



ESC ENGINEERING OF NEW YORK, P.C.

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**OPERATION, MAINTENANCE, AND MONITORING PLAN
VAPOR INTRUSION MITIGATION SYSTEMS
EMERSON POWER TRANSMISSION
620 AURORA STREET
ITHACA, NEW YORK
SITE NO. 7-55-010**

PREPARED

BY

ESC ENGINEERING OF NEW YORK, P.C.

JANUARY 31, 2008

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Acronym List

EPA	U.S. Environmental Protection Agency
EPT	Emerson Power Transmission
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	Operation, Maintenance, and Monitoring
PVC	polyvinyl chloride
SMD	sub-membrane depressurization
SSD	sub-slab depressurization
TCE	trichloroethene

1.0 Introduction

ESC Engineering of New York, P.C., on behalf of Emerson and Emerson Power Transmission (EPT), has prepared this operation, maintenance, and monitoring (OM&M) plan describing the activities related to operation and maintenance of the vapor mitigation systems installed at selected residences in the South Hill neighborhood to the north of the EPT facility in Ithaca, New York. The OM&M activities will be conducted in accordance with the New York State Department of Health's (NYSDOH's) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006. The OM&M activities were designed to ensure that each mitigation system is operating efficiently and effectively.

The following sections provide a brief description of the site and its history. Section 2 of this plan describes the mitigation systems, the post mitigation testing procedures, and the maintenance and monitoring procedures. A schedule for the OM&M activities is provided in Section 3 and a project contact list is included in Section 4.

1.1 Site Description

The EPT facility is located at 620 South Aurora Street in Ithaca, New York (Figure 1). The site comprises approximately 110 acres within the City of Ithaca and the Town of Ithaca in Tompkins County and includes the New York State Electric and Gas substation property to the west. The area surrounding the facility is mostly residential. The campus of Ithaca College is located to the east across South Aurora Street. The southern portion of the property is unused and vacant. Wooded land and residential areas border the property to the west, and residential areas, including the South Hill Community (Figure 1), are located to the north. Cayuga Lake is approximately 2 miles north of the site.

1.2 Site History

The EPT site was first developed in 1906 by the Morse Industrial Corporation, which manufactured steel roller chain for the automobile industry. In 1928, the facility switched from chain production to the manufacture of automotive components and power transmission equipment. Borg-Warner operated the Morse facility until 1983, when the facility was acquired

by Emerson. Emerson, under the new facility name of EPT, continues to manufacture automotive components and bearings, including roller chain and clutches.

During Borg-Warner's plant ownership, Borg-Warner used a number of chlorinated solvents in manufacturing operations. The solvent trichloroethene (TCE), which is widely used in the industry, was reportedly used to clean metal parts in degreasers including one located on the ground floor of the Main Plant building. TCE was discovered in a firewater reservoir that lies beneath one of the outbuildings directly across from the former vapor degreaser area in the main building (Figure 1). Subsequent investigations conducted by Emerson beginning in 1987 revealed TCE-contaminated groundwater in the area directly downhill from the reservoir. Emerson reported these findings to the New York State Department of Environmental Conservation (NYSDEC) in 1987. Additional investigation in the late 1980s and early 1990s led to the installation of the groundwater remediation system directly downgradient of the firewater reservoir and a groundwater investigation program that included a number of wells in the neighborhoods adjacent to the EPT facility.

2.0 Vapor Intrusion Mitigation System Operation, Maintenance and Monitoring

This section provides a description of the vapor intrusion mitigation systems installed (or to be installed) in the study area. This is followed by a discussion of the system maintenance and monitoring activities.

2.1 Description of Mitigation Systems

In accordance with the NYSDOH soil vapor intrusion guidance, the methods of mitigation involve sealing infiltration points and manipulating the pressure differential between a building's interior and exterior on a continuous basis. The study area around the EPT Ithaca site involves single family homes. The homes generally are older structures with field stone and/or concrete foundations underlain by bedrock. The basements in these homes have concrete floors, dirt floors, and/or crawl spaces. System designs are based on the condition of the foundations along with diagnostic communication testing at homes with existing concrete slabs to measure the ability of a suction field and air flow to extend through the material beneath the slab.

Homes having a competent concrete floor in the basement are addressed by sealing all potential subsurface vapor entry points including joints, cracks, penetrations in the concrete slab, and where the concrete slab meets the foundation wall using an elastomeric joint sealant. In addition, any voids in fieldstone foundation walls are sealed with expansion foam, as necessary. Homes that do not have a full concrete slab are provided a new concrete floor over the existing soil to seal off vapor entry into the home. A minimum 6-mil polyethylene sheeting material is placed on top of coarse base material prior to pouring the concrete to serve as a barrier to vapor intrusion by bridging any cracks that may develop in the concrete slab and to prevent concrete from entering the void spaces of the aggregate base material. In some cases where the existing floor is in poor condition (significant cracks, non-continuous, extreme spauling), a polypropylene drain board is installed overlain by a new concrete floor to enhance vacuum beneath the slab. Any existing or newly installed sumps are covered with a sealed lid to retard soil gas entry into the basement.

In addition to sealing the basement of the homes, a sub-slab depressurization (SSD) system is installed to draw vapors from the soil beneath the concrete slab. A minimum of one vacuum point is installed through the floor slab into the soil underneath. A cavity is excavated at each vacuum point location to facilitate installation of a 4-inch-diameter polyvinyl chloride (PVC) pipe.

Soil vapor is conveyed via PVC piping from the vacuum point using a radon-type fan that creates a vacuum, and air flows from the vacuum point to an exhaust stack that discharges to the atmosphere. In some cases, more than one vacuum point is installed to achieve a pressure differential over the entire footprint of the concrete slab. Each vacuum point is sealed to the surrounding concrete slab using an elastomeric joint sealant. Liquid filled manometers are installed on the vertical riser of each vacuum point to measure the vacuum. In addition, shutoff valves are installed to control the flow from each vacuum location. An appropriately sized fan and exhaust piping are installed on the outside of each home, extending above the roofline in accordance with applicable standards (i.e., exhaust at least 12 inches above the surface of the roof, in a location at least 10 feet away from any window or other opening into the conditioned spaces of the building that is less than 2 feet below the exhaust point, and 10 feet from any adjoining or adjacent buildings).

Homes with a crawl space foundation are addressed by installing a sub-membrane depressurization (SMD) system. A 45-mil synthetic EPDM liner is placed on the ground in the crawl space to retard the flow of soil vapors into the home. The sheets of liner are sealed at the seams with at least a 12-inch overlap, and sealed around the perimeter of any interior piers and around the foundation walls. A vacuum point consisting of a 4-inch-diameter PVC pipe is installed and sealed to draw vapors from the beneath the membrane and discharge them to the atmosphere using a fan system. This results in a lower pressure beneath the membrane relative to the air pressure in the crawl space, which prevents the infiltration of subsurface vapors into the home. Homes requiring a SMD system for crawl spaces also have SSD systems to address the portion of the basement containing a concrete slab (or newly installed slab). In these cases, a common fan, conveyance piping, and discharge stack may be utilized to operate both systems.

Each mitigation system is designed and installed in accordance with the following:

- New York State Department of Health. 2006. Guidance for Evaluating Soil Vapor Intrusion in the State of New York. October.
- ASTM International. 2003. Standard Practice for Installing Radon Mitigation Systems in Existing Low-rise Residential Buildings (ASTM E-2121). ASTM E-2121-03. February 10.
- Environmental Protection Agency (EPA). October 1993 (Revised 1994). Radon Mitigation Standards. 402-R-93-078.
- EPA. 1992. Consumer's Guide to Radon Reduction. 402-K92-003. August.

- EPA. 1994. Model Standards and Techniques for Control of Radon in New Residential Buildings. 402-R-94-009. March.
- EPA. 1993. Radon Reduction Techniques for Detached Houses, Technical Guidance (Third Edition) for Active Soil Depressurization Systems. 625/R-93-011. October.
- EPA. 2001. Building Radon Out: A Step-by-Step Guide on How to Build Radon-Resistant Homes. 402-K-01-002. April.
- Kladder et al. 1993. Protecting Your Home from Radon: A Step-by-Step Manual for Radon Reduction.
- EPA. 1994. Radon Prevention in the Design and Construction of Schools and Other Large Buildings. 625-R-92-016. June.

Upon completion of installation of an SSD system, ESC Engineering of New York field personnel will explain the system manometer to the homeowner. Homeowners will be instructed on how to read the system manometers and to periodically check the manometers for functionality. Homeowners will also be shown signage on SSD system piping that contains contact information for the general contractor that installed the system. Homeowners will be instructed to contact ESC Engineering of New York or the general contractor if they notice a problem with their SSD system (e.g., abnormal fan noise) or if a component of the SSD system becomes damaged. A copy of this OM&M plan will be provided and explained to each homeowner.

2.2 Post-Mitigation Testing

Upon completing the mitigation system installation, the effectiveness and proper operation are confirmed. Smoke tubes are used to identify any leaks through the concrete floor, floor joints, and at the suction point. Identified leaks are repaired. Each home is tested for backdrafting while the system is operating. Any backdrafting conditions identified are corrected before the mitigation system is placed into operation.

Post system installation communication testing, or pressure field extension testing, is conducted on each system to demonstrate that a vacuum is being induced beneath the entire slab. The test is conducted by drilling 3/8-inch-diameter holes through the slab and measuring the

vacuum using a digital manometer. After completing the test, each hole is sealed with elastomeric joint sealant.

Following at least 3 months of operation, indoor air basement and first floor samples are collected from within the homes and an ambient air sample is collected in the vicinity of the homes. If the 3-month period falls outside the heating season, then upon approval from the NYSDOH, testing is postponed until the following heating season. Testing and sampling procedures follow those outlined in the approved original work plan for the indoor air program; however, because no drilling is conducted through the concrete slab which may cause organic fumes to enter the basement, testing procedures are initiated on the same day as the inventory is completed. All post mitigation testing results are documented and reported to the NYSDEC, the NYSDOH, and each property owner in accordance with the NYSDOH Guidance (October 2006).

