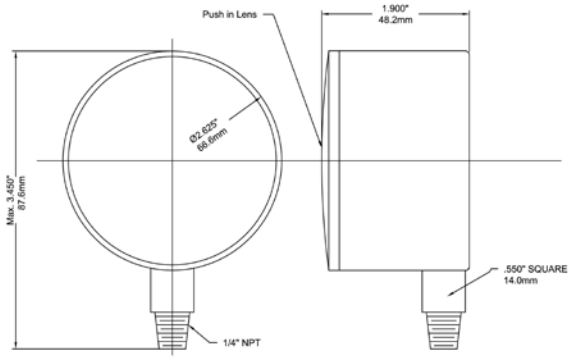
Dial Size	2.5" (63mm)
Case Material	Steel
Connection	1/4" Bottom
Capsule, Movement, Socket	Brass w/Over-pressure protection
0/5 psi/kPa	PLP305OP
0/8 psi/kPa	**PLP307OP**
0/10 psi/kPa	PLP306OP

Other ranges and connection sizes available upon request. For scale change, refer to How to Order Guide for scale codes. **For options, attach suffix to end of order code: i.e. PLP340-UC for U-CLAMP**

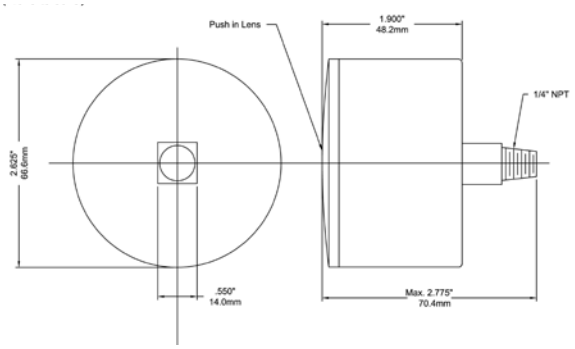
Option suffix:

3Y = 4" (100mm) PBT Enclosure
LPBF = Back flange (all sizes except 2.5" (63mm))
LPFF = 4.5" (115mm) Front flange
LPFF6 = 6" (150mm) Front flange
UC = 2.5" (63mm) U-clamp

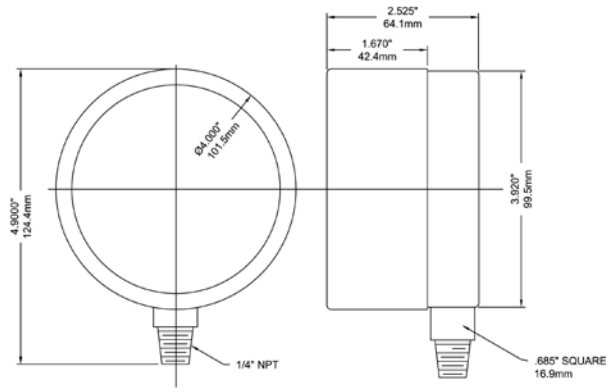
2.5" Bottom Connection Brass



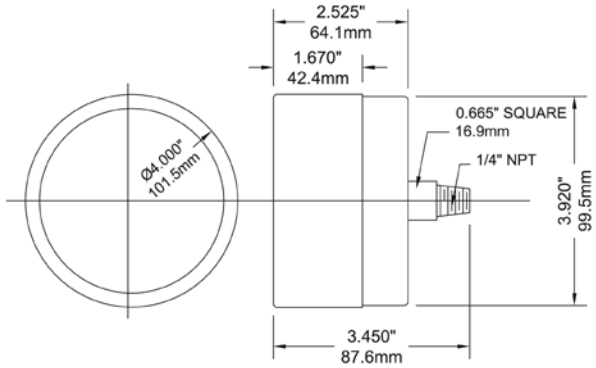
2.5" Back Connection Brass



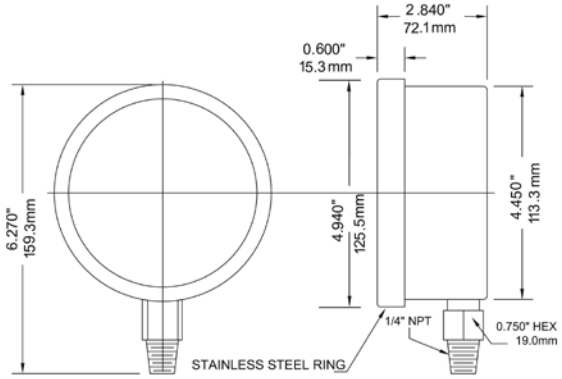
4” Bottom Connection Brass



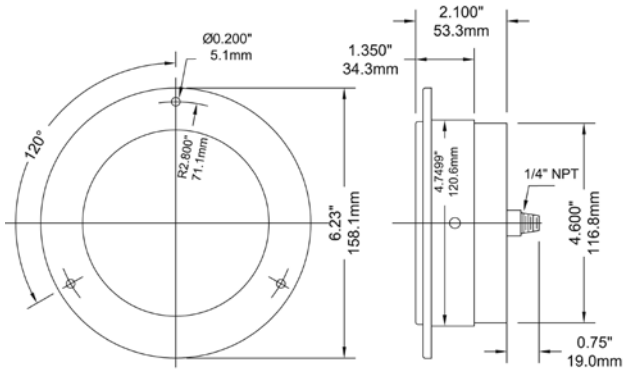
4” Back Connection Brass



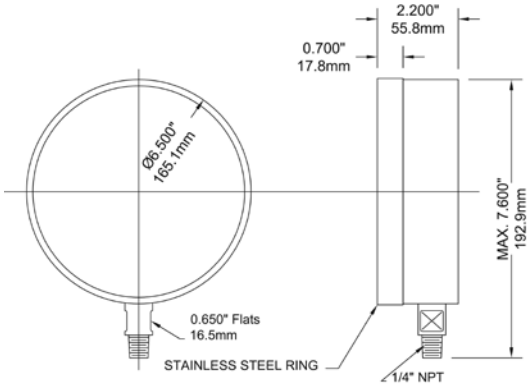
4.5” Bottom Connection Stainless Steel



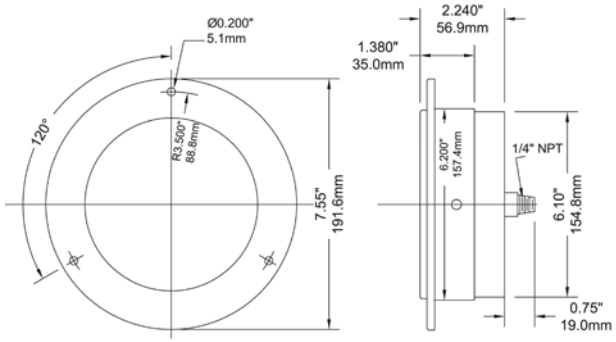
4.5” Back Connection Stainless Steel with Front Flange