2.3 System Maintenance and Monitoring

On an annual basis, each vapor mitigation system will be inspected and maintenance will be performed, as appropriate, to ensure the system is operating satisfactorily. During each visit, the following routine maintenance and monitoring activities will be conducted:

- A visual inspection of the complete system will be conducted including the vent fan, piping, warning device (liquid filled manometers), labeling on the system, and any membranes installed as a soil vapor retarder. The fan will be inspected to ensure proper operation and continued effectiveness at proving the appropriate vacuum. Manufacturer's specifications will be referenced to determine if and when replacement parts and/or system adjustments are required. Observations will be recorded on a log sheet as shown in Table 1.
- Any leaks identified will be repaired. This will include, at a minimum, inspecting all sealed joints, cracks, etc. on the concrete floor, foundation walls, vacuum points, and soil vapor retarder membrane (where it is attached to the walls and around foundation piers). Smoke tests will be performed as necessary to verify there are no leaks.
- Exhaust or discharge point from the mitigation system will be inspected to verify no air intakes have been located nearby.

Non-routine maintenance activities may be conducted in the event of the following:

- The building's owners or occupants report that the warning device (liquid filled manometer) indicates the mitigation system is not operating properly.
- The mitigation system becomes damaged (e.g., piping, valves, soil retarder membrane, fan).
- The building has undergone renovations that may reduce the effectiveness of the mitigation system.

The required non-routine maintenance activities will be determined and conducted after an evaluation is completed. All non-routine maintenance calls will be documented and reported to the NYSDEC and NYSDOH within 24 hours.

3.0 Operation and Maintenance Schedule

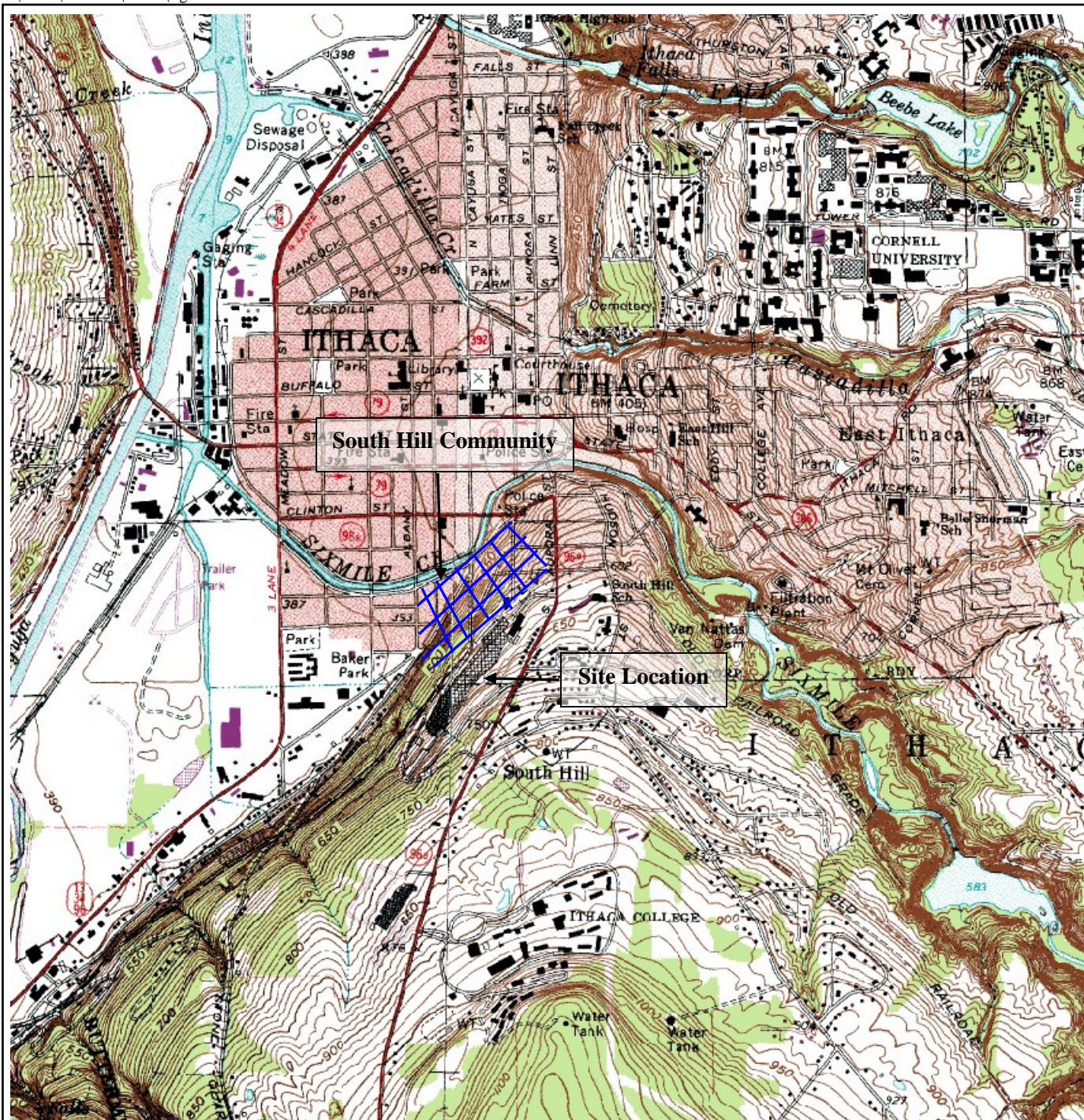
Routine inspections and maintenance on the vapor intrusion mitigation systems will be conducted on an annual basis. During each visit, a log sheet (Table 1) will be completed. Any system components requiring repair work will be identified during this inspection and addressed as soon as possible based on contractor availability. All OM&M activities and annual inspections results will be documented and reported to the NYSDEC and NYSDOH on an annual basis. The annual reports will include a description of any modifications made to the SSD system installed at each property.

4.0 Project Contact List

Following is a list of key contacts related to the operation and maintenance program. Should there be any problems related to the mitigation systems installed in the homes within the study area, one of the following personnel should be contacted.

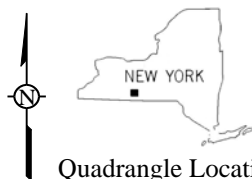
ESC Engineering of New York Site Chief Engineer:	Todd Musteraite, P.E.	716-662-6876
ESC Engineering of New York Site Engineer:	Karen Beljan/Scott Petersen	315-655-3900
WSP Environmental Strategies Project Manager:	Jim Bulman	703-709-6500
Emerson Contact:	Derek Chase	866-265-0634

Figure



Reference

7.5 Minute Series Topographic Quadrangle
Ithaca East, New York
Photorevised 1990 Scale 1:24,000



Quadrangle Location

1000 0 2000 4000

Scale in Feet



ESC ENGINEERING OF NEW YORK, P.C.
11911 FREEDOM DRIVE, SUITE 900
RESTON, VIRGINIA 20190
703-709-6500

Figure 1
Site Location
Emerson Power Transmission
Ithaca, New York

Table

Table 1

Operational Checklist
VAPOR INTRUSION MITIGATION SYSTEM
Emerson Power Transmission
Ithaca, New York

Property Address and ID: _____
Date: _____
Arrival Time: _____
Departure Time: _____

Inspector (print): _____
Inspector (sign): _____
Weather Conditions: _____

Reason for Visit (check all that apply):

Annual O&M _____
 Other _____

MITIGATION SYSTEM INSPECTION CHECKLIST
Comments

Fan _____

Piping _____

Manometer(s) _____

Exhaust Stack _____

Concrete Floor _____

Foundation Walls _____

Sump(s) _____

Drainger(s) _____

MANOMETER READINGS

Location	Reading (Inches of Water)
Manometer #1	
Manometer #2	
Manometer #3	
Manometer #4	
Manometer #5	
Manometer #6	
Manometer #7	

Notable Observations:

SYSTEM MAINTENANCE

Equipment _____

Reason for Maintenance _____

Description of Maintenance Action _____

Appendix A – Manufacturer’s Specifications and/or Operation Manuals



Installation Instructions for Radon Fans Model HP/FR

READ & SAVE THESE INSTRUCTIONS!



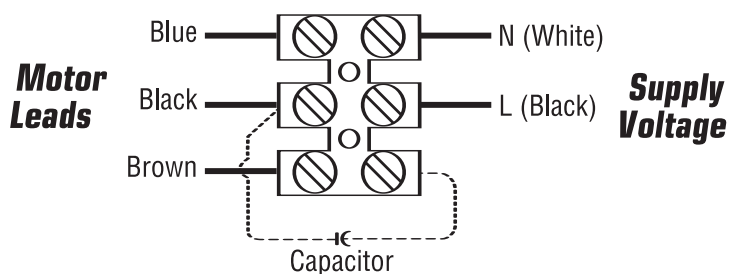
Warnings

DO NOT CONNECT POWER SUPPLY UNTIL FAN IS COMPLETELY INSTALLED, MAKE SURE ELECTRICAL SERVICE TO THE FAN IS LOCKED IN "OFF" POSITION.

1. Suitable for use with solid-state speed control.
2. This unit has rotating parts and safety precautions should be exercised during installation, operation and maintenance.
3. CAUTION: "For General Ventilation Use Only. Do Not Use To Exhaust Hazardous Or Explosives Materials and Vapors."
4. **WARNING: TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS-OBSERVE THE FOLLOWING:**
 - a. Use this unit only in the manner intended by the manufacturer. If you have questions, contact the factory.
 - b. Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
 - c. Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.
 - d. The combustion airflow needed for safe operation of fuel burning equipment may be affected by this unit's operation. Follow the heating equipment manufacturer's guidelines and safety standards such as those published by the National Fire Protection Association (NFPA), the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) and the local code authorities.
 - e. When cutting or drilling into wall or ceiling, do not damage electrical wires or other hidden utilities.
 - f. Ducted fans must always be vented to the outdoors.
 - g. If this unit is to be installed over a tub or shower, it must be marked as appropriate for the application.
 - h. NEVER place a switch where it can be reached from a tub or shower.
5. **WARNING!** Check voltage at the fan to see if it corresponds to the motor nameplate.

GUARDS MUST BE INSTALLED WHEN FAN IS WITHIN REACH OF PERSONNEL OR WITHIN SEVEN (7) FEET OF WORKING LEVEL OR WHEN DEEMED ADVISABLE FOR SAFETY.

Wiring Diagram



Five (5) Year Warranty

This warranty supersedes all prior warranties

Installation that will result in condensate forming in the outlet ducting should have a condensate bypass installed to route the condensate outside of the fan housing. Conditions that are likely to produce condensate include but are not limited to: outdoor installations in cold climates, long lengths of outlet ducting, high moisture content in soil and thin wall or aluminum outlet ducting. Failure to install a proper condensate bypass may void any warranty claims.