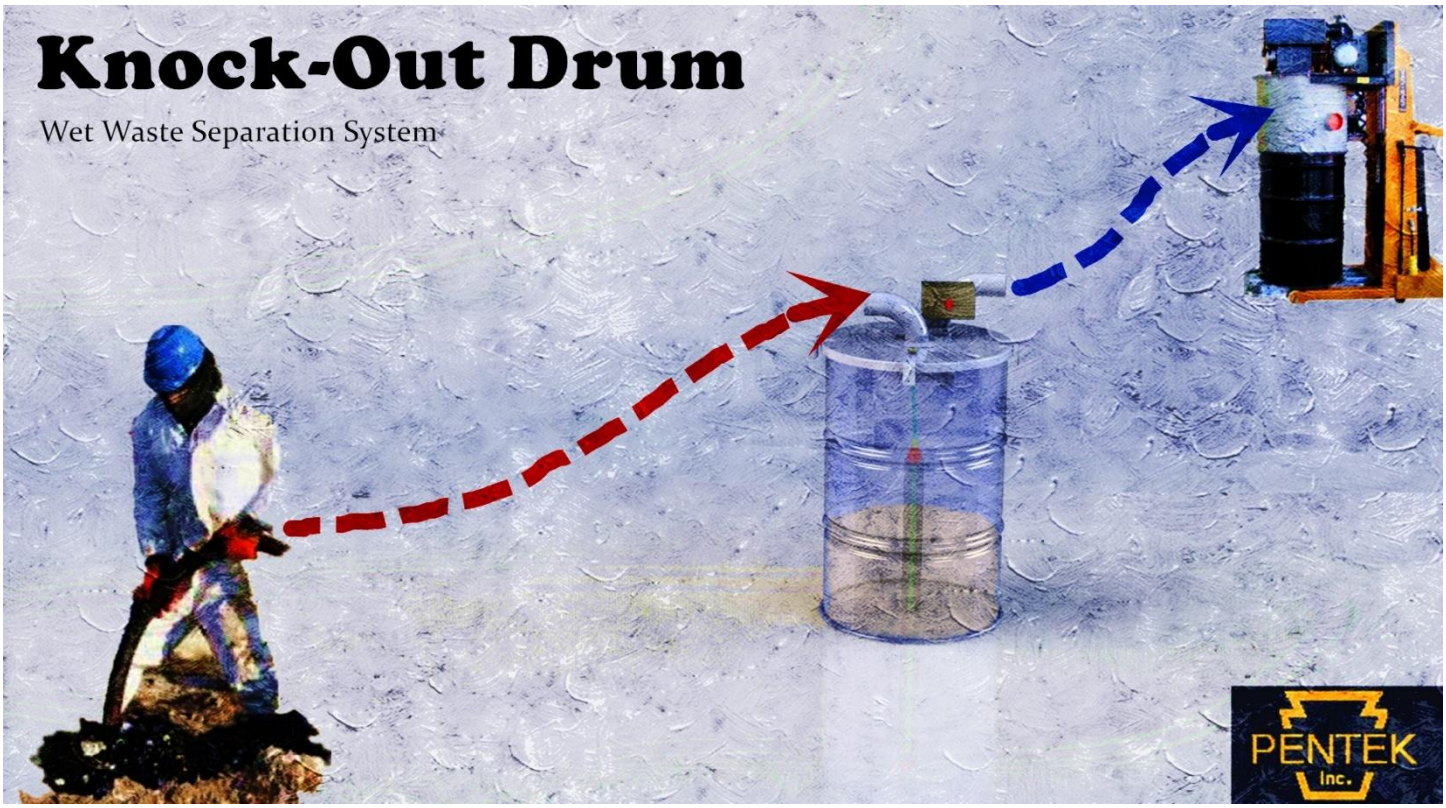


6” Bottom Connection Stainless Steel



6” Back Connection Stainless Steel with Front Flange





The Pentek Knock-Out Drum is the perfect accessory to your HEPA vacuum waste collection scheme. When inserted between the waste and the VAC-PAC®, you are assured of trouble-free, automated operation with no downtime and minimum maintenance cost.

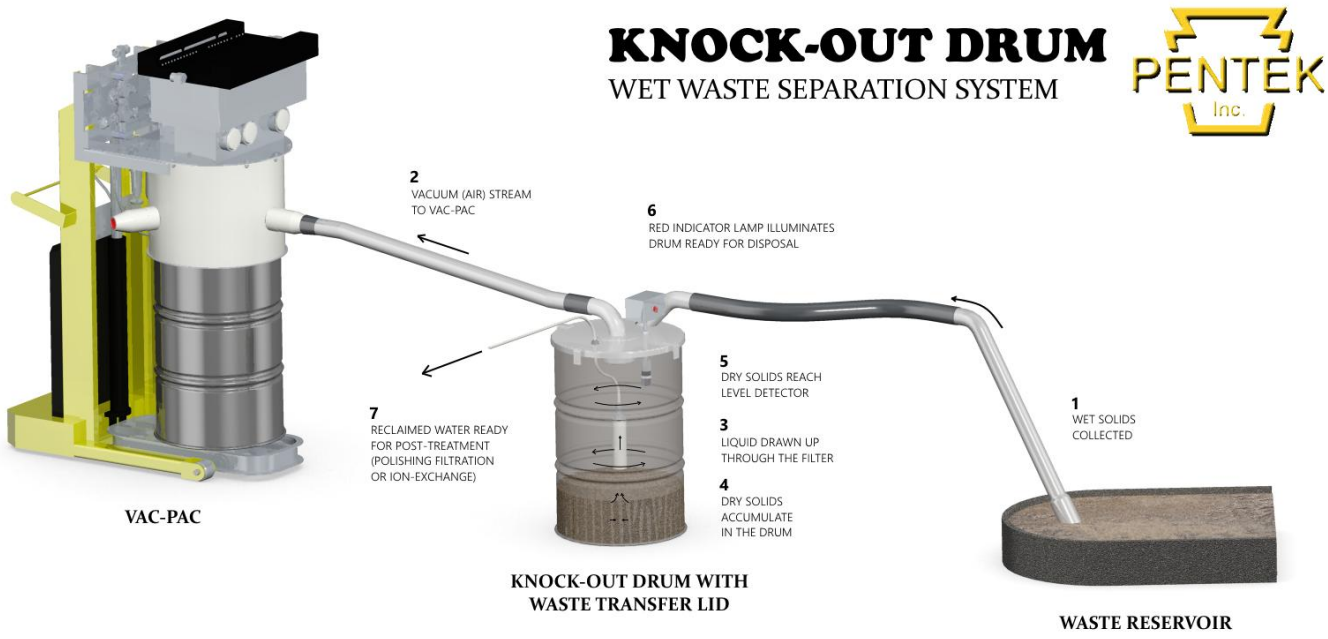
The Pentek Knock-Out Drum provides continuous clear liquid extraction from hazardous materials collected during your waste cleanup and removal operations. The Knock-Out Drum is offered with lead paint removal, PCB clean-up, and nuclear decontamination applications in mind, though it can handle most non-combustible wet waste. Whether it's thick sludge, slurry, or particulate-contaminated water, the Knock-Out Drum will extract and discharge clear water from the waste stream, leaving behind only the solid waste to accumulate in a standard, DOT-certified, 55-gallon waste drum.

The Knock-Out Drum is designed to be unobtrusive and maintenance-free. The drum unit has no moving parts. Setup is a simple and quick, 4-step process requiring attachment of:

- the Pentek Waste Transfer Lid to the Knock-Out Drum,
- a pick-up hose attachment at the inlet,
- a vacuum extraction hose at the outlet to the VAC-PAC®, and
- a discharge hose to the clear liquid extraction port.

Once the battery-powered lid-mounted level detector signals that the drum is full, simply detach the hoses, swap the transfer lid for a standard lid (included), and the filled drum is sealed and ready for disposal. And since no one has to handle the waste in the drum, the safety of the workers and the nearby public is never compromised.

All hoses connections are standard sizes, and can be custom-tailored to your specifications. Custom engineered drums and waste containers can also be provided. Please for contact us for further information concerning your particular project requirements.



Specs

- Hose connection options
  - 2-inch (50mm) diameter inlet and outlet tubes
  - 3-inch (75mm) diameter inlet and outlet tubes
  - Connection options are compatible with standard Pentek hose cuffs
- Electrical protection
  - Electronic controls provide positive waste drum level detection
  - IP-54 sealing of electrical components
  - Built-in test of Full Drum indicating lamp
- Battery operation
  - Replaceable, 18-volt Battery Pack utilizes standard, 9 volt DC cells available from suppliers and retail stores anywhere in the world.
  - Expected battery life under continuous use is approximately 4 weeks
  - Built-in test circuit warns operators to replace the Battery Pack
- Physical and environmental
  - Dry weight: 55 lbs (25 kg), including the waste drum
  - Size: 24-inch (600mm) diameter to fit standard dimension 55-gallon (208-litre) waste drums
  - Operating temperature: 35°F to +118°F (2°C to +50°C)
  - Operating vacuum conditions: +0.0 to -5 psig (0 to -0.35 bar) vacuum
  - Maximum free liquid flow rates: up to 5 gpm (22.7 litre/min)
  - Not qualified to handle explosive materials
- Clear water recovery
  - Standard solids separation efficiency: 99% @ 10µ (custom filtration is available)
  - Maximum clear water/permeate flow rate: 5 gpm (22.7 litre/min)
  - Maximum discharge pressure: 90 psig (7 bar)

LASCO® Fittings, Inc.