DURING ENTIRE WARRANTY PERIOD:

FANTECH will repair or replace any part which has a factory defect in workmanship or material. Product may need to be returned to the fantech factory, together with a copy of the bill of sale and identified with RMA number.

FOR FACTORY RETURN YOU MUST:

- Have a Return Materials Authorization (RMA) number. This may be obtained by calling FANTECH either in the USA at 1.800.747.1762 or in CANADA at 1.800.565.3548. Please have bill of sale available.
- The RMA number must be clearly written on the outside of the carton, or the carton will be refused.
- All parts and/or product will be repaired/replaced and shipped back to buyer; no credit will be issued.

OR

The Distributor may place an order for the warranty part and/or product and is invoiced. The Distributor will receive a credit equal to the invoice only after product is returned prepaid and verified to be defective.

FANTECH WARRANTY TERMS DO NOT PROVIDE FOR REPLACEMENT WITHOUT CHARGE PRIOR TO INSPECTION FOR A DEFECT. REPLACEMENTS ISSUED IN ADVANCE OF DEFECT INSPECTION ARE INVOICED, AND CREDIT IS PENDING INSPECTION OF RETURNED MATERIAL. DEFECTIVE MATERIAL RETURNED BY END USERS SHOULD NOT BE REPLACED BY THE DISTRIBUTOR WITHOUT CHARGE TO THE END USER, AS CREDIT TO DISTRIBUTOR'S ACCOUNT WILL BE PENDING INSPECTION AND VERIFICATION OF ACTUAL DEFECT BY FANTECH.

THE FOLLOWING WARRANTIES DO NOT APPLY:

- Damages from shipping, either concealed or visible. Claim must be filed with freight company.
- Damages resulting from improper wiring or installation.
- Damages or failure caused by acts of God, or resulting from improper consumer procedures, such as:
 1. Improper maintenance
 2. Misuse, abuse, abnormal use, or accident, and
 3. Incorrect electrical voltage or current.
- Removal or any alteration made on the FANTECH label control number or date of manufacture.
- Any other warranty, expressed, implied or written, and to any consequential or incidental damages, loss or property, revenues, or profit, or costs of removal, installation or reinstallation, for any breach of warranty.

WARRANTY VALIDATION

- The user must keep a copy of the bill of sale to verify purchase date.
- These warranties give you specific legal rights, and are subject to an applicable consumer protection legislation. You may have additional rights which vary from state to state.

United States
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Sarasota, FL 34234
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Phone: 800.565.3548; 506.743.9500
Fax: 877.747.8116; 506.743.9600
www.fantech.ca; info@fantech.ca

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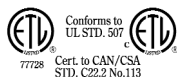
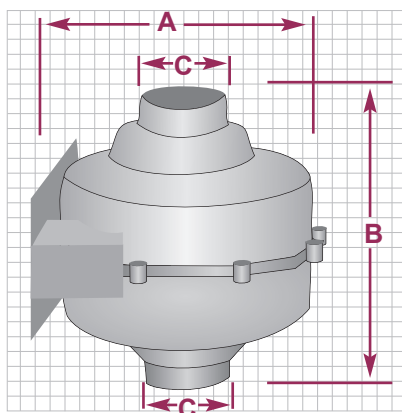
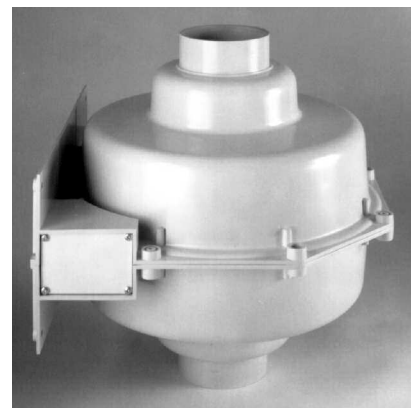
Article #: 301077
Item #: 401443
Rev Date: 010307



Radon Mitigation Fans

Specially designed for radon mitigation, GP Series Fans provide a wide range of performance that makes them ideal for most subslab radon mitigation systems.

GP Series



- ♦ 5-Year Warranty
- ♦ Mounts on duct pipe or with integral flange
- ♦ 3" diameter ducts for use with 3" or 4" pipe
- ♦ Electrical box for hard wire or plug in
- ♦ ETL Listed - for indoor or outdoor use.

Model	Dimensions		
	A	B	C Duct Size
GP series	12.5"	13"	3"

The following chart shows performance of GP Series fans:

Model	Watts	Maximum Pressure "WC	Typical CFM vs. Static Pressure WC						
			1.0"	1.5"	2.0"	2.5"	3.0"	3.5"	4.0"
GP201	40-60	2.0	82	58	5	-	-	-	-
GP301	55-90	2.6	92	77	45	10	-	-	-
GP401	60-110	3.4	93	82	60	40	15	-	-
GP501	70-140	4.2	95	87	80	70	57	30	10

Choice of model is dependent on certain building characteristics including sub-slab materials and should be made by a radon professional.

FOR FURTHER INFORMATION CONTACT:



RadonAway Ward Hill, MA IN014 Rev E

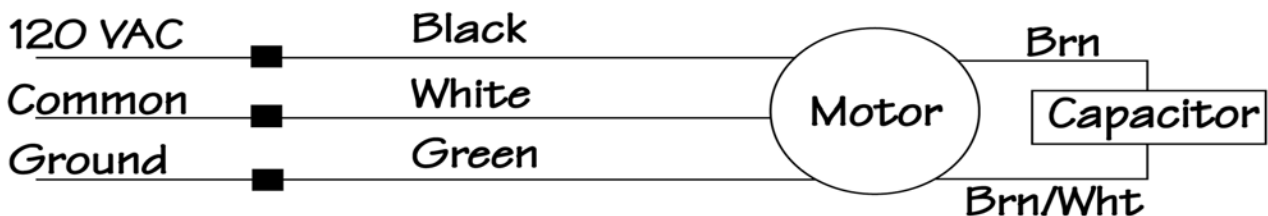
XP/GP/XR Series Fan Installation Instructions

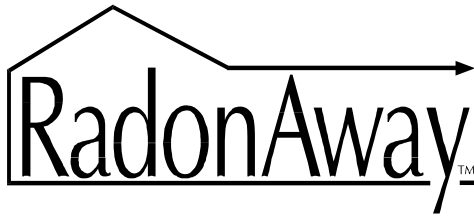
Please Read And Save These Instructions.

DO NOT CONNECT POWER SUPPLY UNTIL FAN IS COMPLETELY INSTALLED. MAKE SURE ELECTRICAL SERVICE TO FAN IS LOCKED IN "OFF" POSITION. DISCONNECT POWER BEFORE SERVICING FAN.

- 1. WARNING!** Do not use fan in hazardous environments where fan electrical system could provide ignition to combustibles or flammable materials.
- 2. WARNING!** Do not use fan to pump explosive or corrosive gases.
- 3. WARNING!** Check voltage at the fan to insure it corresponds with nameplate.
- 4. WARNING!** Normal operation of this device may affect the combustion airflow needed for safe operation of fuel burning equipment. Check for possible backdraft conditions on all combustion devices after installation.
- 5. NOTICE!** There are no user serviceable parts located inside the fan unit. **Do NOT attempt to open.** Return unit to the factory for service.
- 6.** All wiring must be in accordance with local and national electrical codes.

DynaVac GP/XP/XR/RP Series Fan Wiring Diagram





INSTALLATION INSTRUCTION IN014 Rev E

DynaVac - XP/XR Series

XP101 p/n 23008-1,-2
XP151 p/n 23010-1,-2
XP201 p/n 23011-1,-2
XR161 p/n 23018-1,-2
XR261 p/n 23019-1,-2

DynaVac - GP Series

GP201 p/n 23007-1
GP301 p/n 23006-1,-2
GP401 p/n 23009-1
GP501 p/n 23005-1,-2

1.0 SYSTEM DESIGN CONSIDERATIONS

1.1 INTRODUCTION

The DynaVac GP/XP/XR Series Radon Fans are intended for use by trained, professional Radon mitigators. The purpose of this instruction is to provide additional guidance for the most effective use of a DynaVac Fan. This instruction should be considered as a supplement to EPA standard practices, state and local building codes and state regulations. In the event of a conflict, those codes, practices and regulations take precedence over this instruction.

1.2 ENVIRONMENTALS

The GP/XP/XR Series Fans are designed to perform year-round in all but the harshest climates without additional concern for temperature or weather. For installations in an area of severe cold weather, please contact RadonAway for assistance. When not in operation, the fan should be stored in an area where the temperature is never less than 32 degrees F. or more than 100 degrees F.

1.3 ACOUSTICS

The GP/XP/XR Series Fan, when installed properly, operates with little or no noticeable noise to the building occupants. The velocity of the outgoing air should be considered in the overall system design. In some cases the "rushing" sound of the outlet air may be disturbing. In these instances, the use of a RadonAway Exhaust Muffler is recommended.

1.4 GROUND WATER

In the event that a temporary high water table results in water at or above slab level, water may be drawn into the riser pipes thus blocking air flow to the GP/XP/XR Series Fan. The lack of cooling air may result in the fan cycling on and off as the internal temperature rises above the thermal cutoff and falls upon shutoff. Should this condition arise, it is recommended that the fan be turned off until the water recedes allowing for return to normal operation.

1.5 SLAB COVERAGE

The GP/XP/XR Series Fan can provide coverage up to 2000+ sq. ft. per slab penetration. This will primarily depend on the sub-slab material in any particular installation. In general, the tighter the material, the smaller the area covered per penetration. Appropriate selection of the GP/XP/XR Series Fan best suited for the sub-slab material can improve the slab coverage. The GP & XP series have a wide range of models to choose from to cover a wide range of subslab material. The higher static suction fans are generally used for tighter subslab materials. The XR Series is specifically designed for high flow applications such as stone/gravel and drain tile. Additional suction points can be added as required. It is recommended that a small pit (5 to 10 gallons in size) be created below the slab at each suction hole.

1.6 CONDENSATION & DRAINAGE

Condensation is formed in the piping of a mitigation system when the air in the piping is chilled below its dew point. This can occur at points where the system piping goes through unheated space such as an attic, garage or outside. The system design must provide a means for water to drain back to a slab hole to remove the condensation. The GP/XP/XR Series Fan **MUST** be mounted vertically plumb and level, with the outlet pointing up for proper drainage through the fan. Avoid mounting the fan in any orientation that will allow water to accumulate inside the fan housing. The GP/XP/XR Series Fans are **NOT** suitable for underground burial.

For GP/XP/XR Series Fan piping, the following table provides the minimum recommended pipe diameter and pitch under several system conditions.

Pipe Dia.	Minimum Rise per Foot of Run*		
	@25 CFM	@50 CFM	@100 CFM
4"	1/8"	1/4"	3/8"
3"	1/4"	3/8"	1 1/2"



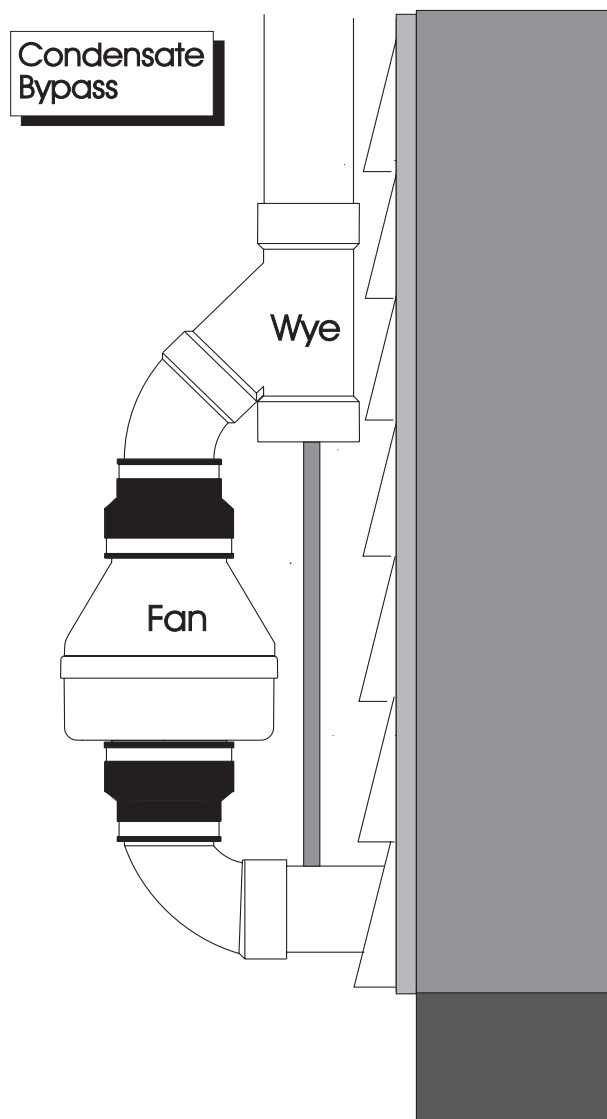
*Typical GP/XP/XR Series Fan operational flow rate is 25 - 90 CFM.
(For more precision, determine flow rate by using the chart in the addendum.)

Under some circumstances in an outdoor installation a condensate bypass should be installed in the outlet ducting as shown. This may be particularly true in cold climate installations which require long lengths of outlet ducting or where the outlet ducting is likely to produce large amounts of condensation because of high soil moisture or outlet duct material. Schedule 20 piping and other thin-walled plastic ducting and Aluminum downspout will normally produce much more condensation than Schedule 40 piping.

The bypass is constructed with a 45 degree Wye fitting at the bottom of the outlet stack. The bottom of the Wye is capped and fitted with a tube that connects to the inlet piping or other drain. The condensation produced in the outlet stack is collected in the Wye fitting and drained through the bypass tube. The bypass tubing may be insulated to prevent freezing.

1.7 "SYSTEM ON" INDICATOR

A properly designed system should incorporate a "System On" Indicator for affirmation of system operation. A manometer, such as a U-Tube, or a vacuum alarm is recommended for this purpose.



1.8 ELECTRICAL WIRING

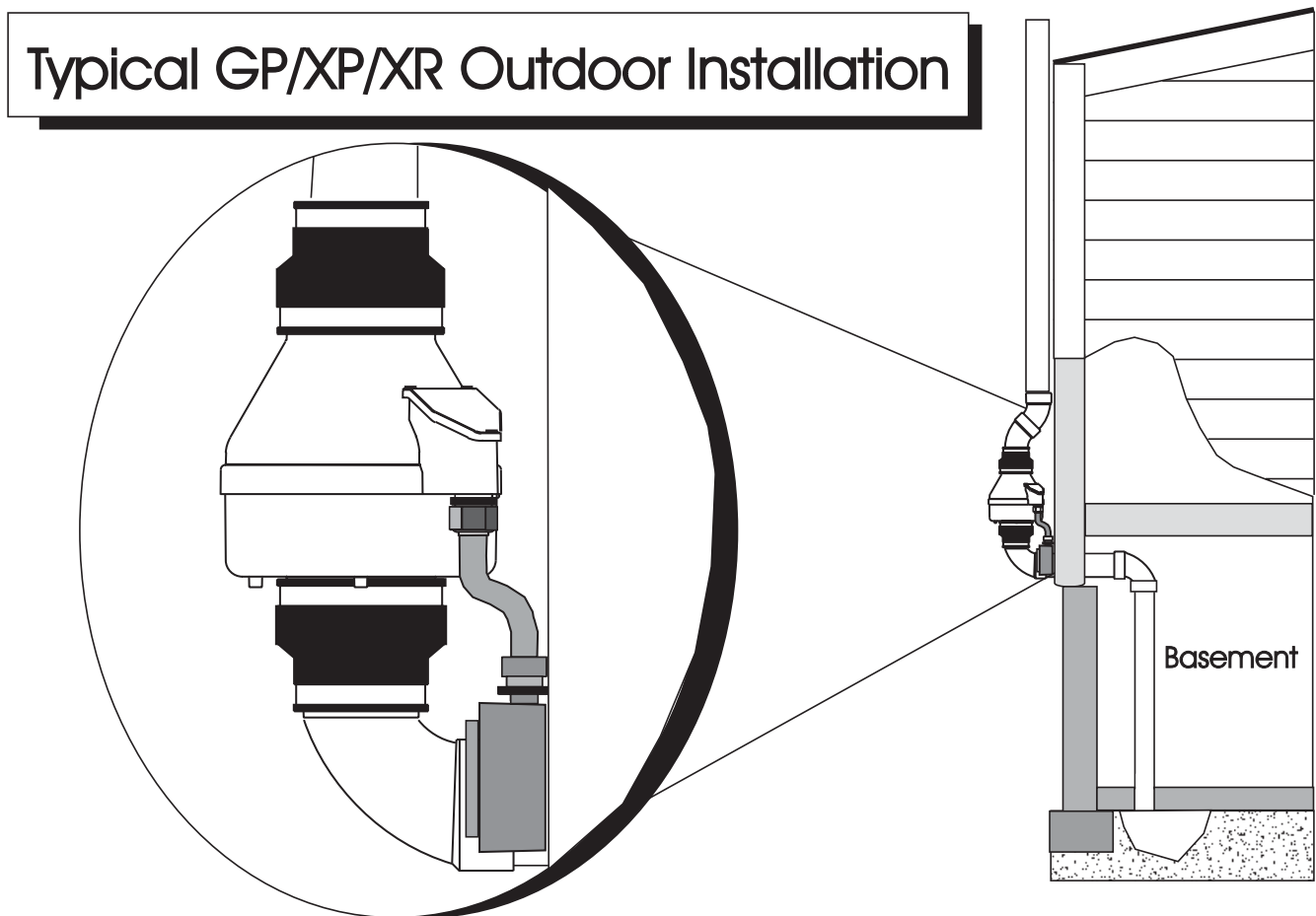
The GP/XP/XR Series Fans operate on standard 120V 60 Hz. AC. All wiring must be performed in accordance with the National Electrical Code and state and local building codes. All electrical work should be performed by a qualified electrician. Outdoor installations require the use of a U.L. listed watertight conduit.

1.9 SPEED CONTROLS

The GP/XP/XR Series Fans are rated for use with electronic speed controls ,however, they are generally not recommended.

2.0 INSTALLATION

The GP/XP/XR Series Fan can be mounted indoors or outdoors. (It is suggested that EPA recommendations be followed in choosing the fan location.) The GP/XP/XR Series Fan may be mounted directly on the system piping or fastened to a supporting structure by means of optional mounting bracket.



2.1 MOUNTING

Mount the GP/XP/XR Series Fan vertically with outlet up. Insure the unit is plumb and level. When mounting directly on the system piping assure that the fan does not contact any building surface to avoid vibration noise.

2.2 MOUNTING BRACKET (optional)

The GP/XP/XR Series fan may be optionally secured with the integral mounting bracket on the GP Series fan or with RadonAway P/N 25007-2 mounting bracket for an XP/XR Series fan. Foam or rubber grommets may also be used between the bracket and mounting surface for vibration isolation.

2.3 SYSTEM PIPING

Complete piping run, using flexible couplings as means of disconnect for servicing the unit and vibration isolation.

2.4 ELECTRICAL CONNECTION

Connect wiring with wire nuts provided, observing proper connections:

Fan Wire	Connection
Green	Ground
Black	AC Hot
White	AC Common

2.5 VENT MUFLER (optional)

Install the muffler assembly in the selected location in the outlet ducting. Solvent weld all connections. The muffler is normally installed at the end of the vent pipe.

2.6 OPERATION CHECKS

_____ **Verify** all connections are tight and **leak-free**.

_____ **Insure** the GP/XP/XR Series Fan and all ducting is secure and vibration-free.

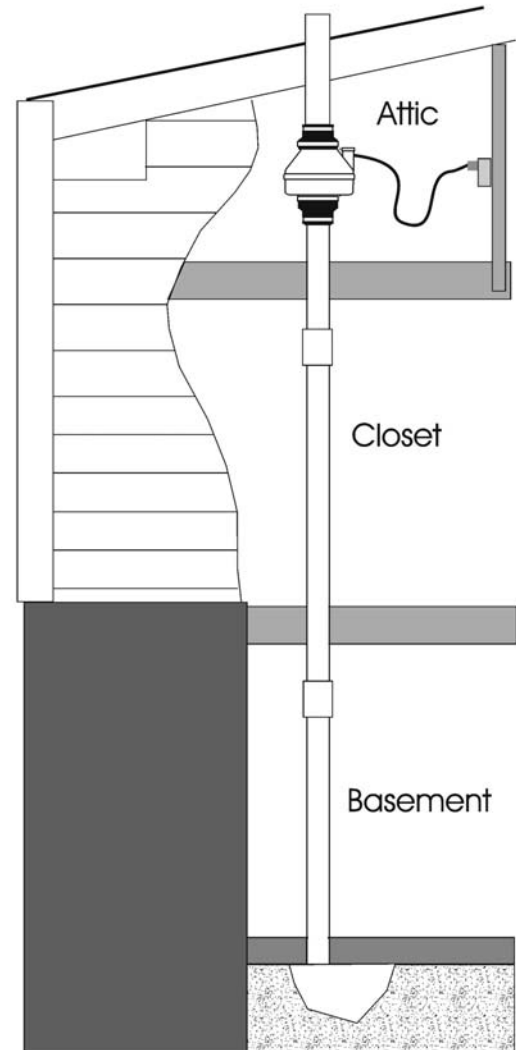
_____ **Verify** system vacuum pressure with manometer. **Insure** vacuum pressure is **less than** maximum recommended operating pressure

(Based on sea-level operation, at higher altitudes reduce by about 4% per 1000 Feet.)