PRODUCT SPECIFICATIONS
PVC SCHEDULE 80 PRESSURE FITTINGS

SCH80PSPEC-01 | Nov 29, 2018

APPLICATION:

Corrosion resistant injection molded PVC pipe fittings, IPS sizes 1/4" through 12" produced to Schedule 80 dimensions, for use at temperatures up to and including 140°F. Pressure rating varies with pipe size and temperature. Generally resistant to most acids, bases, salts, aliphatic solutions, oxidants and halogens. Chemical resistance data must be referenced by the design authority for proper material selection prior to use. Typical applications include chemical processing, plating, chilled water, potable water, water and waste water treatment, chemical drainage, and other industrial applications where corrosive fluids are conveyed.

SCOPE:

This specification establishes minimum manufacturing requirements for Poly (Vinyl Chloride) (PVC) Schedule 80 pressure fittings. These fittings are intended for use in pressure applications where the temperature of the fluid conveyed does not exceed 140°F. These fittings meet or exceed the industry standards set forth by the American Society for Testing and Materials (ASTM) and NSF International ANSI/NSF Standard No. 61 and ANSI/NSF Standard No. 14.

MATERIALS:

The materials used in the manufacture of the fittings shall be a dark gray in color Rigid Poly (Vinyl Chloride) (PVC) Type 1 PVC compound having a Cell Classification of 12454 per ASTM D1784 (also known as Type I, Grade I PVC; PVC 1120.) Materials used in the manufacture of these fittings shall meet the health and safety requirements of ANSI/NSF Standard 61 as being safe for use with potable water.

DIMENSIONS AND PROPERTIES:

All sizes of PVC Schedule 80 injection molded pressure fittings shall be manufactured in strict accordance to the requirements of ASTM D2467 (Schedule 80 socket fittings) or ASTM D2464 (Schedule 80 threaded fittings) as applicable for physical dimensions and tolerances. All schedule 80 PVC injection molded fittings shall consistently meet and/or exceed the Quality Assurance and other requirements of ASTM D2467 or D2464 with regard to material, workmanship, burst pressure, dimensions and product marking. All PVC flanges shall be designed and manufactured to meet ANSI Standard B16.5 CL150 bolt pattern, and carry a maximum internal pressure rating of 150 psi, non-shock at 73°F. All PVC Schedule 80 fittings must also be certified to meet the requirements of ANSI/NSF Standard 61 and ANSI/NSF Standard 14 for use with potable water and shall bear the mark of the Listing agency. These products shall also be certified to NSF/ ANSI 372 conforming to the lead content requirements for "lead free" plumbing as defined by the U.S. Safe Drinking Water act and the state laws of California, Vermont, Maryland, and Louisiana.

MARKING:

All sizes of PVC Schedule 80 fittings shall meet the marking requirements of ASTM D2467 or ASTM D2464, which includes as a minimum the manufacturers name and/or trademark, the material designation PVC 1, the NSF mark seal of approval for use with potable water, and the designation D2467 or D2464 as applicable.

LASCO Fittings Inc. PVC Sch 80 Fittings Conform to the Following Standards and Specifications as applicable:

ASTM D1784 (Material)	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds. Cell Classification 12454 Type I PVC (formerly known as Type I, Grade I PVC) PVC 1120
ASTM D2464	Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2467	Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM F1970	Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems
ANSI/ASME B1.20.1	American National Standard Tapered Pipe Threads, General Purpose, Inch
ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings - LASCO Flanges bolt hole dimensions conform to ANSI B16.5 Class 150 bolt pattern.
NSF Standard 61	Drinking Water System Components – Health Effects (Third Party Certification materials are suitable for potable water applications)
NSF Standard 14	Plastics Piping System Components and Related Materials (Third Party Certification products meet applicable ASTM performance requirements and are suitable for potable water applications per NSF Std 61)
USA	Pipe fittings manufactured by LASCO Fittings Inc. are manufactured in the United States of America

PVC SCHEDULE 80 FITTINGS SAMPLE SPECIFICATION:

All PVC Schedule 80 fittings shall be supplied by LASCO Fittings, Inc. from a rigid Type 1 Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. Fittings manufactured by LASCO shall be manufactured in the USA in strict compliance to ASTM D2467 for schedule 80 socket fittings or ASTM D2464 for schedule 80 threaded fittings, consistently meeting and/or exceeding the Quality Assurance and other requirements of these standards with regard to material, workmanship, burst pressure, dimensions and product marking. All PVC Schedule 80 fittings shall bear the NSF International mark as being certified for use with potable water. All PVC Schedule 80 injection molded fittings shall be supplied by LASCO Fittings, Inc.