(Further reduce Maximum Operating Pressure by 10% for High Temperature environments)

See Product Specifications. If this is exceeded, increase the number of suction points.

_____ **Verify Radon levels by testing to EPA protocol.**



XP/XR SERIES PRODUCT SPECIFICATIONS

The following chart shows fan performance for the XP & XR Series Fan:

	Typical CFM Vs Static Suction "WC								
	0"	.25"	.5"	.75"	1.0"	1.25"	1.5"	1.75"	2.0"
XP101	125	118	90	56	5	-	-	-	-
XP151	180	162	140	117	78	46	10	-	-
XP201	150	130	110	93	74	57	38	20	-
XR161	215	175	145	105	75	45	15	-	-
XR261	250	215	185	150	115	80	50	20	-

Maximum Recommended Operating Pressure*	
XP101	0.9" W.C. (Sea Level Operation)**
XP151	1.3" W.C. (Sea Level Operation)**
XP201	1.7" W.C. (Sea Level Operation)**
XR161	1.3" W.C. (Sea Level Operation)**
XR261	1.6" W.C. (Sea Level Operation)**

**Reduce by 10% for High Temperature Operation*

***Reduce by 4% per 1000 feet of altitude*

Power Consumption @ 120 VAC	
XP101	40 - 49 watts
XP151	45 - 60 watts
XP201	45 - 66 watts
XR161	48 - 75 watts
XR261	65 - 105 watts

XP Series Inlet/Outlet: 4.5" OD (4.0" PVC Sched 40 size compatible)

XR Series Inlet/Outlet: 5.875" OD

Mounting: Mount on the duct pipe or with optional mounting bracket.

Recommended ducting: 3" or 4" Schedule 20/40 PVC Pipe

Storage temperature range: 32 - 100 degrees F.

Normal operating temperature range: -20 - 120 degrees F.

Maximum inlet air temperature: 80 degrees F.

Size: 9.5H" x 8.5" Dia.

Weight: 6 lbs. (XR261 - 7 lbs)

Continuous Duty

Thermally protected

Class B Insulation

3000 RPM

Residential Use Only

Rated for Indoor or Outdoor use

LISTED
Electric Fan



Tested to
UL
Std. 507

77728

GP SERIES PRODUCT SPECIFICATIONS

The following chart shows fan performance for the GPx01 Series Fan:

	1.0"	Typical CFM Vs Static Suction "WC					
		1.5"	2.0"	2.5"	3.0"	3.5"	4.0"
GP501	95	87	80	70	57	30	5
GP401	93	82	60	38	12	-	-
GP301	92	77	45	10	-	-	-
GP201	82	58	5	-	-	-	-

Maximum Recommended Operating Pressure*			
GP501	3.8" W.C.	(Sea Level Operation)**	
GP401	3.0" W.C.	(Sea Level Operation)**	
GP301	2.4" W.C.	(Sea Level Operation)**	
GP201	1.8" W.C.	(Sea Level Operation)**	

**Reduce by 10% for High Temperature Operation*

***Reduce by 4% per 1000 feet of altitude*

Power Consumption @ 120 VAC	
GP501	70 - 140 watts
GP401	60 - 110 watts
GP301	55 - 90 watts
GP201	40 - 60 watts

Inlet/Outlet: 3.5" OD (3.0" PVC Sched 40 size compatible)

Mounting: Fan may be mounted on the duct pipe or with integral flanges.

Weight: 12 lbs.

Size: 13H" x 12.5" x 12.5"

Recommended ducting: 3" or 4" Schedule 20/40 PVC Pipe

Storage temperature range: 32 - 100 degrees F.

Normal operating temperature range: -20 - 120 degrees F.

Maximum inlet air temperature: 80 degrees F.

Continuous Duty

Class B Insulation

3000 RPM

Thermally protected

Rated for Indoor or Outdoor Use

GP301C / GP501C Rated for Commercial Use

LISTED
Electric Fan



77728

Tested to
UL
Std. 507

IMPORTANT INSTRUCTIONS TO INSTALLER

Inspect the GPx01/XP/XR Series Fan for shipping damage within 15 days of receipt. Notify RadonAway of any damages immediately. Radonaway is not responsible for damages incurred during shipping. However, for your benefit, Radonaway does insure shipments.

There are no user serviceable parts inside the fan. **Do not attempt to open.** Return unit to factory for service.

Install the GPx01/XP/XR Series Fan in accordance with all EPA standard practices, and state and local building codes and state regulations.

WARRANTY

Subject to any applicable consumer protection legislation, RadonAway warrants that the GPX01/XP/XR/RP Series Fan (the "Fan") will be free from defects in materials and workmanship for a period of 90 days from the date of purchase (the "Warranty Term").

RadonAway will replace any Fan which fails due to defects in materials or workmanship. The Fan must be returned (at Owner's cost) to the RadonAway factory. Any Fan returned to the factory will be discarded unless the Owner provides specific instructions along with the Fan when it is returned regardless of whether or not the Fan is actually replaced under this warranty. Proof of purchase must be supplied upon request for service under this Warranty.

This Warranty is contingent on installation of the Fan in accordance with the instructions provided. This Warranty does not apply where any repairs or alterations have been made or attempted by others, or if the unit has been abused or misused. Warranty does not cover damage in shipment unless the damage is due to the negligence of RadonAway.

5 YEAR EXTENDED WARRANTY WITH PROFESSIONAL INSTALLATION.

RadonAway will extend the Warranty Term of the fan to 5 years from date of manufacture if the Fan is installed in a professionally designed and professionally installed radon system or installed as a replacement fan in a professionally designed and professionally installed radon system. Proof of purchase and/or proof of professional installation may be required for service under this warranty. Outside the Continental United States and Canada the extended Warranty Term is limited to one (1) year from the date of manufacture.

RadonAway is not responsible for installation, removal or delivery costs associated with this Warranty.

EXCEPT AS STATED ABOVE, THE GPx01/XP/XR/RP SERIES FANS ARE PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT SHALL RADONAWAY BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR RELATING TO, THE FAN OR THE PERFORMANCE THEREOF. RADONAWAY'S AGGREGATE LIABILITY HEREUNDER SHALL NOT IN ANY EVENT EXCEED THE AMOUNT OF THE PURCHASE PRICE OF SAID PRODUCT. THE SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY SHALL BE THE REPAIR OR REPLACEMENT OF THE PRODUCT, TO THE EXTENT THE SAME DOES NOT MEET WITH RADONAWAY'S WARRANTY AS PROVIDED ABOVE.

For service under this Warranty, contact RadonAway for a Return Material Authorization (RMA) number and shipping information. No returns can be accepted without an RMA. If factory return is required, the customer assumes all shipping cost to and from factory.

RadonAway
3 Saber Way
Ward Hill, MA 01835
TEL. (978) 521-3703
FAX (978) 521-3964

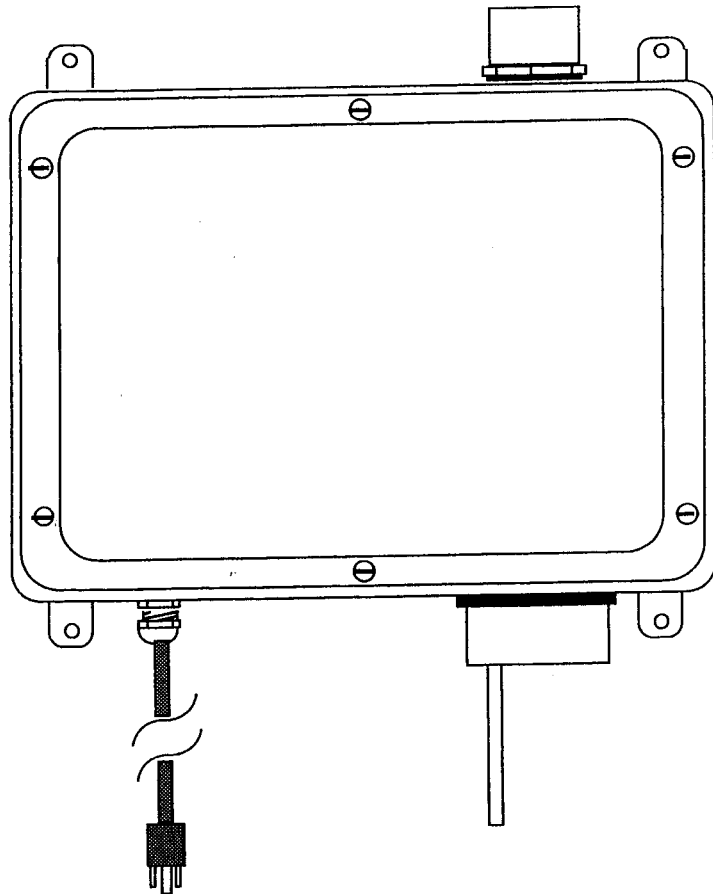
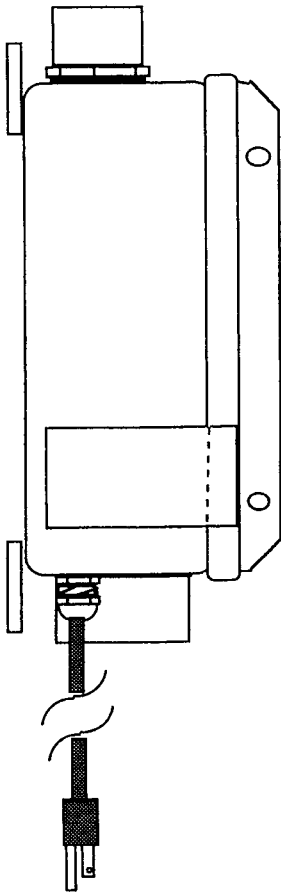
Record the following information for your records:

Serial No. _____
Purchase Date _____

HS SERIES INSTALLATION INSTRUCTIONS

BY

RadonAway™



RadonAway, Inc. Ward Hill, MA.

P/N IN007 Rev E



RadonAway Ward Hill, MA.

HS Series Fan Installation Instructions

Please Read and Save These Instructions.

DO NOT CONNECT POWER SUPPLY UNTIL FAN IS COMPLETELY INSTALLED. MAKE SURE ELECTRICAL SERVICE TO FAN IS LOCKED IN "OFF" POSITION. DISCONNECT POWER BEFORE SERVICING FAN.

1. **WARNING!** Do not use fan in hazardous environments where fan electrical system could provide ignition to combustible or flammable materials.
2. **WARNING!** Do not use fan to pump explosive or corrosive gases.
3. **WARNING!** Check voltage at the fan to insure it corresponds with nameplate.
4. **WARNING!** Normal operation of this device may affect the combustion airflow needed for safe operation of fuel burning equipment. Check for possible backdraft conditions on all combustion devices after installation.
5. **NOTICE!** There are no user serviceable parts located inside the fan unit.
Do NOT attempt to open. Return unit to the factory for service.
6. All wiring must be in accordance with local and national electrical codes.
7. **WARNING!** In the event that the fan is immersed in water, return unit to factory for service before operating.
8. **WARNING!** Do not twist or torque fan inlet or outlet piping as Leakage may result.

INSTALLATION INSTRUCTIONS (Rev D)
for DynaVac High Suction Series
HS2000 p/n 23004-1
HS3000 p/n 23004-2
HS5000 p/n 23004-3

1.0 SYSTEM DESIGN CONSIDERATIONS

1.1 INTRODUCTION

The DynaVac is intended for use by trained, professional Radon mitigators. The purpose of this instruction is to provide additional guidance for the most effective use of the DynaVac. This instruction should be considered as a supplement to EPA standard practices, state and local building codes and state regulations. In the event of a conflict, those codes, practices and regulations take precedence over this instruction.

1.2 ENVIRONMENTALS

The DynaVac is designed to perform year-round in all but the harshest climates without additional concern for temperature or weather. For installations in an area of severe cold weather, please contact RadonAway for assistance. When not in operation, the DynaVac should be stored in an area where the temperature is never less than 32 degrees F. or more than 100 degrees F. The DynaVac is thermally protected such that it will shut off when the internal temperature is above 104 degrees F. Thus if the DynaVac is idle in an area where the ambient temperature exceeds this shut off, it will not restart until the internal temperature falls below 104 degrees F.

1.3 ACOUSTICS

The DynaVac, when installed properly, operates with little or no noticable noise to the building occupants. There are, however, some considerations to be taken into account in the system design and installation. When installing the DynaVac above sleeping areas, select a location for mounting which is as far away as possible from those areas. Avoid mounting near doors, fold-down stairs or other uninsulated structures which may transmit sound. Insure a solid mounting for the DynaVac to avoid structure-borne vibration or noise.

The velocity of the outgoing air must also be considered in the overall system design. With small diameter piping, the "rushing" sound of the outlet air can be disturbing. The system design should incorporate a means to slow and quiet the outlet air. The use of the RadonAway Exhaust Muffler, p/n 24001, is strongly recommended.

1.4 GROUND WATER

Under no circumstances should water be allowed to be drawn into the inlet of the DynaVac as this may result in damage to the unit. The DynaVac should be mounted at least 5 feet above the slab penetration to minimize the risk of filling the DynaVac with water in installations with occasional high water tables.

In the event that a temporary high water table results in water at or above slab level, water will be drawn into the riser pipes thus blocking air flow to the DynaVac. The lack of cooling air will result in the DynaVac cycling on and off as the internal temperature rises above the thermal cutoff and falls upon shutoff. Should this condition arise, it is recommended that the DynaVac be disconnected until the water recedes allowing for return to normal operation.

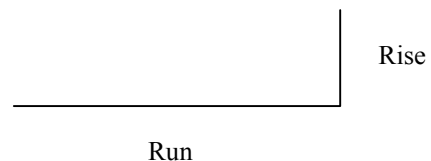
1.5 CONDENSATION & DRAINAGE

(WARNING!: Failure to provide adequate drainage for condensation can result in system failure and damage the DynaVac).

Condensation is formed in the piping of a mitigation system when the air in the piping is chilled below its dew point. This can occur at points where the system piping goes through unheated space such as an attic, garage or outside. The system design must provide a means for water to drain back to a slab hole to remove the condensation.

The use of small diameter piping in a system increases the speed at which the air moves. The speed of the air can pull water uphill and at sufficient velocity it can actually move water vertically up the side walls of the pipe. This has the potential of creating a problem in the negative pressure (inlet) side piping. For DynaVac inlet piping, the following table provides the minimum recommended pipe diameters as well as minimum pitch under several system condition. Use this chart to size piping for a system.

Pipe Diam.	Minimum Rise per Foot of Run*		
	@ 25 CFM	@ 50 CFM	@ 100 CFM
4"	1/32 "	3/32 "	3/8 "
3"	1/8 "	3/8 "	1 1/2 "



*Typical operational flow rates:

HS3000, or HS5000
HS2000

20 - 40 CFM
50 - 90 CFM

All exhaust piping should be 2" PVC.

1.6 "SYSTEM ON" INDICATOR

A properly designed system should incorporate a "System On" Indicator for affirmation of system operation. A Magnehelic pressure gauge is recommended for this purpose. The indicator should be mounted at least 5 feet above the slab penetration to minimize the risk of filling the gauge with water in installations with occasional high water tables.

1.7 SLAB COVERAGE

The DynaVac can provide coverage of well over 1000 sq. ft. per slab penetration. This will, of course, depend on the sub-slab aggregate in any particular installation and the diagnostic results. In general, sand and gravel are much looser aggregates than dirt and clay. Additional suction points can be added as required. It is recommended that a small pit (2 to 10 gallons in size) be created below the slab at each suction hole.

1.8 ELECTRICAL WIRING

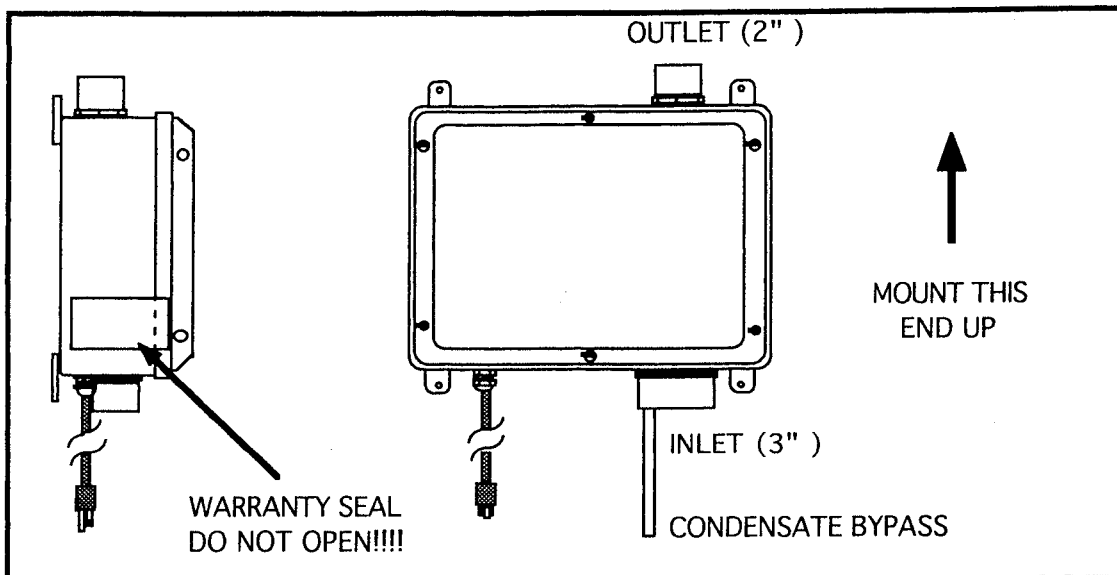
The DynaVac plugs into a standard 120V outlet. All wiring must be performed in accordance with the National Electrical Code and state and local building codes.

1.8a ELECTRICAL BOX (optional)

The optional Electrical Box (p/n 20003) provides a weathertight box with switch for outdoor hardwire connection. All wiring must be performed in accordance with the National Electrical Code and state and local building codes. All electrical work should be performed by a qualified electrician. Outdoor installations require the use of a U.L. listed watertight conduit.

1.9 SPEED CONTROLS

Electronic speed controls can **NOT** be used on HS series units.



2.0 INSTALLATION

2.1 MOUNTING

Mount the DynaVac to the wall studs, or similar structure, in the selected location with (4) 1/4" x 1 1/2" lag screws (not provided). Insure the DynaVac is both plumb and level.

2.2 DUCTING CONNECTIONS

Make final ducting connection to DynaVac with flexible couplings. Insure all connections are tight. Do not twist or torque inlet and outlet piping on DynaVac or leaks may result.

2.3 VENT MUFFLER INSTALLATION

Install the muffler assembly in the selected location in the outlet ducting. Solvent weld all connections. The muffler is normally installed above the roofline at the end of the vent pipe.

2.5 OPERATION CHECKS

____ Make final operation checks by verifying all connections are tight and leak-free.

____ Insure the DynaVac and all ducting is secure and vibration-free.

____ Verify system vacuum pressure with Magnehelic. Insure vacuum pressure is less than the maximum recommended as shown below:

DynaVac	HS2000	14" WC
DynaVac	HS3000	21" WC
DynaVac	HS5000	40" WC

(Above are based on sea-level operation, at higher altitudes reduce above by about 4% per 1000 Feet.)

If these are exceeded, increase number of suction points.

____ Verify Radon levels by testing to EPA protocol.

Addendum

PRODUCT SPECIFICATIONS

Model	Maximum Static Suction	Typical CFM vs Static Suction WC (Recommended Operating Range)						Power* Watts @ 115 VAC
		0"	10"	15"	20"	25"	35"	
HS2000	18"	110	72	40	-	-	-	150-270
HS3000	27"	40	33	30	23	18	-	105-195
HS5000	50"	53	47	42	38	34	24	180-320

*Power consumption varies with actual load conditions

Inlet: 3.0" PVC

Outlet: 2.0" PVC

Mounting: Brackets for vertical mount

Weight: Approximately 18 lbs.