MADE IN USA

LASCO® Fittings, Inc.

PRODUCT SPECIFICATIONS
PVC SCHEDULE 80 PIPE PRESSURE RATINGS

SCH80PSPEC-01 | Nov 29, 2018

Nominal Size	* Pipe Maximum W.P. Rating (non-shock) @73°F
¼"	1130
⅜"	920
½"	850
¾"	690
1"	630
1¼"	520
1½"	470
2"	400
2½"	420
3"	370
4"	320
6"	280
8"	250
10"	230
12"	230

* Pressure ratings stated are for pipe. PVC Sch 80 fittings meeting the requirements of ASTM D2467 or D2464 meet the same burst pressure as the same size Sch 80 pipe. There are no working pressure ratings established for fittings per these standards.

** See below for additional information.

TEMPERATURE DE-RATING

The pipe pressure ratings shown are the maximum allowable working pressure for water, non-shock, at 73°F. *Allowable pressure ratings decrease with an increase in temperature.* The following temperature de-rating factors must be applied to the working pressure ratings shown to determine the maximum allowable pressure rating at elevated temperatures.

Multiply the working pressure rating shown at 73°F by the appropriate de-rating factor for the elevated temperature selected to determine the maximum allowable pressure rating at that temperature.

PVC TEMPERATURE DE-RATING FACTORS

Operating Temp (°F)	De-Rating Factor
73°	1.00
80°	0.88
90°	0.75
100°	0.62
110°	0.51
120°	0.40
130°	0.31
140°	0.22

*The maximum allowable operating temperature for PVC is 140°F

EXAMPLE:

What is the maximum allowable pressure rating for 4" PVC SCH 80 pipe operating at a temperature of 110°F?

4" PVC Sch 80 pipe = 320 psi@73°F

4" PVC Sch 80 pipe (320 psi x 0.51) = 163 psi

Maximum allowable pressure rating for 4" PVC Sch 80 pipe non-shock for water operating at a temperature of 110°F = 163 psi

NOTES:

PVC Schedule 80 Pipe and Fitting Material Equivalents: ASTM D1784 Cell Classification 12454 = PVC Type 1 (formerly Type 1, Grade 1 PVC) = PVC1120 = Rigid PVC = UPVC (Unplasticized PVC). Maximum Hydrostatic Design Stress (HDS) @73°F = 2,000 psi; Maximum Hydrostatic Design Basis (HDB) @73°F = 4,000 (Per ASTM D2837/PPI TR-3/PPI TR-4).

Solvent Welded joints should be utilized for joining systems operating at or near maximum allowable temperatures for PVC. LASCO Fittings, Inc. does not recommend the use of conventional PVC threaded connections at temperatures above 110°F. Use flanged connections, unions, grooved couplings or other suitable mechanical connections where disassembly is necessary at elevated temperatures. Threading of Schedule 40 pipe is not recommended due to insufficient wall thickness. Thread only Schedule 80 dimensions or heavier walls. Threaded piping systems require a 50% reduction in pressure rating stated for plain-end pipe. Flange components must be installed in accordance with LASCO published Flange Installation Guidelines.

Plastic piping systems must be engineered, installed, operated and maintained in accordance with accepted standards and procedures. Suitability for the intended application should be determined and verified by the designer and/or installer prior to use. Chemical resistance data must be referenced for proper material selection prior to use.

**Although fittings meet the same burst pressure as pipe, working pressure ratings for schedule 80 fittings are not established per ASTM D2464 or D2467. A respected rule of thumb based on practical experience suggests that the working pressure ratings for PVC Sch 40 and Sch 80 molded fittings is 60% of the maximum working pressure rating of the same size and schedule PVC pipe (reference 1987 publication "Operating and Maintaining Piping Systems Using PVC Fittings" by Ron D. Bliesner). LASCO Fittings, Inc. supports this widely accepted rule of thumb. The exception is special engineered fittings such as flanges, unions, and valves that do have working pressure ratings established by the manufacturer (they are typically lower than that of the same size pipe). As is the case with pipe, the maximum allowable working pressure for fittings must be decreased with an increase in temperature using the same material temperature de-rating factors. Factors such as fitting geometry, fitting design, system operating conditions (i.e. actual surge conditions), fluids conveyed, severity of service, temperature and other variables must be considered by the design authority when determining suitability for the intended application. Substantial reductions in working pressure are advisable when handling aggressive chemicals and in high temperature service applications.

Contact LASCO Technical Services for additional information.
Customer Service: 800-776-2756 • www.lascofittings.com

⚠ WARNING:
USE OF COMPRESSED AIR OR GAS IN PVC/CPVC PIPE AND FITTINGS CAN RESULT IN EXPLOSIVE FAILURES AND CAUSE SEVERE INJURY OR DEATH.

MADE IN USA

aalberts

SOLBERG®
Filtration & Separation

See-Through Vacuum Filters

ST Series 1” - 4”

Features

- Compact design for space restrictions; min. service area
- Inlet above element for extended element life & maintenance intervals
- Corrosive resistant cast aluminum top with machined connections and integrated baffle design
- “T” style design minimizes piping requirements
- Shatter-resistant polycarbonate drop down bucket

Connection Size	Drill Points/ Gauge Taps	(4) Tap, Mount Sizes	Fasteners
1"	Drill	Drill	Clips
1 ¼”	Drill	Drill	Clips
1 ½”	Drill	Drill	Clips
2"	Drill	M12x1.75	Clips
2 ½”	Drill	M12x1.75	Clips
3"	Drill	½”-13	Clips
4"	Drill	½”-13	Clips

Technical Specifications

- Vacuum Rating: medium vacuum service*
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20” H_2O over initial Δ P
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

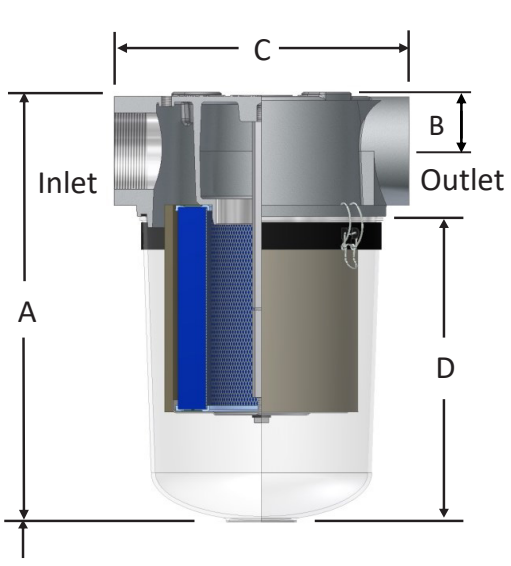
Options

- Swing bolts for heavy duty environments
- Drain ports
- Spool piece extender (select models)
- Reverse pulse configuration

Rev: ST-US1904K

Sales/Service: 630.773.1363
sales@solbergmfg.com

ST Series 1” - 4”



Inlet/Outlet Size	Type	Assembly SCFM Rating	Assembly Part Number Polyester	Paper	Dimensions - inches A	B	C	D	Suggested Service Ht. E	Approx. Weight lbs	Replacement Element Part No. Polyester	Paper	Element SCFM Rating
1”	NPSC	40	**ST-897-100C**	**ST-896-100C**	13 3/8	1½	7	10 3/8	9”	11	897	896	80
1 ¼”	NPSC	60	**ST-897-125C**	**ST-896-125C**	13 3/8	1½	7	10 3/8	9”	11	897	896	80
1 ½”	NPSC	80	**ST-897-150C**	**ST-896-150C**	13 3/8	1½	7	10 3/8	9”	10	897	896	80
2”	NPSC	175	**ST-851/1-200C**	**ST-850/1-200C**	16 ¼	2	9	12 7/16	9”	15	851/1	850/1	290
2 ½”	FPT	210	**ST-851/1-250C**	**ST-850/1-250C**	16 ¼	2	9	12 7/16	9”	14	851/1	850/1	290
3”	FPT	300	**ST-235P-300C**	**ST-234P-300C**	19 ¾	2 11/16	13 ½	14	9”	29	235P	234P	570
4”	FPT	520	**ST-235P-400C**	**ST-234P-400C**	19 ¾	2 11/16	13 ½	14	9”	25	235P	234P	570

*See Vacuum Filter Technical Data section for sizing guidelines and service data.