Size: Approximately 15"W x 13"H x 8"D

Minimum recommended inlet ducting (greater diameter may always be used):

HS3000, HS5000 --- 2.0" PVC Pipe

HS2000 --- Main feeder line of 3.0" or greater PVC Pipe

Branch lines (if 3 or more) may be 2.0" PVC Pipe

Outlet ducting: 2.0" PVC

Storage temperature range: 32 - 100 degrees F.

Thermally protected

Locked rotor protection

Internal Condensate Bypass

IMPORTANT INSTRUCTIONS TO INSTALLER

Inspect the HS Series Fan for shipping damage within 15 days of receipt. Notify **RadonAway of any damages immediately**. Radonaway is not responsible for damages incurred during shipping. However, for your benefit, Radonaway does insure shipments.

There are no user serviceable parts inside the fan. **Do not attempt to open**. Return unit to factory for service.

Install the HS Series Fan in accordance with all EPA standard practices, and state and local building codes and state regulations.

WARRANTY

Subject to any applicable consumer protection legislation, RadonAway warrants that the HS Series Fan (the "Fan") will be free from defects in materials and workmanship for a period of one (1) year from the date of manufacture (the "Warranty Term"). Outside the Continental United States and Canada the Warranty Term is one (1) year from the date of manufacture.

RadonAway will replace any Fan which fails due to defects in materials or workmanship. The Fan must be returned (at owner's cost) to the RadonAway factory. Proof of purchase must be supplied upon request for service under this Warranty.

This Warranty is contingent on installation of the Fan in accordance with the instructions provided. This Warranty does not apply where any repairs or alterations have been made or attempted by others, or if the unit has been abused or misused. Warranty does not include damage in shipment unless the damage is due to the negligence of RadonAway.

RadonAway is not responsible for installation, removal or delivery costs associated with this Warranty.

EXCEPT AS STATED ABOVE, THE HS SERIES FANS ARE PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT SHALL RADONAWAY BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR RELATING TO, THE FAN OR THE PERFORMANCE THEREOF. RADONAWAY'S AGGREGATE LIABILITY HEREUNDER SHALL NOT IN ANY EVENT EXCEED THE AMOUNT OF THE PURCHASE PRICE OF SAID PRODUCT. THE SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY SHALL BE THE REPAIR OR REPLACEMENT OF THE PRODUCT, TO THE EXTENT THE SAME DOES NOT MEET WITH RADONAWAY'S WARRANTY AS PROVIDED ABOVE.

For service under this Warranty, contact RadonAway for a Return Material Authorization (RMA) number and shipping information. No returns can be accepted without an RMA. If factory return is required, the customer assumes all shipping cost to and from factory.

RadonAway
3 Saber Way
Ward Hill, MA 01835
TEL. (978) 521-3703
FAX (978) 521-3964

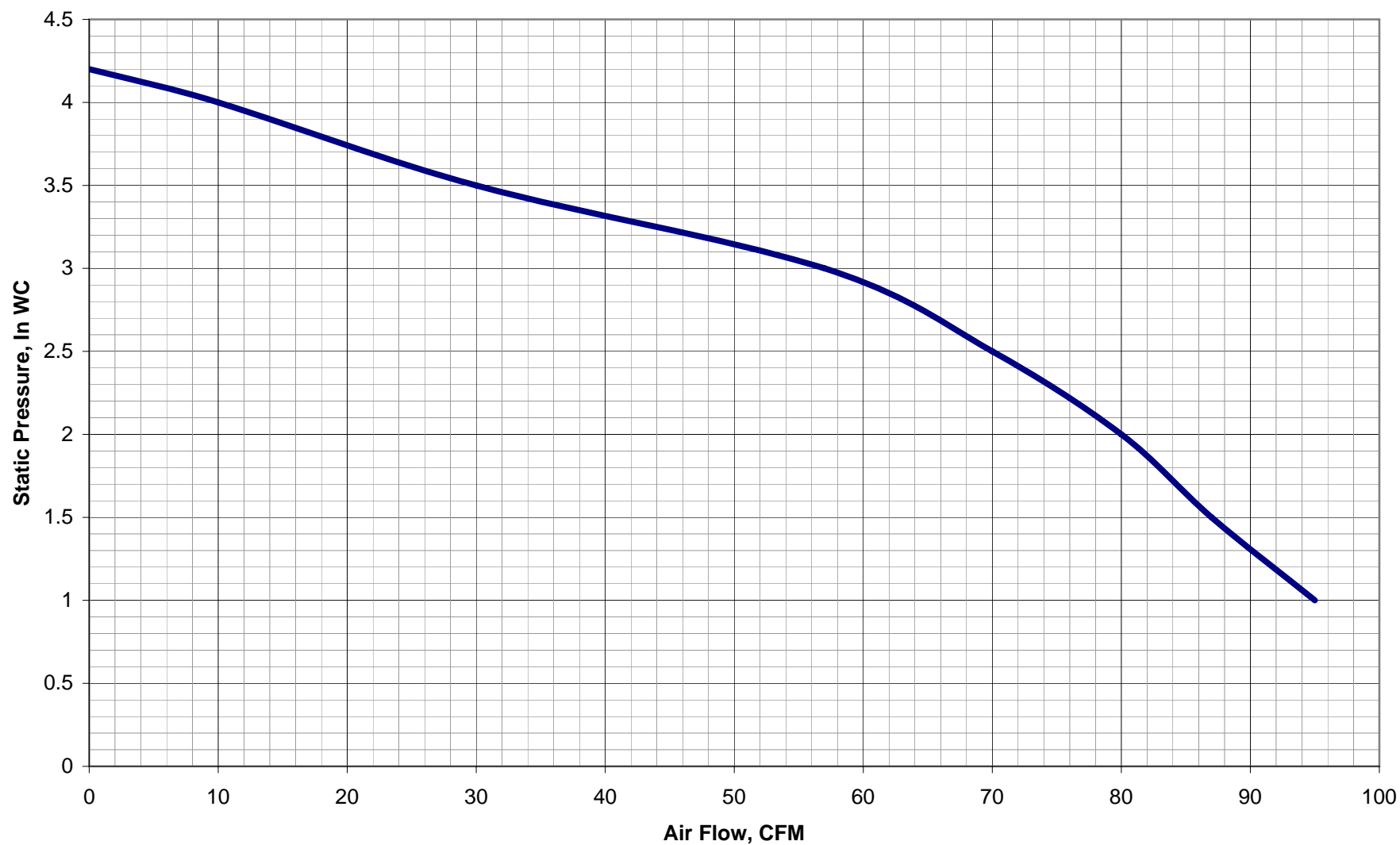
Record the following information for your records:

Serial No. _____
Purchase Date _____



Performance Curve, GP501.

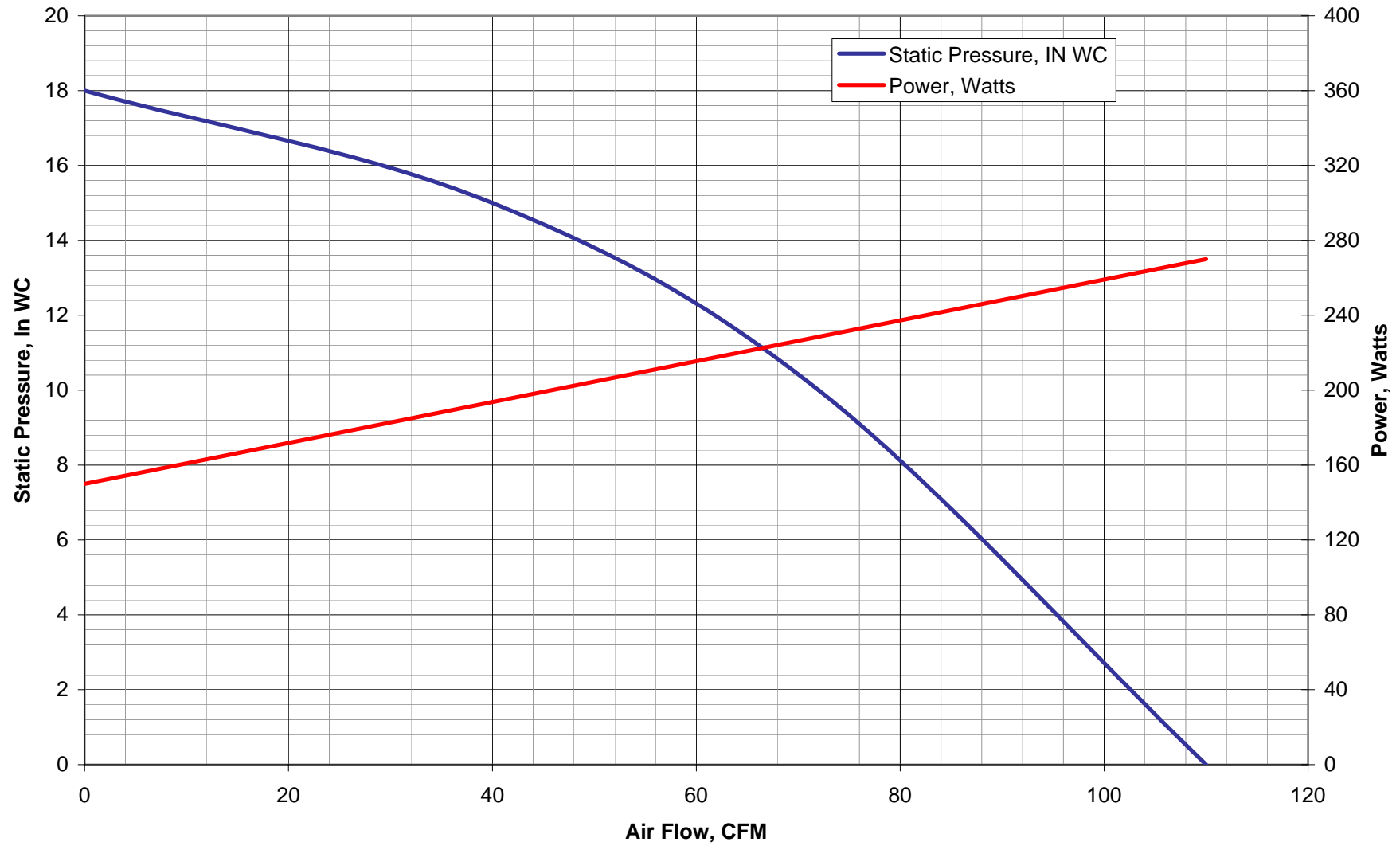
By: TS
Date:10/14/05





Performance Curve, HS2000

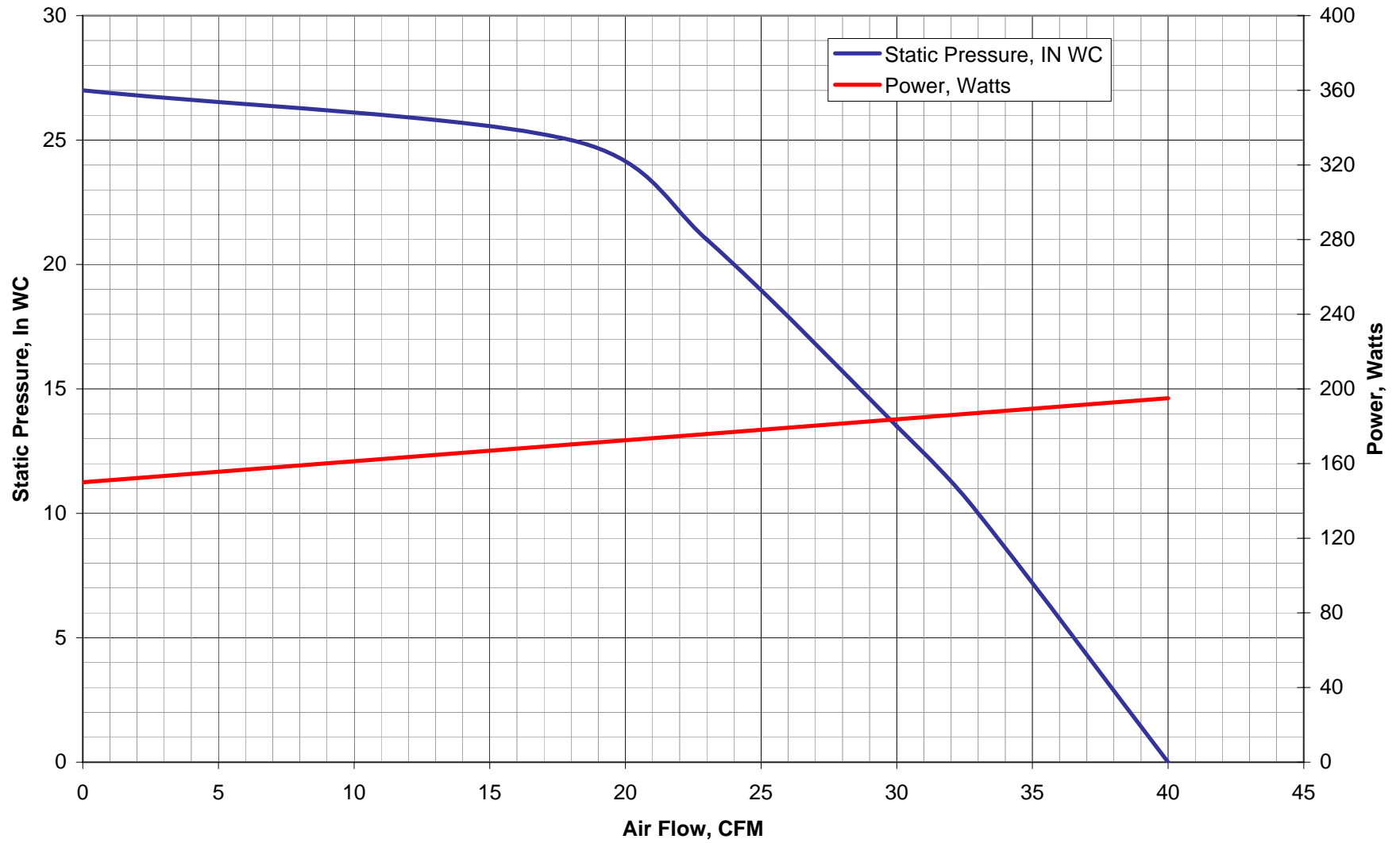
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Date: 4/16/07





Performance Curve, HS3000

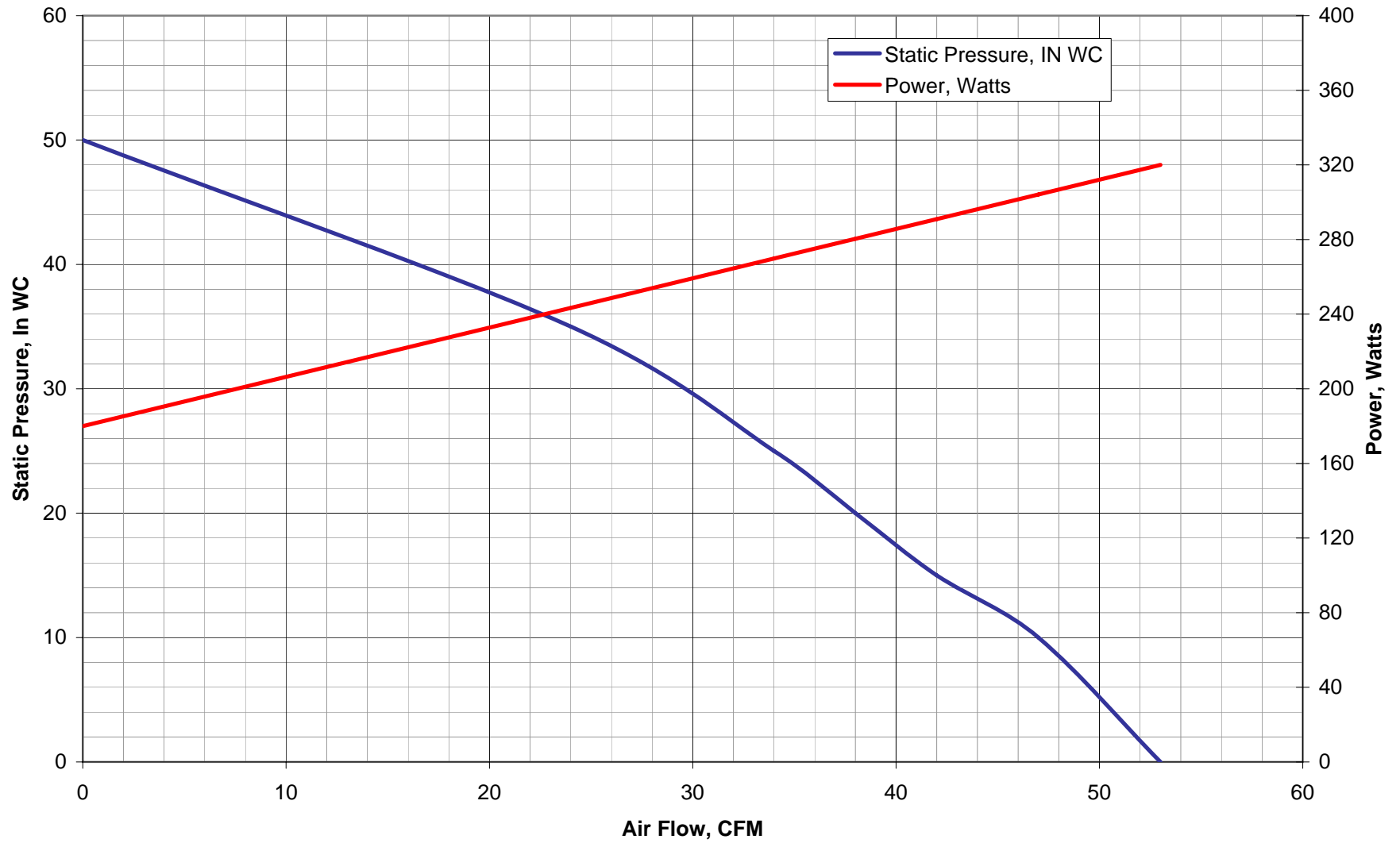
By: TS
Date:4/16/07





Performance Curve, HS5000

By: TS
Date: 4/16/07

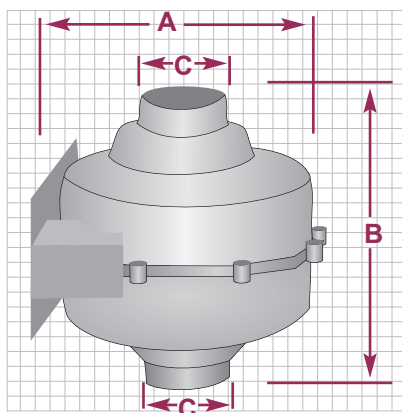
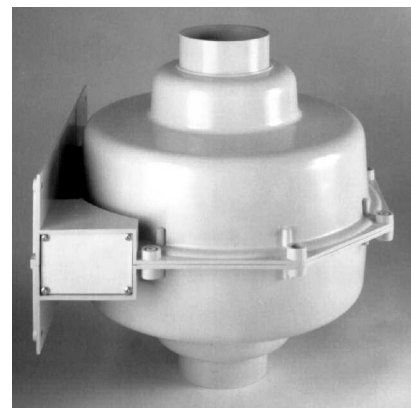




Radon Mitigation Fans

Specially designed for radon mitigation, GP Series Fans provide a wide range of performance that makes them ideal for most subslab radon mitigation systems.

GP Series



- ♦ 5-Year Warranty
- ♦ Mounts on duct pipe or with integral flange
- ♦ 3" diameter ducts for use with 3" or 4" pipe
- ♦ Electrical box for hard wire or plug in
- ♦ ETL Listed - for indoor or outdoor use.

Model	Dimensions		
	A	B	C Duct Size
GP series	12.5"	13"	3"

The following chart shows performance of GP Series fans:

Model	Watts	Maximum Pressure "WC	Typical CFM vs. Static Pressure WC						
			1.0"	1.5"	2.0"	2.5"	3.0"	3.5"	4.0"
GP201	40-60	2.0	82	58	5	-	-	-	-
GP301	55-90	2.6	92	77	45	10	-	-	-
GP401	60-110	3.4	93	82	60	40	15	-	-
GP501	70-140	4.2	95	87	80	70	57	30	10

Choice of model is dependent on certain building characteristics including sub-slab materials and should be made by a radon professional.

FOR FURTHER INFORMATION CONTACT:

