

APXX



TRUVAC[®]



TRUVAC[®]
by Vactor Mfg., Inc.

APXX

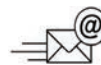
TRUVAC Training Academy



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TRUVAC[®]



TRUVAC APXX

Operation & Maintenance Manual

Operation & Maintenance Manual

APXX

Release history

- 0 Preliminary release. (AC 7-20-2022)
- 1 Added APXX-C blink codes and air excavation option. (AC 12-4-2022)
- 2 Airbag suspension content update (DE 4-3-2024)
- 3 Recirculator/Preheat, Hetronic ERGO S content update (DE 7-3-2024)
- 4 Added Dumping Best Practices, Longterm Storage (9-16-2024)
- 5 Added Boom and Body Out of Position content (DE 1-27-2025)

Manual and Parts Page Files

Operation, maintenance, troubleshooting, parts pages, and supporting files for this unit are located in the Service Cloud and Vactor's Electronic Parts Catalog at: **Vactor.com** → **Parts and Service** → scroll down to **Service Cloud**

Replacement operation manuals require the unit serial number. Order part No.: 512459A-30

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NOTICE

Consult OEM chassis and engine operation and maintenance manuals for complete details on operation.



NOTICE

- Due to available options, the control panel illustrations and decals reflected in this manual may not appear the same on all units.
- Prior to operation, perform daily maintenance on the Vactor unit according to the Daily Maintenance Check List in the Maintenance Section of this manual.
- Read the safety and operation manuals before operating Vactor equipment.
- Set the parking brake and select neutral before operating the Vactor.
- Turn on any safety lighting according to procedures and local, state and federal law requirements.
- Everyone associated in any way with a Vactor® Mfg. product must thoroughly understand and apply the contents of this manual. It is the responsibility of the owner to train his employees in the operation and safety procedures while operating or repairing this equipment.

NOTICE

- Do not overload the vehicle. Due to weight restrictions, it may be better to fill the water tanks near the work site. Know the Gross Vehicle Weight Rating (G.V.W.R.). Know the vehicle axle capacities. Do not exceed the Gross Vehicle Weight (G.V.W.).
- Always follow procedures established by the water supplier.
- When connecting the fill hose, inspect the area around the fire hydrant and place hose in a position that will not impede traffic or cause vehicles to strike the hose.

NOTICE

Custom Machine Parameters

Reprogramming the chassis or engine controls will result in problems ranging from improper operation to complete loss of service. Follow chassis manufacturer's procedures when reprogramming to avoid the loss of the custom machine parameters.



WARNING

Overriding Controls

To avoid injury or death never override any operator controls, fail-safe or deadman features of a control; or hydraulic, mechanical, or electrical safety devices during use.

Follow service instructions for overrides during maintenance.

WARNING

Cancer and Reproductive Harm

Required for compliance with California Prop 65.

Refer to: www.P65Warnings.ca.gov

NOTICE

Follow recommended safety practices while performing all work. Refer to the FS Solutions/Guzzler/Vactor/TRUVAC/Westech Safety Manual for additional information.

This manual is available at: www.vactor.com



NOTICE

Jump Starting Or Welding Can Damage Electrical System

To avoid damage:

- Disconnect ECU, control modules and batteries before welding on unit.
- Disconnect control modules before jump starting. Consult chassis service manual for details on jump starting.
- Never use a test light when troubleshooting. Only use digital multimeter on all circuits. Test lights and older analog meters can damage the electronic systems.
- Set all ignition switches to OFF before testing CANbus system.



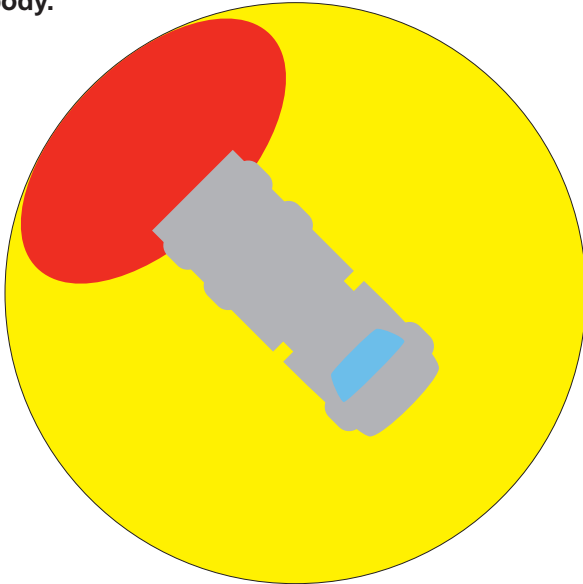
SAFETY INSTRUCTIONS

Unit operator must hold the pendant/remote during vacuum operations and stay within line of sight of the hose end operation. In an emergency, use the E-stop or pendant/remote to disable the vacuum. Maintain clear access to all E-stops and place an operator near one.

NOTICE

Safe Work Zone

Bystanders must be kept a minimum of 15 feet from the work area. **NEVER** stand directly behind the truck when raising or lowering the body.



⚠ WARNING

Trip, fall and other hazards

To avoid serious injury or death always use the ladders, walkways, grab handles and safety tie off points provided on the unit. Follow all required site, local, state, federal requirements for service work. This may require that the unit be moved to location that can provide the required safe access equipment.





Scan the QR Code with your mobile device or visit:
<http://www.fsescgsafety.com>
for the latest FESG product and application safety information.

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NOTICE

Preparing for Transport

Prior to transport secure all tools, hoses and all miscellaneous items in their storage locations.

- All items in tool trays and racks need to be secured or tied down.
- If equipped, secure boom in transport mode.
- If equipped, lower debris body, close rear door.
- If equipped, secure all hose ends on hose reels.
- Close and secure all cabinet, tool box and control panel doors and covers.
- Remove and stow all hoses, suction tube, extension pipes and accessories.
- Disengage the hydraulic, vacuum and water systems.
- Check and clear the area around the unit before moving.

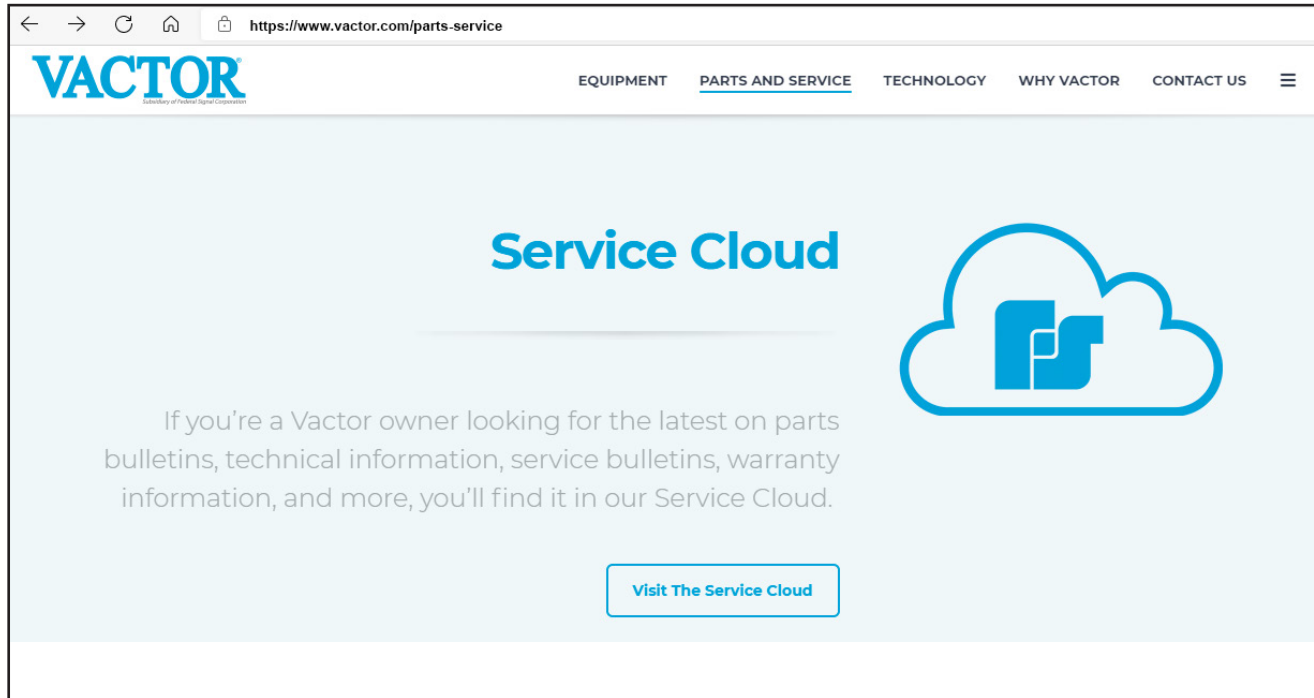
Guzzler/TRUVAC/Vestech/Vactor Manual

This manual package contains safety and operation, maintenance, basic troubleshooting for your unit.

Electronic versions of the operation, maintenance, troubleshooting, parts pages, options, videos, and supporting files for this unit are located in the Service Cloud and Vactor's Electronic Parts Catalog at: **Vactor.com** → **Parts and Service** → scroll down to **Service Cloud**

Replacement operation manuals require the unit serial number.

Order part No.: 512459A-30



Units with High Pressure Handgun Options

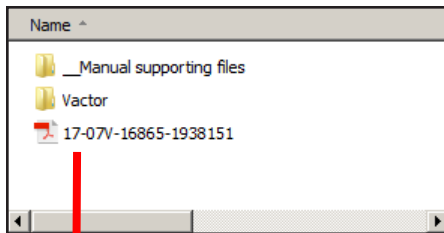
Note: Preferred browsers are Microsoft Edge or Google Chrome. Other browsers may not work correctly.



Selecting the Service Cloud will take you to the login page. Registration is required.

Once in you will find parts manuals for over 7000 Vector products. Each manual contains relevant drawings and parts lists for the assemblies that make up the machine as a whole. The purpose of the EPC is to provide you with the parts information that is relevant to your machine.

If you have any issues with obtaining a Vector manual through this website to please e-mail crmadmin@federalsignal.com.



Unit Parts Pages from the Service Cloud

The parts pages Adobe Acrobat PDF file is arranged in the same order as when printed.

- A. Cover page with model and serial number of unit.
- B. Parts common to all models.
- C. Build ticket - included with units built after February 2011.
- D. Common parts across the model line.
- E. Parts specific to model variations as noted.
- F. Parts Index - start of unique parts pages for the unit organized as shown. Note, older units may not be indexed.



PARTS INDEX

- A. . . . WATER SECTION
- B. . . . HOSE REEL SECTION
- C. . . . HYDRAULIC/PNEUMATIC SECTION
- D. . . . ELECTRICAL SECTION
- E. . . . P.T.O. SECTION
- F. . . . BOOM SECTION
- G. . . . DEBRIS BODY SECTION
- H. . . . REAR DOOR SECTION
- I. . . . AUX. ENGINE / BLOWER SECTION
- J. . . . FAN & FAN DUCT / FINAL FILTER & FINAL FILTER DUCT SECTION
- K. . . . WATER TANK SECTION
- L. . . . OPTIONS SECTION

WARRANTY & TECHNICAL SERVICE TEAM



TRUVAC®



The Vactor Service Team provides assistance to all Guzzler/TRUVAC/Vactor dealers and customers via remote (telephone, e-mail, fax, etc.) and on-site (dealer/customer visits, field training, etc.) support operations.

Toll-Free Telephone

1-877-DIAL ESG

(877) 342-5374

Fax (815) 673-1621 • Website www.vactor.com

Technical Support • 24 hours/Day, 7 Days/Week!

Pride in partnership ... *training* from Vactor

At Vactor, our partnership with you includes our commitment to insure that you're getting the maximum performance from your Vactor, Guzzler or TRUVAC unit.

That's why we offer a full range of training giving you the know-how to safely and efficiently operate, troubleshoot, repair, and maintain your equipment. Training to help you:

- * Operate safely and efficiently at all times
- * Select the right tools for every application and environment
- * Save time and money on troubleshooting and repairs
- * Protect your investment by using proper maintenance techniques

Whether you're an operator, dealer, mechanic, or contractor, Vactor training will help you boost performance and your bottom line!

Make the most of your partnership with Vactor. Call us today for complete information on upcoming training opportunities.

Training at Vactor takes advantage of our multimedia classroom and hands-on lab where you'll enjoy working with our expert instructors. Small class size and an informal atmosphere mean you will have ample opportunity to ask questions and get answers for your specific needs.

In-the-field demonstrations provide additional hands-on learning showcasing the right tools and techniques for safe, efficient operations; the key to getting the maximum performance out of your Vactor equipment!

Learn about our entire range of custom-crafted options and tools designed to boost your system's performance in every application. We've refined our products during thirty years of partnering with our customers to develop the world's leading vacuum loader technologies!

Take a tour of our facility to see how we build in quality at every step of the design and production process. Meet with our experts in engineering, manufacturing, and customer service to get connected with your entire Vactor support team!



Training workshops held at our facility are typically two or three days in length, depending on the topic and the audience. Sessions focus on the specific needs of operators, mechanics, and dealers. On-site training at your location may also be arranged. Call our Customer Service Coordinator, at 847-468-2371 or visit our web site at www.vactor.com for complete information on training from Vactor!

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GENERAL SECTION

Vactor® Manufacturing, LLC is happy to welcome you to our growing family of Vactor, Guzzler and TRUVAC customers. The current series of Vactors, Guzzlers, TRUVACs and accessory equipment are the latest developments in the continuous research program carried out by the Vactor's engineering staff. This program is formulated to bring you the latest and most efficient pneumatic cleaning and jet-rodding equipment available in the world today.

Good operation and a planned maintenance program, as outlined in this manual, are of vital importance in obtaining maximum performance and long life. Instructions on the operation and preventive maintenance of the current series Vactors and Jet-Rodders, as well as applicable parts lists are contained herein. The operator should familiarize himself thoroughly with the contents of this manual before operating the equipment or carrying out maintenance procedures.

The information, specifications, illustrations and parts numbers in this publication are based on the information in effect at the time of approval for publication. We are constantly improving our products and, therefore, reserve the right to make changes at any time without notice.

If a question arises concerning your Vactor product or this publication, please contact your Vactor® Manufacturing, LLC distributor.

SALES POLICY

Prices: All merchandise will be billed at prices at the time of shipment, unless otherwise stated.

Terms: Standard terms are NET cash within 30 days from date of invoice to customers with approved credit.

Shipments: All shipments, unless otherwise quoted, are F.O.B. ex--factory. Claims for shortages or damages in transit shall be made by the Consignee against the Carrier. If shipping instructions are not given, we will decide how to ship. We are not responsible for products after delivery to the transportation company. We are not responsible for delays resulting from causes beyond our control.

Returned Material: Goods **will not** be accepted for return or credit unless pre-authorized by us. Credit or allowance for authorized return of new parts will be based on condition of part, price originally paid and current parts prices. A restocking charge may be made, if required. We will not allow credit for return of used parts unless specifically authorized.

INFORMATION FOR ORDERING PARTS

Parts

When ordering parts or accessory equipment, refer to the Vactor® Manufacturing, LLC name plate. The name plate (one located on Vactor equipment, one located in cab of truck) lists the model and serial number of your Vactor. The model number and serial number of your Vactor are also listed in the front of the parts book. It is important that the model number and serial number be included with ALL parts orders to insure prompt service and necessary replacement parts. Parts should be ordered from Vactor® Manufacturing, LLC through your Vactor distributor.

Trucks

Refer truck parts orders to your local chassis distributor following the instructions in the truck manual.

INTRODUCTION PROPER USE OF THE PART'S MANUAL

This manual provides the general information that will enable operation and maintenance personnel to understand the unit and its accessories. Each Vactor Parts Manual is customized for the individual unit shown on the binder cover. Each Vactor unit is unique unto itself. The individual specifications and option package make this unit different from any other unit. This manual shows those unique differences and should only be used to order parts for the serial numbered unit shown on the binder cover. Use of this manual for any other unit may cause incorrect parts to be ordered.

Each manual has tabs A through L. An index of these tabs is at the beginning of the manual. All of the tabs may not be used on a particular unit. If a section, or tab, is not used a sheet is installed in that section explaining that the particular section is not used. If the section is used, the particular information shown on the index is illustrated in that section.

EXAMPLE: Section F is the BOOM section of the manual. If the particular unit does not have a boom on it, this section is empty. If the unit does have a boom on it, all of the information pertaining to that particular boom is shown in that section.

Many times the information in a section will show the word (REF) in place of a part number. This is generally the case with items not normally supplied

by Vactor such as engine components. It is also the case for electrical and hydraulic components. When an electrical or hydraulic component is referenced (REF) it is normally shown in the electrical or hydraulic schematics supplied for that unit. In some cases the particular part number for a item shown in the breakdown is left blank. These items are usually electrical or hydraulic and are therefore shown in the individual schematic for that unit.

EXAMPLE: The hydraulic cylinders do not have part numbers listed. If you look at the hydraulic schematic for the boom you will find all of the individual cylinders listed.

This is done specifically because the same base drawing can be used on many different units. Some units may require a special spacer in the cylinder to restrict its movement. Again, this would be reflected in the part number shown in the schematic not in the parts page.

If after going through the manual, you still cannot find the particular part you are after, feel free to contact the Vactor parts and service department. Please have the model and serial number of the unit that you are working on, available to give to the parts and service representative at Vactor. He or she must have the correct model and serial number of the unit in order to look up and get the correct information.

Vactor

INTRODUCTION

This manual is for use only with units meeting Vactor Mfg., standards. If your unit does not meet these standards, contact your Vactor representative to have your unit retrofit to meet these standards.



VACTOR
Manufacturing, LLC

1621 S. Illinois St.
Streator, IL 61364
Ph: 815-672-3171
Fax: 815-672-2779

*Subsidiary of
Federal Signal
Corporation*

OWNERS MANUAL COVERING OPERATION,
SAFETY, UNIT IDENTIFICATION AND REGISTRATION
FOR VACTORS, GUZZLERS, TRUVACS, VAXJETS
AND JET RODDERS.

IMPORTANT NOTICE

It is essential that everyone associated in any way with a Vactor® Mfg. product thoroughly understand and apply the contents of this manual. It is the responsibility of the owner to train his employees in the operation and safety procedures while operating or repairing this equipment.

PLEASE KEEP VACTOR INFORMED OF ANY CHANGE OF VEHICLE OWNERSHIP OR ADDRESS.

THIS OPERATOR'S MANUAL SHOULD BE CONSIDERED A PERMANENT PART OF THE YOUR UNIT
AND SHOULD BE WITH THE VEHICLE AT ALL TIMES FOR READY REFERENCE.

Vector (ESG) Technical Service Hotline

24 Hour

Vector now has in place a 24 hour a day service hotline In the USA or Canada Call:

877-342-5374 • Outside the USA or Canada call 847-741-4330

You will be asked for specific information pertaining to the type of unit you are calling about, Vector, Elgin, Guzzler, TRUVAC, etc. You will be asked for the zip code you are calling from. Your call will then automatically be transferred to the Vector dealer closest to you. If it is after normal business hours and the closest dealer to you does not have a 24-hour line, your call will be transferred to a factory service technician.

When the dealer or the technician answers, you will be asked for the model and serial number of the Vector unit you are working on. Please have that number available. It will definitely help to expedite our being able to help you with any questions or problems you have. Our plan is to service our customers to the best of our ability 24 hours a day, seven days a week, no matter where you are in the world!

Vactor

MODEL IDENTIFICATION - SERIAL NUMBERS



All units all have the serial plate in the same general location on the passenger side near the controls or water heater (if equipped). Options may obscure direct viewing.

Note: Unit serial number can also be found on the chassis door tag.

Serial Numbers				
Example: 03-02GL-4125				
Year made	Month made	Product Code	Manufacturing Location	Sequential build number
03	02	G	L	4125
		G - Guzzler	No letter - Streator IL	
		E - Elgin	E - Elgin IL	
		V - Vactor	C - Long Beach CA	
		R - TRUVAC	L - Leeds AL	
		T - Jetter/Ramjet	H - La Porte TX	
		X - Vaxjet	N - New Brunswick NJ	
		S - Gylcol	W - Williston ND	



FEDERAL SIGNAL

Environmental Solutions

DELIVERY, INSTALLATION AND WARRANTY REGISTRATION FORM

Serial Number: _____ Dealer Name: _____

Hours: _____ Miles: _____ Delivery Date: _____ In-Service Date: _____ **

** Form must be accompanied by a letter of request/explanation if different from Delivery date.

Comments: _____

Dealer Representative

ESG Representative

Print Name

Signature

Print Name

Signature

To assure warranty protection, this form must be filled out completely and signed by an authorized retail customer agent at the time of delivery to the end user / customer.

Failure to complete, sign and return form to the factory will void the limited warranty.

We have reviewed the ESG product installation and start up procedures, and understand the warranty, operation, service, and maintenance responsibilities for the above ESG product dated this _____ day of _____, _____.

End/Retail Customer Name: _____

Address 1: _____

Address 2: _____

City: _____ State / Province: _____

Zip Code: _____ Country: _____

Customer Contact Name: _____

Phone: (____) _____ Fax: (____) _____ E-mail: _____

Whom should we contact after 6 months to inquire about machine reliability and level of satisfaction with product?

Name: _____ Phone # (____) _____

Customer Representatives Present at Delivery

Print Name

Print Name

Print Name

Signature

Signature

Signature

FOR INFORMATION REGARDING THIS FORM OR FILING INSTRUCTIONS CALL (815) 673-3841 • ATTN WARRANTY ADMINISTRATOR. MAIL COMPLETED FORM TO:

VACTOR MFG., LLC, 1621 S ILLINOIS ST., STREATOR IL 61364 • ATTN WARRANTY ADMINISTRATOR

Original to Manufacturer

Copy to Dealer

Copy to Customer

Operation

Operation



Vacuum Excavation occurs when high-pressure water or pressurized air breaks up and cuts the soil, while a high-flow vacuum system lifts the soil up and out of the excavation area.

Buried natural gas, petroleum pipelines, and water mains can be quickly and efficiently uncovered with greatly reduced risk of strike. Fiber optic lines, cables, and other utilities can be efficiently located without the damage that can happen with traditional mechanical digging.

Operators can dig with precision, establishing a less invasive method for slot trenching, potholing, and pipe location.

This manner of excavation causes less surface damage, reduces disruption of traffic and other

surface activities and can be easier and less expensive to repair.

Non-destructive vacuum excavation is quickly gaining acceptance by cities, utilities, and contractors as a relatively safe, effective alternative to traditional excavation methods in a wide range of applications such as line location, installation and repair for utilities and pipelines, sewer and pipe, rehabilitation, slot trenching, waterline maintenance and repair, directional digging, excavation in congested areas, sign and pole installation, landscaping excavation and precision digging.

Vacuum excavation also is the preferred approach in confined locations that simply don't accommodate even the most compact standard mechanical excavators.



Both mediums have very distinct advantages. Air vacuum excavators use compressed air to loosen the soil and positive displacement blowers to vacuum the spoils into the debris body. Hydro-excavation uses high-pressure water to loosen soils, and the residual slurry spoils are easily extracted into the debris body.

Water excavation

Water is the most productive process, especially in rocky soils. It outperforms air because it moves large amounts of material faster and more efficiently favoring larger excavation jobs. Heated water (optional) can be used to cut through frozen soils. There is minimal abrasion to the underground utilities. Water system components tend to have a longer useful lifespan than compressed air systems.

Hydro-excavation advantages:

- In frozen ground or harder materials, water can be heated with on-board water heaters to aid in cutting through these materials.
- Hydro-excavation equipment can often be used for adjacent applications, such as tank cleaning. With the on-board high pressure water pump, hydro-excavators can perform many alternate applications that cannot be completed with pneumatic excavators.
- Hydro-excavation does not produce the sandblasting effect the way air does. This reduces the potential for damage to underground utilities.
- Water is also a lubricant, which helps to prolong the life of the excavation equipment by reducing wear on the vacuum hose and other components in the air stream.

Optional Air excavation

Compressed air offers some advantages under the right conditions. It is not limited by the limited supply of water and on small jobs where the hole will back filled right after the work is completed. It may be a safer choice when working around buried power cables. Air, however does produce a sandblasting effect that may create issues with dust and abrasion.

Some utility companies, departments of transportation (DOTs) or power plants specify air vacuum excavation for a given job for a number of reasons. Air vacuum excavation is desired in applications where the soil tends to be loose, water is not readily available, in small-scale excavation projects or where immediate backfill of the hole is required. When working around buried electrical lines or brittle utilities, air vacuum excavation is often preferred due to the lower operating pressures.

Air vacuum excavation advantages:

- Air is limitless. Onboard compressors generate the required pressure on demand so there are is no need to refill water.
- Air is nonconductive. When vacuuming around live electrical wires, pneumatic excavation can be a preferred choice over hydro-excavation.
- Air vacuum excavation provides dry spoils which can immediately be returned to the excavation site. Many applications in the utility segment require exposing the utility, making the repair, and then backfilling the material. This can't be done with hydro-excavation.
- Air vacuum excavation uses lower excavation pressures compared to hydro-excavation. Protective coatings and brittle underground utilities can easily be damaged when using hydro-excavation if the operator is not careful.

The operational systems on the Vactor are dependent upon the options and capacities of the vehicle as ordered. The vehicle is custom designed to provide a combination of high-pressure water and suction to perform in a designated area and application. The water, hydraulic and vacuum systems work together to provide a powerful excavating machine.

It is important to remember that the vacuum tube uses air flow and not vacuum to pick up material. Keep the suction end of the nozzle in the upright position to receive air and material. Submerging the nozzle in material stops airflow, prevents material movement and creates a loading and unloading effect on the blower/fan. The nozzle is designed to pull air into the pipe to move material. The end is serrated with small holes; if the end is submerged no air is pulled in through the holes.

The weather and operating conditions cannot be controlled, but the air speed, water volume and water pressure can be controlled. Blower/fan speed controls the volume of air and the speed of air movement through the pipe and into the debris body. Adjust the air speed to move maximum amount of material without carry over into the blower exhaust.

Air speed is important when working in freezing temperatures. High air speeds cause wind chill conditions because of the air velocity created. The wind chill conditions cause ice build up in the vacuum tube or boom which blocks material movement.

Proper air speed will vary depending on the material moved. Air velocity should be set so that material does not hang in the pipe. Adjust speed to the lowest setting to move the material efficiently. Increase the speed as needed to pick-up large rocks or heavy sludge. Watch the air exhaust for carry over of material.

The further the distance from the work site to the debris body the higher the air speed that is needed. The shorter the distance, the lower the air speed needed. Material moving through a pipe or tube creates a friction factor. The longer the tube or pipe, the higher the friction factor called friction loss. Pipe and tube diameter is a major factor when moving material. Lower engine/air speed translates to lower fuel costs and reduced noise.

NOTICE

- Due to available options, the control panel illustrations and decals reflected in this manual may not appear the same on all units.
- Prior to operation, perform daily maintenance on the Vactor unit according to the Daily Maintenance Check List in the Maintenance Section of this manual.
- Read the safety and operation manuals before operating Vactor equipment.
- Set the parking brake and select neutral before operating the Vactor.
- Turn on any safety lighting according to procedures and local, state and federal law requirements.
- Everyone associated in any way with a Vactor® Mfg. product must thoroughly understand and apply the contents of this manual. It is the responsibility of the owner to train his employees in the operation and safety procedures while operating or repairing this equipment.

NOTICE

- Do not overload the vehicle. Due to weight restrictions, it may be better to fill the water tanks near the work site. Know the Gross Vehicle Weight Rating (G.V.W.R.). Know the vehicle axle capacities. Do not exceed the Gross Vehicle Weight (G.V.W.).
- Always follow procedures established by the water supplier.
- When connecting the fill hose, inspect the area around the fire hydrant and place hose in a position that will not impede traffic or cause vehicles to strike the hose.

You have three things that you can control; blower/fan speed, water volume and water pressure.

Blower/fan speed controls the volume of air and the speed of the air through the pipe and into the debris tank. If you are in conditions where the soil breaks up easily, you can run at a higher rpm. This allows material to move faster.

If the ground is very hard or frozen, slow the speed down. You are not able to move the volume of material in these conditions and slowing down the blower/fan saves fuel and allows for a better working environment. How far from the truck are you having to work? The longer the distance the higher the blower speed. The shorter the distance, the lower the blower speed. Material moving through a hose or pipe has a friction factor. The more hose or pipe, the higher is this factor. Its actually called *friction loss*.

Understanding the vacuum system

The term “vacuum system” as it pertains to any Hydro Excavator product is actually a misnomer. We should be talking about an “air movement system” because that’s really what it is. Air picks the material up and carries it into the debris body.

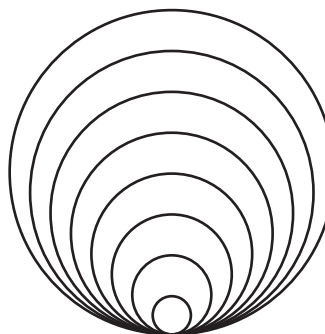
Air must be moving in order to move material. If the nozzle is totally submerged in the material no air can get in. When this happens, the material is pulled up only so high in the tube and it sits there. In the case of a blower (PD) machine, air movement becomes even more important because air is what cools the blower. Restricted air flow can cause the blower to over heat which can cause damage to the blower. The chart below shows the percent of restriction that is created as an eight (8) inch nozzle is closed down.

Hose Restriction				
Hose Dia. Inches	Hose Area square/inches	Orifice Area	Orifice Area	Orifice Area
8	50.3	100.0%		
7	38.5	76.6%		
6	28.3	56.3%	100.0%	
5	19.6	39.1%	69.4%	
4	12.6	25.0%	44.4%	100.0%
3	7.1	14.1%	25.0%	56.3%
2	3.1	6.3%	11.1%	25.0%
1	0.8	1.6%	2.8%	6.3%

NOTICE

Machine Can Be Damaged

- Beware of carry over material from debris body through the blower or fan.
- Running the blower/fan too fast with light material can carry the material over into the blower or fan. This can cause premature wear.
- Over filling the debris body can cause carry over and damage to the fan/blower.
- A build-up of material on the fan will cause an out-of-balance condition. Operating an out-of-balance fan can cause damage to the fan, fluid drive, spindle box or auxiliary engine. If necessary, remove the intake elbow for proper cleaning.



All HXX units have a vacuum system powered by either a positive displacement (PD) blower or a fan. They differ in their applications and capabilities.

Trucks equipped with a PD system can lift sludge or a column of water, while fan system trucks cannot. Fan systems can move much more air than PD systems, so they move material faster, but they cannot lift as much.

Filtration is more important on PD units. If the blower gets plugged, it can stall. If fan units get plugged, they continue to spin.

PD Models

The positive displacement, rotary lobe type blower is powered by the truck's diesel engine and is coupled to the truck power transmission chain by means of a transfer case. The transfer case is positioned between the transmission and the rear axle. When engaged, the transfer case diverts power away from the road wheels to drive a blower, which is the source of airflow.

All Models

The blower or fan sucks air out of the tank, creating an area of low pressure in the tank. Air from outside the tank rushes into the tank through the attached hoses. This equalizes the pressure differential. Any loose material in the path of the rushing air is conveyed by the high-speed air stream to the debris tank via the hoses.

When material enters the debris tank, the transition from a hose to the larger debris tank causes the air speed to drop considerably. The incoming air strikes a specially designed deflector plate that directs the material flow downward. The now slower airflow cannot sustain the debris in the air and the material falls into the tank. This is the first of three stages of filtration.

Any lighter, powdery material still suspended in the airflow is conveyed to the cyclone chambers, the second filtration stage. There, due to the forced centrifugal action of the flow, most of the dust particles separate and collect in the dead air space of the hopper. By this stage of filtration, about 96% of the material has dropped out of the airflow.

Exiting the cyclone, nearly dust-free air passes through the final stage of filtration. It enters the final filter. After leaving the microstrainer, the air flow passes through the blower and the silencer before being exhausted into the atmosphere.

Optimizing Speed

Running the system at higher speeds than necessary is not only uneconomical in terms of excessive fuel consumption, accelerated wear and tear on the engine, transmission, and the blower; but will also prevent the filtration system from working properly. Minimum working speed will reduce wear.

Selecting Hoses

To help prevent or reduce clogging, use large diameter (6 inches or larger), smooth bore hose in as straight a line as possible.

For maximum output, the system is designed to use 6-inch diameter hose. Hose sizes smaller than that will cause additional friction losses and a higher percentage of the available engine and blower power will be used up in overcoming these inefficiencies. This will result in a dramatic increase in time required to complete a job.

If it is necessary to use smaller hose diameters, use multiple connections. Their combined area should equal that of an 6-inch hose.

To reduce friction losses use metallic, smooth-bore piping as much as possible and flexible hose for bends and curves. When bends in the hose run must be made, they should be wide and gradual. Using inexpensive, lightweight hose lengths for the last few working feet at the operator's end will provide greater maneuverability and less operator fatigue.

Vacuum System Components

The major components of the vacuum system are illustrated in this section, as follows:

- Suction Hose (as required)
- Boom
- Debris Body
- Float-Ball Vacuum Shut-Off (liquids only)
- Vacuum Relief Valves (automatic & manual)
- Blower (vacuum pump) or Fan
- Silencer (inlet and discharge)

Hydro excavation trucks have four major systems: vacuum, water, filtration, and hydraulic.

Vacuum System

The term “vacuum system” as it pertains to any Hydro Excavator product is actually a misnomer. It should be called an “air movement system.” Air picks up material and carries it to the debris body.

Air must be moving in order to move material. If the nozzle is submerged, no air can get in and material cannot reach the debris body. Air movement is even more important on PD units because the air cools the blower.

On PD units, the vacuum module is powered by the truck’s diesel engine and is coupled to the truck’s power transmission chain through the transfer case. When the transfer case is engaged, it diverts power away from the road wheels to drive the blower.

Vacuum System Components: Suction hose, boom, debris body, float ball vacuum shut off, vacuum relief valve, blower, silencer, vacuum enhancer (optional)

Water System

Water is held in the water tank. It can be heated with the water heater for clay or cold weather applications. It can be recirculated to keep it from freezing and to maintain a consistent temperature.

Water is pumped out under pressure through a hose to the handgun or wand. The high pressure water is used to cut up soil into chunks small enough to fit in the vacuum hose.

Water System Components: water tank, water pump, handgun, nozzle, water heater (optional), recirculator (optional), air purge, water hose and reel, water filter

Filtration System

The filtration system cleans the air coming into the system by removing all dirt, dust and foreign matter from the air. The filtration system’s primary purpose is to protect the blower from damage by carryover material.

Filtration System Components: debris body and deflector, prefilter, cyclone filter, filter element, microstrainer, silencer.

Hydraulic System

The hydraulic system powers many of the functions on the unit. The hydraulic pumps are usually driven by the PTO or transfer case system.

Operations Overview

When operating the unit, two people operate the machine. One person uses the wand or water handgun to break up the soil. The other person operates the vacuum hose to remove the soil.

The operators can use blower/fan speed, water pressure, and water volume to optimize excavation in various environmental and soil conditions.

As the material is cut up, the vacuum hose carries the material into the tank. The transition from the hose to the debris body causes the air speed to drop. The incoming air strikes a deflector plate that directs the material flow downward. The now slower airflow cannot sustain the debris in the air and the material falls into the tank.

Any lighter powdery material still suspended in the airflow is conveyed to the cyclone chambers. There, due to the forced centrifugal action of the flow, most of the dust particles separate and collect in the dead air space of the hopper.

Exiting the cyclone, the nearly dust-free air passes through the filter and microstrainer (PD only). The air then passes through the fan or blower. On PD units, the air passes through a silencer.

When the job is done or the debris body is full, the debris body is dumped and cleaned for the next use.

The proper amount of water and / or air being used depends greatly on the soil conditions and the weather conditions at the time.

Weather can and does play a big factor in doing the job. Is the ground frozen? Is the ground sun baked and dry? Is it raining out and the ground is sloppy and muddy? Is the ground sandy or dry clay? Is it real hard and rocky ground? Is it soft ground? All of these and other questions have a direct affect on the job you are trying to do!



The filtration system is designed to clean the air coming into the system by removing all dirt, dust and foreign matter from the air. The filtration system's primary purpose is to protect the blower by removing all material from the air stream before it reaches the blower.

- 1 Waste material first enters the Hydro-Excavator through the boom located on top of the tank.
- 2 The deflector plate knocks the bulk of the material out of the airstream and it falls to the floor of the debris tank. The deflector plate is located inside the rear and at the top of the tank. In the tank, the air travel is slowed as it goes through it to the other end and leaves the debris tank.
- 3 The air flows into the secondary prefilter or cyclone chamber.

- 4 In the filter chamber, centrifugal force hurls the denser particles toward the cyclone walls where they spiral downward into the collection hopper. The lighter and by now relatively particle-free air is directed to the filter element.
- 5 The air stream leaves the filter element and enters the microstrainer section of the housing. It is the safety dropout point for any objects which may accidentally enter the filtration system.
- 6 Finally, the air passes through the vacuum pump (blower) and out through the silencers.

Vacuum Excavation occurs when high-pressure water or pressurized air breaks up and cuts the soil, while a high-flow vacuum system lifts the soil up and out of the excavation area.

Buried natural gas, petroleum pipelines, and water mains can be quickly and efficiently uncovered with greatly reduced risk of strike. Fiber optic lines, cables, and other utilities can be efficiently located without the damage that can happen with traditional mechanical digging.

Operators can dig with precision, establishing a less invasive method for slot trenching, pot holing, and pipe location.

This manner of excavation causes less surface damage, reduces disruption of traffic and other surface activities and can be easier and less expensive to repair.

Non-destructive vacuum excavation has quickly gaining acceptance by cities, utilities, and contractors as a relatively safe, effective alternative to traditional excavation methods in a wide range of applications such as line location, installation and repair for utilities and pipelines, sewer and pipe, rehabilitation, slot trenching, waterline maintenance and repair, directional digging, excavation in congested areas, sign and pole installation, landscaping excavation and precision digging.

The following pages provide basic resources to plan and operate a hydro-excavation digging site safely.

Follow all federal, state, and local regulations for locating utilities before starting work.

WARNING

High pressure water

High pressure water can cause serious injury or death.

The handgun operates under high pressure. Never point the handgun at another individual. Severe injury can result from the high-pressure water.

Special safety equipment is required when operating the high-pressure handgun. Always wear safety toe shoes or boots (waterproof shoes or boots preferred), coveralls, face shield and safety goggles and gloves (waterproof gloves preferred).



ALWAYS CALL BEFORE YOU DIG





One free, easy call gets your utility lines marked AND helps protect you from injury and expense.

**Safe Digging Is No Accident:
Always Call 811 Before You Dig**

Know what's below. Always call 811 before you dig.
Visit call811.com for more information.







TRAVELLERS
Common Ground Alliance

Do Not Enter an Unprotected Trench!



For your safety:

- Slope or bench trench walls, or
- Shore trench walls with supports, or
- Shield trench walls with trench boxes.
- Provide safe access through the use of ladders, ramps or stairways.
- Keep heavy equipment away from trench edges.
- Know where underground utilities are prior to digging.
- Keep excavated or other materials at least 2 feet back from the edge of trench.

OSHA's role is to assure the safety and health of workers by setting and enforcing standards; providing training, outreach and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.



**Occupational
Safety and Health
Administration**

U.S. Department of Labor

To get more information, report an emergency or contact your local office:
www.osha.gov • (800) 321-OSHA • TTY (877) 889-5627

OSHA 3215-04N-01

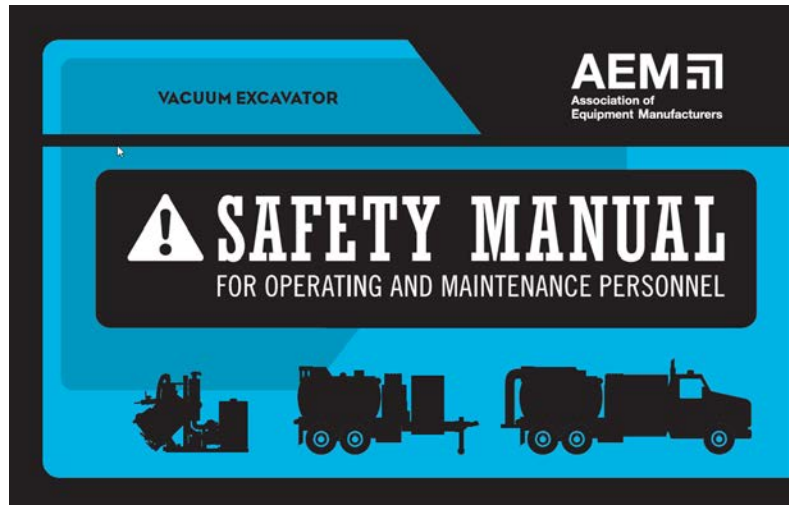
The AEM is a leading provider of training and safety material.



Association of Equipment Manufacturers

6737 West Washington Street
Suite 2400
Milwaukee, WI 53214-5647

414.272.0943
Fax: 414.272.1170
Email aem@aem.org
website: www.aem.org



Operators using or working around high pressure water systems need to take additional precautions including specialized personal protection equipment. Additional information on high pressure water safety is available from the WJTA.

Also available from the WJTA:

Recommended Practices for the Use of High Pressure Waterjetting Equipment

Recommended Practices for the Use of Industrial Vacuum Equipment



WaterJet Technology Association

917 Locust Street, Suite 1100
St Louis MO 63101-1419

314-241-1445
Fax 314-241-1449
e-mail: wjta@wjta.org
website: www.wjta.org



Underground power lines may require special precautions including cutting power to the lines and the use of special protective bonding equipment.

Kri-Tech is a source of protective bond mats used during hydro-excavation:



Kri-Tech Products Ltd.

Box 364, Mirror
Alberta Canada T0B 3C0

877-788-3883
Fax: 403-788-3723
Email: info@kri-tech.net
website: www.kri-tech.net



Common Ground Alliance

2300 Wilson Boulevard
Suite 400
Arlington, Virginia 22201

703-836-1709

Fax: 309-407-2244

websites:

www.commongroundalliance.com

www.call811.com

www.cga-dirt.com



Ontario Regional Common Ground Alliance

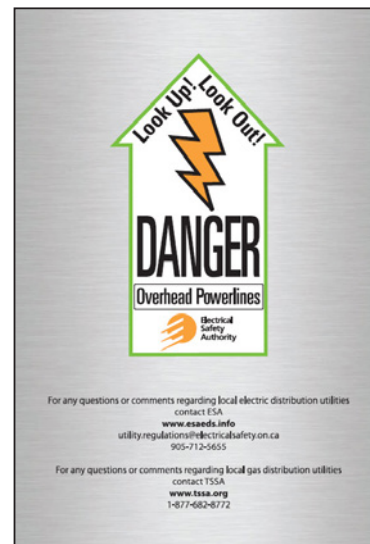
195 King Street, Suite 105
St Catharines, Ontario L2R 3J6

866-446-4493

Fax: 866-838-6739

Email: office@orga.com

website: www.orga.com



Centre for Health and Safety Innovation

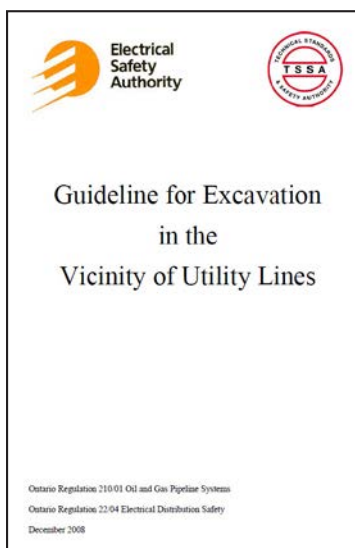
5110 Creekbank Road, Suite 400
Mississauga, ON L4W 0A1

800-263-5024

Fax: 905-625-8998

Email: info@ihsa.ca

website: www.ihsa.ca

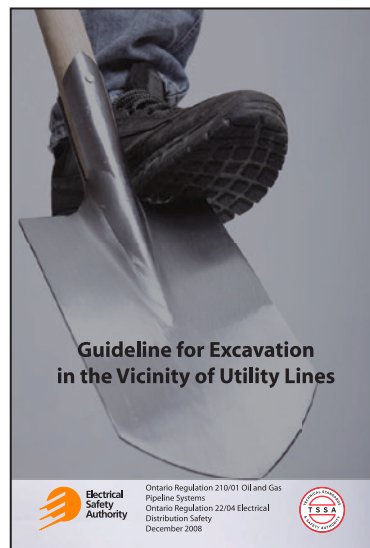


1-877-ESA-SAFE

1-877-372-7233

Customer Service Center

website: www.esasafe.com



Follow all requirements for PPE when operating and servicing. The Occupational Safety and Health Administration (OSHA) requirements apply to most workers. The following information is from OSHA 3151-12R 2003. The full document can be obtained from www.osha.gov.

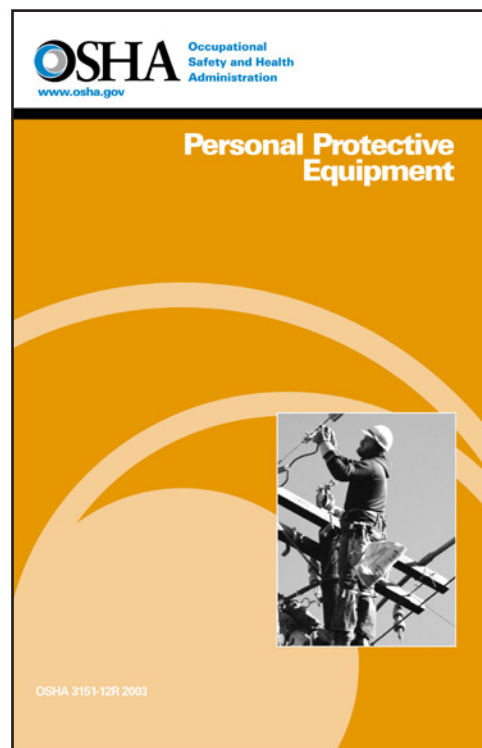
A hazard assessment should be made to determine the correct level of footwear safety protection. Underground electrical utilities may require the use of insulating gloves and dielectric footwear. The minimum requirements for gloves are compliant with OSHA 1910.137, OSHA 1910.268, NFPA 70E and exceeds the ASTM D120 and European EN60903 standards. Refer to NFPA 70E for dielectric footwear.

National Fire Protection Association (NFPA)

1 Batterymarch Park
Quincy, MA 02169-7471
Telephone: (800) 344-3555

NOTICE

Reference to OSHA regulations are for informational purposes only and not intended as legal advice.



ASTM Labeling Chart			
Natural Rubber Electrical Insulating Gloves			
Class Color	Proof Test Voltage AC/DC	Max. Use Voltage AC/DC	Insulating Rubber Glove Label
00 Beige	2,500 / 10,000	500 / 750	10 ASTM D120 CLASS 00 TYPE I MAX USE VOLT 500V AC EN60903 TYPE I 500V AC
0 Red	5,000 / 20,000	1,000 / 1,500	10 ASTM D120 CLASS 0 TYPE I MAX USE VOLT 1000V AC EN60903 TYPE I 1000V AC
1 White	10,000 / 40,000	7,500 / 11,250	10 ASTM D120 CLASS 1 TYPE I MAX USE VOLT 7500V AC EN60903 TYPE I 7500V AC
2 Yellow	20,000 / 50,000	17,000 / 25,500	10 ASTM D120 CLASS 2 TYPE I MAX USE VOLT 17000V AC EN60903 TYPE I 17000V AC
3 Green	30,000 / 60,000	26,500 / 39,750	10 ASTM D120 CLASS 3 TYPE I MAX USE VOLT 26500V AC EN60903 TYPE I 26500V AC
4 Orange	40,000 / 70,000	36,000 / 54,000	10 ASTM D120 CLASS 4 TYPE I MAX USE VOLT 36000V AC EN60903 TYPE I 36000V AC

Refer to the Vactor/Guzzler/TRUVAC/Westec Safety Manual for general site preparation. Site specific regulations may also apply.

1. Call 811 before all digging operations to locate and mark off all known utilities
2. All buried utilities suspected to be damaged must be de energized prior to digging.
3. Follow all recommended procedures for electrical bonding. Ground mats may be required.
4. Verify all equipment is in safe working order and suitable for the work to be performed. Water flows above 10gpm are normally not suitable due to the higher risk of erosion problems.
5. The working end of the vacuum tube should be equipped with a soft nonconductive end to help reduce the risk of contact or damage to buried lines and pipes.
6. Water pressure, volume and temperature can have a big impact on the risk of damaging the various underground utilities. Some testing may be required to avoid damage. Lower the water pressure and temperature when getting close to the utilities. The water nozzles must always be in motion.
7. Teamwork is very important when trenching and digging large holes. One person is operating the wand or hand gun. The other person is positioning the boom so the vacuum tube is in the right position to move the material as soon as it breaks away. It is not productive to try to wash the material to the nozzle or to try to vacuum the material a great distance to the nozzle.

The operational systems on the units are dependent upon the options and capacities of the vehicle as ordered. The vehicle is custom designed to provide a combination of high-pressure water and suction to perform in a designated area and application. The water, hydraulic and vacuum systems work together to provide a powerful excavating machine.

It is important to remember that the vacuum tube uses air flow and not vacuum to pick up material. Keep the suction end of the nozzle in the upright position to receive air and material. Submerging the nozzle in material stops airflow, prevents material movement and creates a loading and unloading effect on the blower/fan. The nozzle is designed to



**Know what's below.
Call before you dig.**

⚠ WARNING

Underground hazards

Gas and electrical utility damage can result in fire, explosion and electrocution. To avoid injury or death:

- **Before digging locate all underground utilities. Always call 811 before digging.**
- **Shut off gas lines and electrical power**
- **Always use nozzles designed for excavating applications to reduce the risk of damage.**



pull air into the pipe to move material. The end is serrated with small holes; if the end is submerged no air is pulled in through the holes.

Shown are common industry standard symbols used on the various controls. Actual symbols used will vary with options.



Refer to manual



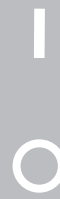
Refer to Service manual



Emergency Stop



Operator Alert



On Off



Lock Unlock



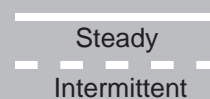
Adjustment Range
Max. to Min.



Alarm On / Off



Audible Alert
On / Off



Steady
Intermittent



Remote Control



Counter



Timer



Hour meter



Battery power Disconnect



Battery charging and/or volts



Plug Connection or Socket



Scale



Slower / Faster



Increase Decrease



Pressure



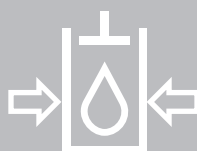
Oil



Oil Temperature



Hydraulic Oil



Hydraulic Oil Pressure



Hydraulic Oil Temperature



Temperature Low/Normal Range/High



Switch Home Position



Hot Water



Spray



Water



Water Level Indicator

Shown are common industry standard symbols used on the various controls. Actual symbols used will vary with options.



Worklights
Front - Side - Rear



Water
Recirculation



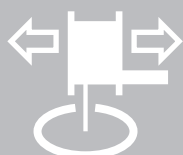
Vibrator



Valve
Open
Closed



Heater or
Cabinet heater



Hose reel
IN/OUT



Hose reel
Speed



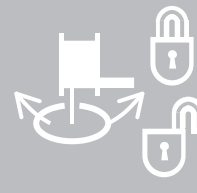
Hose reel
PAY IN/PAY OUT



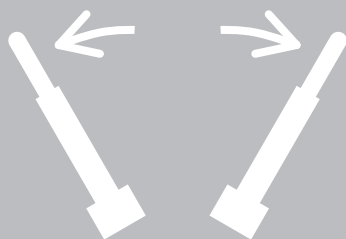
Hose reel
IN/OUT



Hose reel pinch
roller lock



Hose reel lock
(swivel)



Boom rotate
CCW or CW



Strobe/Beacon/
Revolving Light



Mirror Strobe



Boom retract



Boom DigFast
(Clump Buster)



Boom extend



Debris Body Up/DOWN



High Rail UP/DOWN



Boom down



Rear Door OPEN/CLOSE



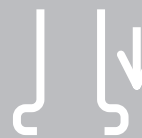
ENGAGE/DISENGAGE



Boom up



Vacuum ENABLE / DISABLE



Suction pick up head UP/DOWN

Shown are common industry standard symbols used on the various controls. Actual symbols used will vary with options.



Transmission or
Transfer Case
Oil Pressure



Transmission or
Transfer Case
Oil



Transmission or
Transfer Case



Clutch



Engine Run



Engine Start



Engine Stop

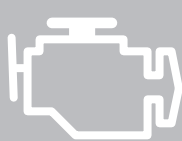


n/min

Engine RPM



Power Take Off
(PTO)



Engine



Fan



Park Brake



Road Mode



n/min

Blower or
Compressor
RPM



Blower or
Compressor



Rotary Compressor,
Liquid Ring or
Vacuum Pump



Water Pump



Liquid Pump



Centrifugal
Pump



Engine
REGEN



Reset



Recirculator



Automatic
Cycle



Water
Reclaimer



Emergency Stop



E-Stop - normally disables vacuum and water pressure. Refer to the controls section for each model for the additional functions controlled by the E-Stop.

Activate the E-Stop daily to verify it functions correctly and that no error message appear on the display (if equipped).



Red indicator light - activated when a condition requires immediate attention or the function has been activated.



Hydraulic Oil Temperature



Red indicator light - normally activated when condition requires immediate attention.



Oil Temperature



Red indicator light - normally activated when condition requires immediate attention.



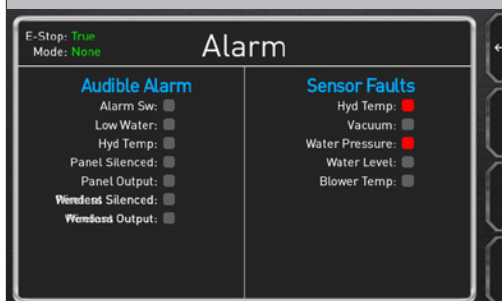
Vacuum ENABLE / DISABLE



Red indicator light - normally activated when vacuum relief valve is set for vacuuming. The vacuum relief valve works differently on PD and fan machines. Refer to the control pages for details.



Note - on many older units (pre-2011) this indicator was used for the vacuum relief valve open/closed position. Refer to the unit's manual for details.



Displays use a variety of colors and message boxes to indicate function status and alerts. Refer to the display information in the unit manual for the specific use when equipped.

Note - Other colors of lights may be used on water level indicators and vendor supplied components like lighting, cameras, scales, etc.

- 1 **Engine Monitor** - Monitors the chassis engine RPM, blower speed, blower hours and other chassis data.
- 2 **Wireless Pendant Plug** - Used to tether the wireless pendant when the battery runs out.

Wireless - Up activates the wireless

Alarm - Silences the alarm

Rear Worklights

Passenger Worklights

Driver Worklights

Boom Worklights

Continuous Fill Option - Activates the option.

Water Pump - Enables the water pump

- 3 **Air Compressor Option** - Up will activate the air compressor in high pressure mode for excavation, down will activate in low pressure mode for tools.

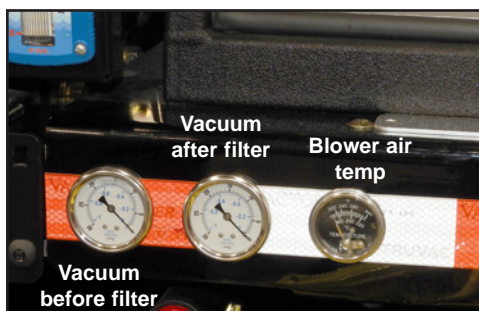
Throttle - Increase/decrease the engine RPM

Blower - Indicates the transfer case has shifted to run the blower

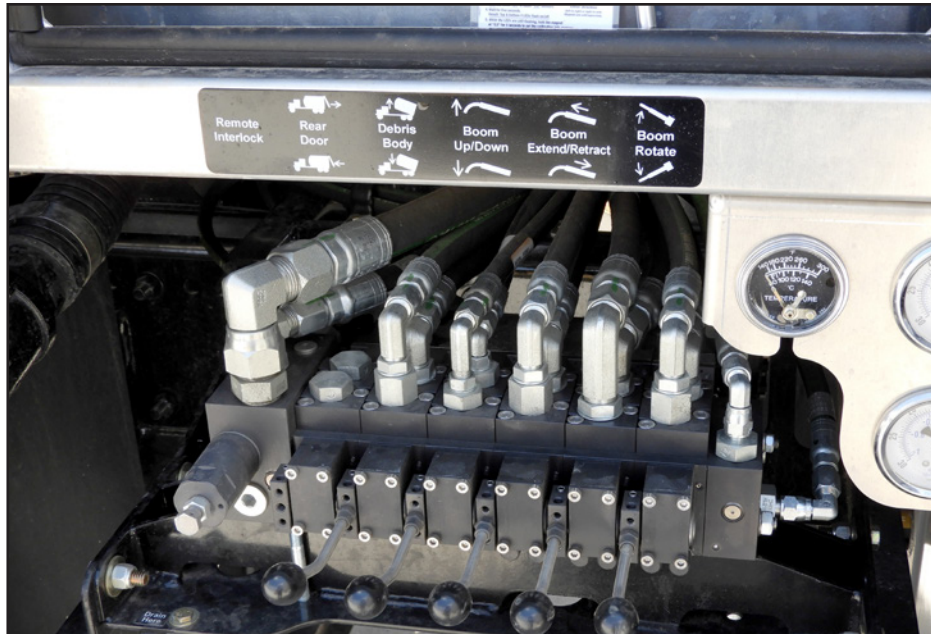
Vacuum Enable - Enables the vacuum

Vibrator Switch - Momentarily operates the vibrator if equipped. Duty cycle is 50%.

Emergency Stop - Disables the PTO, hydraulic, vacuum and water systems. The indicator light will be on when activated.



Water level - A gauge is located on sides of the unit normally in front of the watertanks.



Remote Interlock - Blocks off all hydraulic valves except the water pump when using the wireless remote.

Rear Door - Open/close the rear door

Debris Body - Raise/lower the debris body

Boom Up/Down

Boom Extend/Retract

Boom Rotate

Hand Pump - Normally used in the event of an engine or hydraulics failure. To use install a valve handle in the remote interlock section of the stack valve. Activate it by pushing down and activate the desired function while pumping the hand pump.

WARNING

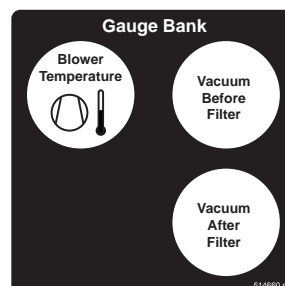
Boom Hose Can Fly Loose

To avoid injury or death when dumping or moving the boom:

- When dumping disconnect the dig tube from the boom hose
- Move the boom hose end out of the travel position and away from the unit
- When digging remove the dig tube from the driver side rack before moving the boom

When digging or dumping failure to move the boom hose end out of the travel position can result in the boom hose and/or the attached pipe being pulled out and swinging into bystanders. The machine can also be damaged.

Refer to manual for details. 514288B r0



APXX

APXX-C CAB CONTROLS

OPERATION



Master Switch - Enables the system

Mode - Blower or Road

Heater - Enables the cabinet heater

Strobe Lights

PTO - enables hydraulic system

Recirc - Activate the recirc system

Body out of Position - Debris body is not fully down.

Boom Out of Position - Boom is not in transport position.

The pendant is a portable control used by the operator to direct the operation of the boom among other operations. Actual configuration may vary with model and options. The function of the buttons normally mimic the master control panel unless otherwise noted here.

Note: The boom brake is locked out when the debris body is raised or out of the fully down position (HXX Paradigm only).

The buttons are momentary switches and upon releasing the button, the boom will cease moving.

The vacuum relief on/off button relieves the air flow at the boom inlet in an emergency.

Units normally come equipped with a wireless remote and **wireless emergency shutoff** wrist strap (WSO). The WSO triggers the E-stop.

Note: On some models the wireless pendant can be used as a wired pendant.

The ring on the wireless remote and wireless emergency shutoff is normally attached to the lance and the module to one of the operator's arms. If the operator loses control of the lance the attached cord will trigger the wireless emergency shutoff.

Note: ParaDIGM wired remote will only work when the wireless switch on the master control panel is set to ON.

Charging

The wireless remote needs charged before use. When the batteries are completely dead, with no charge at all, they will need to be hard wire charged. The batteries will need to be put in an individual charger or connected to the tether to charge the batteries. If they still do not take a charge then they will need to be replaced. The induction charger will not charge a completely dead unit. Other charging options are also available.



SAFETY INSTRUCTIONS

Unit operator must hold the pendant/remote during vacuum operations and stay within line of sight of the hose end operation. In an emergency, use the E-stop or pendant/remote to disable the vacuum. Maintain clear access to all E-stops and place an operator near one.

The WSO uses a replaceable CR123A battery.



Wireless remotes normally only need pairing when either the receiver or transmitter are replaced,

Wireless remote

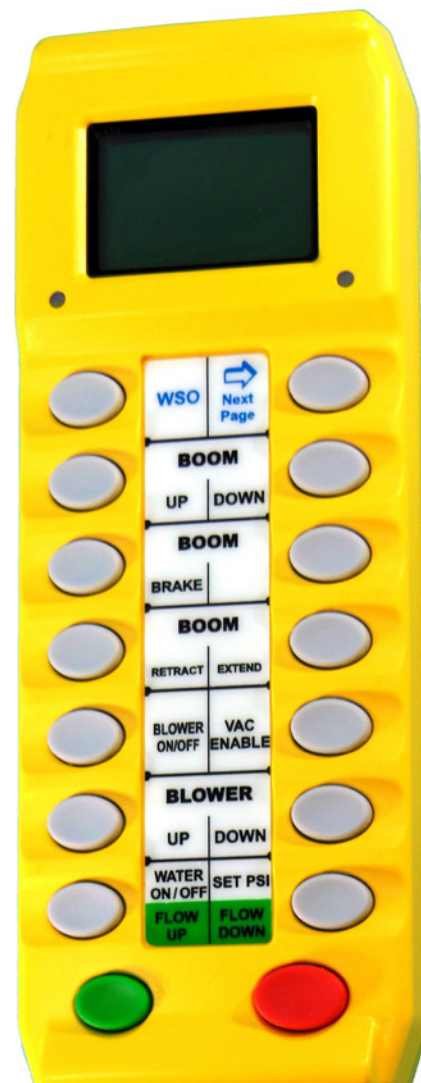
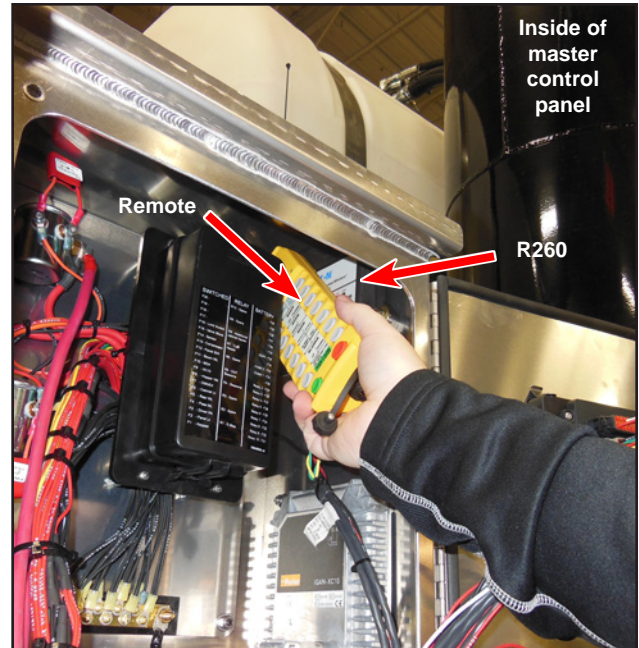
1. Hold down the red button.
2. Hold down the green button.
3. Wait until the splash screen appear, in this case, wait until you see the Vactor logo appears on the screen.
4. Release the red button.
5. Release the green button. The remote is now in service mode.

R260 - receiver

6. Put a magnet next to the top left corner of the R260, near the EATON logo. The magnet on the rear of the remote can be used as shown.
7. Wait until the E-STOP led rapidly blinking green.
8. Remove the magnet. E-STOP led light solid green. The R260 is now in pairing mode.

Wireless remote

9. Move the remote closer to the R260.
10. Press and release the green button.
11. The screen will indicate the pairing result.



TRUVAC

WIRELESS REMOTE CONTROLS - PAIRING - EMERGENCY SHUTOFF

OPERATION

Operation with the emergency shutoff

1. Water Pump is off
2. Set wireless on ●
3. Press Wireless switch at master control panel.
4. Press WSO Enable on the wireless
 - a. Enable can only be cycled with water pump off. Once pump is on WSO enable is locked out, to avoid accidentally turning it off or on.

- b. ◇ Icon appears on the Display when Enabled

Note: FLXX-C - press both WSO buttons

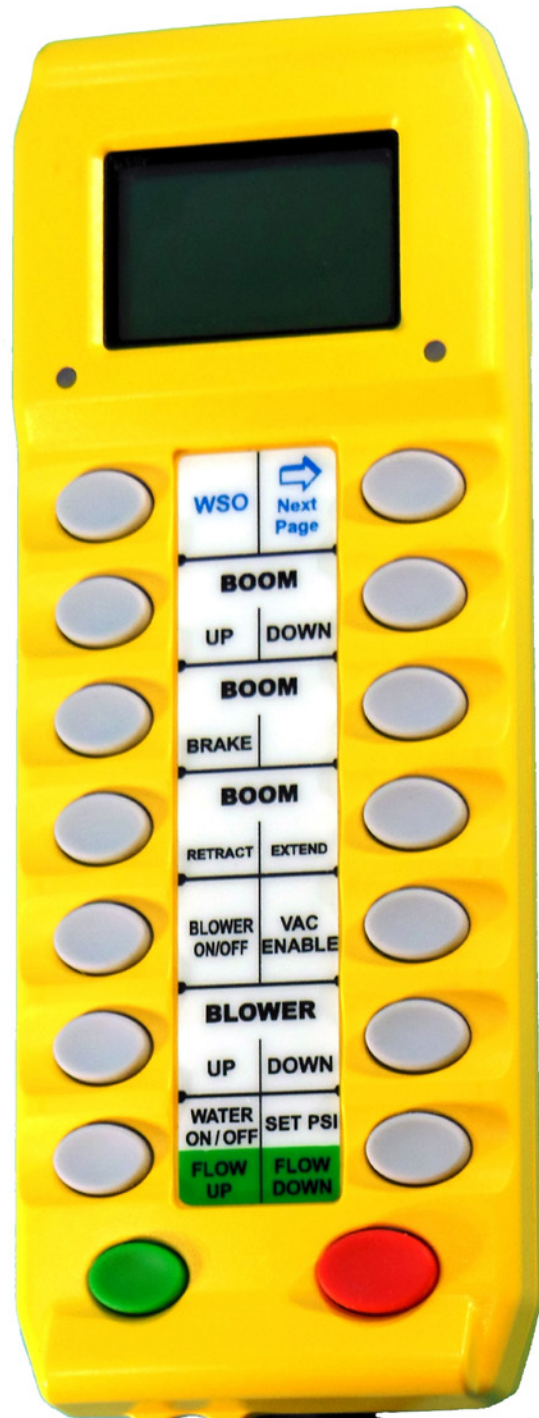
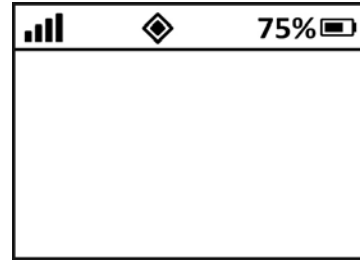
5. Connect WSO lanyard
 - a. WSO connected icon ◇ appears on the display
6. Set Water Pump On

Note: if the WSO lanyard is disconnected during operation, the water pump will turn off and center dot icon ◇ will disappear.

Only one WSO can be actively paired.

Operation without WSO

1. Water Pump is off
2. Set wireless on ●
3. Press Wireless switch at panel
4. Set Water Pump On



Hetronic ERGO S - TRUVAC

WIRELESS REMOTE - HETRONIC ERGO S HANDHELD

OPERATION



The handheld remote is a portable control used by the operator wirelessly. Actual configuration may vary with model and options. The function of the buttons normally mimic the master control panel unless otherwise noted here.

The buttons and joystick are momentary switches. Upon releasing the joystick, the boom will cease moving. Boom controls are proportional.

The E-stop button is used in case of an emergency by disengaging the PTOs/hydraulic system.

The common controls include:

- Debris Body Controls
- Boom Controls
- Vacuum Controls
- Water Pump - Pump ON/OFF
- Throttle - UP/DOWN
- Vibrator

WARNING

Unit operator must hold the remote during digging operations and stay within line of sight of the hose end operation. In an emergency, use the E-stop or pendant/remote to disable the PTOs/hydraulic system. Maintain clear access to all E-stops and place an operator near one.

Note: DO NOT remove USB cover or dongle that is inside the cover. This insures that the firmware stays with the remote and maintains its IP67 waterproof rating.



Hetronic ERGO S - TRUVAC

REMOTE - CONNECTING WIRELESS

OPERATION

Step 1: Pull out E-Stop button.



Step 4: Momentarily press the Pair button on the left side of the remote (screen will prompt when needed).



Step 2: Power on the remote by holding the Power (RPM+) button on the right side of the remote until the screen powers on.



To turn remote off:

- Push E-Stop button in
- Hold Power (RPM+) button until remote shuts down

Step 3: Engage Wireless Mode by pressing the WIRELESS switch located on the main control panel.



Hetronic ERGO S - TRUVAC

REMOTE - E-STOP

OPERATION

The E-Stop output from the Hetronic module (wireless receiver) is the source for the E-Stop circuit. This simplifies the E-Stop circuit and makes it easier to engage the wireless or remote without accidentally creating an E-Stop condition.

The following will trigger an E-stop:

- The remote off/E-stop button is pressed (remote E-Stop works any time remote is on and connected)
- The E-stop on the control panel is pressed (panel E-Stop works regardless of mode)
- The battery dies
- The wireless goes out of range

E-Stop

- 1 Press the red E-Stop button located on top of remote.
- 2 After pressing the E-Stop on the wireless remote, the following screen will display.
To return to work condition, do the following:
- 3 Pull out remote E-Stop button.
- 4 Press the Pair button when the screen prompts to do so.



2



Hetronic ERGO S - TRUVAC

REMOTE - BANNERS

OPERATION



**Mode Selection
Screen**



Controls Interlock Screen



**Standard Mode
Selection**

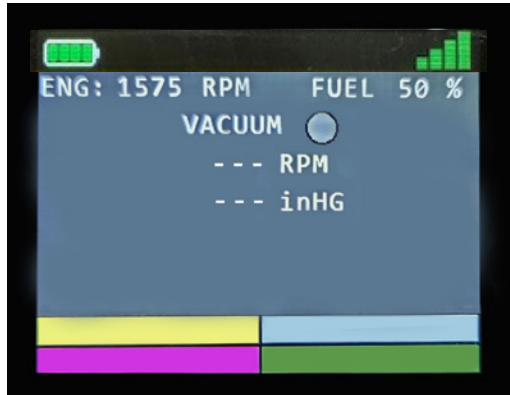


**Dump Controls Mode
Selection**

Hetronic ERGO S - TRUVAC

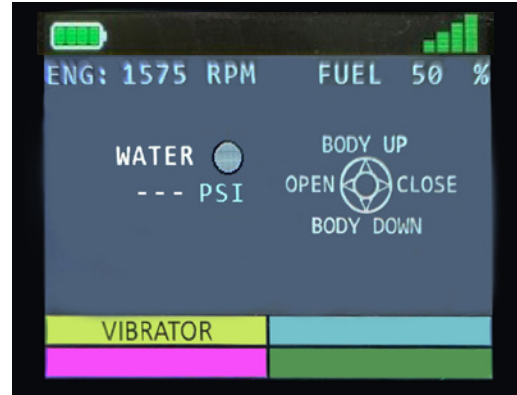
REMOTE - DISPLAYS

OPERATION



Vacuum Page Standard Mode

- Allows boom control via the boom joystick
- Displays vacuum data



Dump Controls Page Dumping Mode

- Allows debris body controls via the boom joystick

Hetronic ERGO S - TRUVAC

REMOTE FUNCTIONS - WATER AND VACUUM

OPERATION

To navigate between modes, press and hold the MODE button on the left side of the remote for 3 seconds.



Water

Note: Must be in Standard Mode (Water digging shown; Air option is available)

- 1 Press the WATER button to engage the Water Pump.
- 2 Press WATER button again to disengage Water Pump.



Button Functions

EXTEND - BOOM EXTEND

RETRACT - BOOM RETRACT

VAC - VACUUM RELIEF

WATER - WATER PUMP

Hetronic ERGO S - TRUVAC

REMOTE FUNCTIONS - DUMP CONTROLS

OPERATION

To navigate between modes, press and hold the MODE button on the left side of the remote for 3 seconds.



Dump Controls

Note: Must be in Dump Controls Mode

Controlling the debris body dumping functions is done using the joystick. Only one function is allowed at a time (cannot open rear door while raising the debris body). The PAGE/PAIR button must be held simultaneously when moving the joystick. This interlock function is designed to ensure that the body/door functions are not unintentionally activated.

Note: Joystick is not proportional for dump controls. It must be fully pressed in the desired direction for the function to operate



Joystick Functions

UP - BODY UP

DOWN - BODY DOWN

RIGHT - CLOSE REAR DOOR

LEFT - OPEN REAR DOOR

Button Functions

YELLOW - VIBRATOR

BLUE - N/A

PINK - N/A

GREEN - N/A

Hetronic ERGO S - TRUVAC

REMOTE - BATTERY REPLACEMENT AND STORAGE

OPERATION

Battery Pack

The battery is located in the bottom of the remote. If battery is pulled, the unit goes into E-Stop mode and must be reset from the control panel.



Press in and pull out battery

Note: If battery pack becomes broken, lost, or you would like to purchase additional packs, please contact Vector Parts & Service to order the battery pack:

Phone: 877-342-5374

Service Cloud: **Vector.com** > **Parts and Service** > scroll down to **Service Cloud**

Wired Pendant Cord

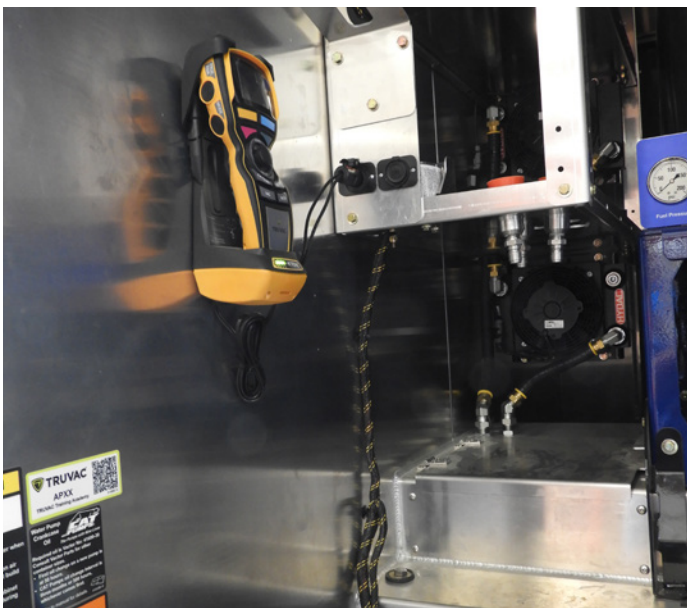
The remote can also be operated using a corded pendant insert. One end plugs into the battery compartment of the remote and the other plugs into the tether port, located on the main control panel.



Wireless Remote - Wired Pendant

- 1** Press in and pull out battery from bottom of remote.
- 2** Attach threaded end of cord connector to the Pendant port on the control panel.
- 3** Plug the battery insert end of the cable into the remote.
- 4** Press the WIRELESS switch.

Charging Dock



The debris body is a single cylindrical shell that can be hydraulically raised or lowered for the purpose of dumping material collected during operations. The debris body is the primary dropout point for any material vacuumed through the vacuum hose. Actual size and capacity will vary with the HXX model.

From the vacuum hose, debris flows into the body to the deflector plate, which separates debris from the airstream. The bulk of the debris falls to the bottom of the debris body. The air flows past the two float-ball vacuum shut-off valves to the cyclonic housing.

Float Balls

Float balls consist of a stainless steel ball suspended from the top of the debris tank. The ball is an automatic shut off. If the body fills with water the float balls block the air vents to stop suction and prevent flooding the blower/fan. The float balls only work on liquids.

As the debris body is filled with liquids, the float ball rises and will shut off the air flow to the blower/fan when the debris body is "full."

The floatballs may be encased inside an optional debris screen. The screen filters debris from the air before it exits the body to the blower/fan.

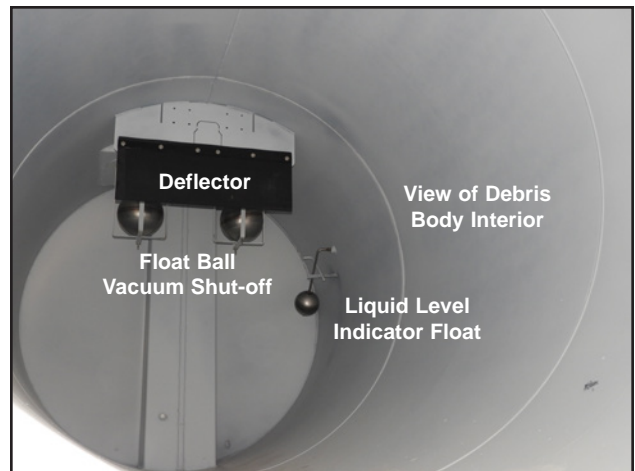
Clean the debris screens with the handgun **EVERY TIME** the debris body is dumped. It is important to keep these clean because debris clogged in the screen will result in a loss of airflow and productivity.

Checking the Debris Level

If the unit is equipped with an inspection port, the level of solid debris can be checked visually.

Visually keep track of how much material you vacuum, especially if the unit does not have an inspection port.

Check the level of liquid matter with the level indicator on the side of the debris body.



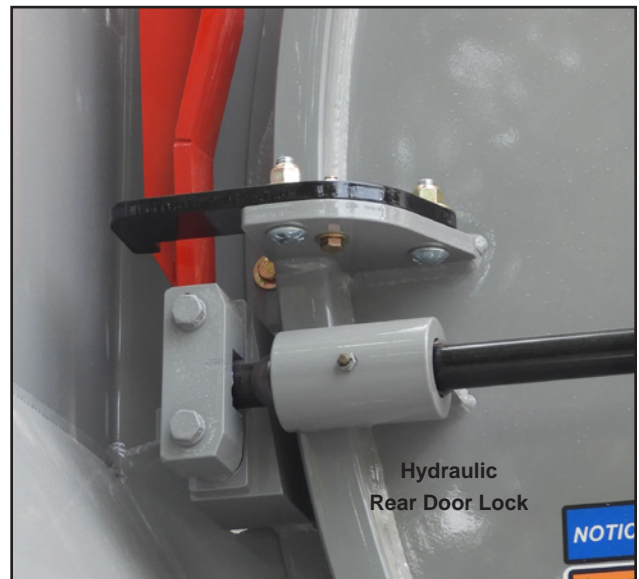
NOTICE

Never overfill the debris body. Do not exceed the GVWR (gross vehicle weight rating.)

The body is emptied by hydraulically raising the body and allowing the material to be dumped from the back by gravity. On the back of the debris body is the rear door with locks that opens to empty the debris body. The rear door is hydraulically opened and closed. The hydraulic system must be turned on for the rear door to open or close. The door is hinged from the top.

The rear door has a gasket around the perimeter to seal the debris body.

Note: The rear door seal gasket and corresponding surface of the debris body must be kept clean to ensure safe and adequate operation of the unit. This can be done with the handgun. Remember to always wipe the rear door clean before closing, to prevent accidental damage to the gasket from foreign material sticking to the body or the gasket.



The liquid level gauge is a float type gauge that indicates the level of liquids inside the debris body.

The lowest measurement indicates the debris body is about half full.

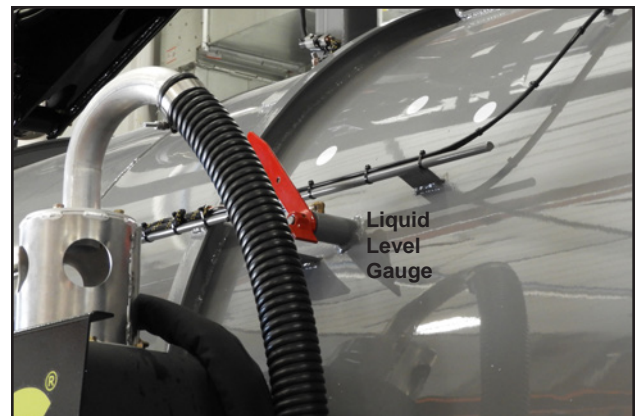
The highest mark indicates the debris body is full and should be decanted or dumped.

Note: Operators should not rely on it as the only indicator for dumping. It does not measure the level of dry debris and does not protect against weight limits.

NOTICE

Machine Can Be Damaged

- Beware of carry over material from debris body through the blower or fan.
- Running the blower/fan too fast with light material can carry the material over into the blower or fan. This can cause premature wear.
- Over filling the debris body can cause carry over and damage to the fan/blower.
- A build-up of material on the fan will cause an out-of-balance condition. Operating an out-of-balance fan can cause damage to the fan, fluid drive, spindle box or auxiliary engine. If necessary, remove the intake elbow for proper cleaning.



Located on the subframe is a body out-of-position sensor. This provides a way to notify the operator if the debris body is not all the way down. The debris body must be fully down before transit.

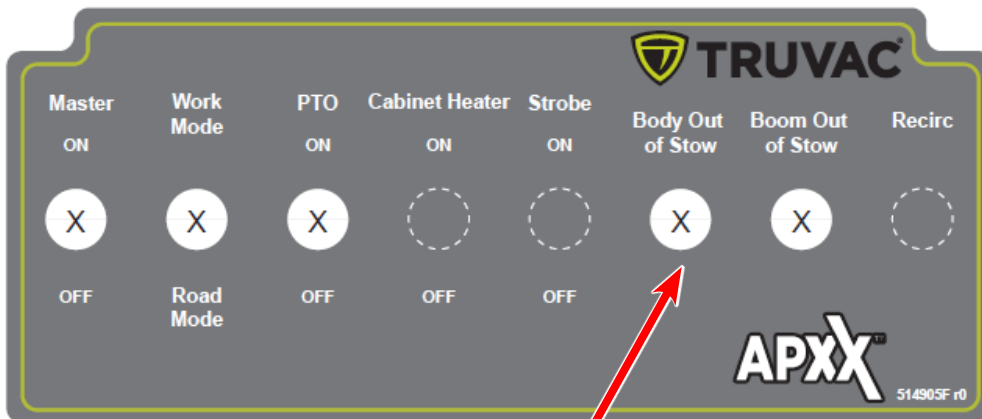
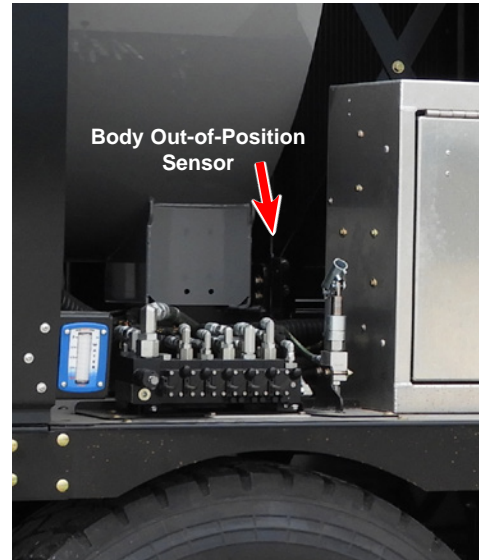
Functionality

Park Brake Set

1. Red light for body out-of-position illuminates

Park Brake Released

1. Red light for body out-of-position illuminates
2. Alarm sounds



Some units will have a vertical switch pad as shown to the right. Others will have the horizontal layout as shown above. Reference "Body Out of Stow" locations.

1



Decanting is the draining of excess liquids from the debris body, typically while at the job site. Fewer trips to the disposal site will be needed if the excess liquid is drained from the debris body at the job site. This also lightens the weight of the truck.

Decanting should be done at job site for several reasons.

Excessive weight can:

- Lead to fines.
- Cause material to carry over into blower or fan.

Various configurations are available. Decanting can be done from gravity or a pump off system.

Note: The decant valve cannot be used during vacuuming operations.

Always check local government laws, regulations and rules for decanting into sewers or catch basins.

The decant port allows liquid to be drained from the debris body.

First position the unit over the container or manhole. If not equipped with an optional valve turn on the vacuum system and operate in mid-range. Unfold the nylon flat-hose and let it hang down into the manhole opening. Turn off the vacuum to allow the liquids to flow out. If equipped with an optional valve open the valve and drain until complete and close the valve. If the drain port plugs with debris the vacuum system can be used to pull the debris clear of the port.

Be sure to check for overhead obstructions. If none, the hydraulic controls can be used to raise the debris body up to the height of the first stage of the hoist cylinder when the rear door is closed.

After the excessive liquid has drained, lower the debris body, refold the hose and place it back into its bracket.

Note: The vacuum system must be shut down to drain. Do not raise the debris body fully when decanting water. Material in the debris body can slide against the rear door and thereby shut off the decanting process.



WARNING

Crushing / Tipping Hazard

To avoid injury or death:

- Position unit on level stable ground.
- Open rear door before dumping.
- **NEVER** move the unit with the debris body in the up or raised position.



WARNING

Crushing Hazard

Unit can tip over when the body is raised while loaded. During decanting or offloading liquids only raise the body no more than three feet, enough to allow the liquid out and not plug the ports.

NEVER attempt to raise body when vehicle is on unlevel ground or in motion.

After decanting or offloading liquids, rear door **MUST BE** opened before the front of the body is 3 feet above the chassis frame.

Operator must remain at controls during all operations.

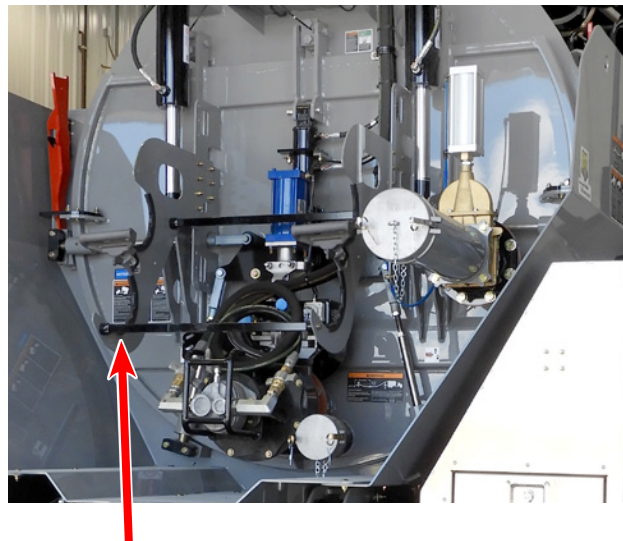


The rear door holds extra vacuum tubing needed in certain operations.

The vacuum pipe, or tube, is attached by quick clamps. The clamps lock by an over center action and should fit tightly.

Removing the Vacuum Pipes

The pipe racks are normally mounted on the rear door. Secure the pipes to the rack with the quick clamps.



**Vacuum Pipe
Storage
Rack**

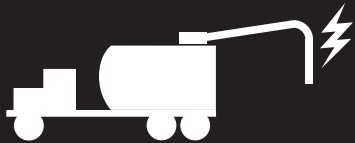
The make break permits the debris body to easily be raised without having to disconnect hoses to the boom and air system.

When the vacuum system is engaged for vacuuming, it is important the debris body and the inlet seal be in good shape and not leaking. If torn, dirty or not adjusted properly, loss of airflow at the end of the debris hose will result. The seal can be adjusted in order to compensate for wear.

See the maintenance section for the procedures to follow in making adjustments.



WARNING



Electrocution hazard

Serious injury or death can result from electrocution.

Check for overhead wires and obstructions before raising or moving boom. Do not leave boom raised while vehicle is unattended. Do not move vehicle unless boom is in travel mode. Do not allow boom to contact the vehicle or any obstruction.

Be aware of the vehicle's surroundings before operating any of the boom functions to prevent death, injury or equipment damage.

Refer to SAFETY section in manual.



1800149A rev A

NOTICE

Boom Can Be Damaged

This lift eye should only be used to lift and move manhole grates to 700 lbs max. weight. Break grates loose before lifting. Other use can damage the boom.

Refer to manual for details.



61924 rC

DANGER

Boom Can Injure or Kill

Always park the boom in travel mode before raising the debris body.

Misuse of boom, including contact with wires or other objects can cause serious injury or death.

Always be aware of the boom position in relation to over head wires, any obstruction (including the unit body) that may prevent proper movement of the boom.

SAFETY INSTRUCTIONS

Unit operator must hold the pendant/remote during vacuum operations and stay within line of sight of the hose end operation. In an emergency, use the E-stop or pendant/remote to disable the vacuum. Maintain clear access to all E-stops and place an operator near one.

NOTICE

Machine can be damaged

The boom operator must maintain a clear view of the boom during all movements to avoid striking the parts of the unit and surrounding structures.

NOTICE

Machine Can Be Damaged

If ice builds up in the boom, shut down the vacuum system. Use hot water to heat the boom tubes or move the vehicle to a warm place. Slowly retract the boom when the tubes have warmed up. Do not retract the boom with ice build up in the vacuum tube. Damage to the boom and/or seal can occur. If hot water is available, start the vacuum system and spray hot water into the vacuum tube/nozzle. As the ice breaks away it will be carried to the debris body.

The optional boom is stored in a cradle on top of the debris body. It is connected to the debris body at a pivot point near the rear center of the tank. See photo.

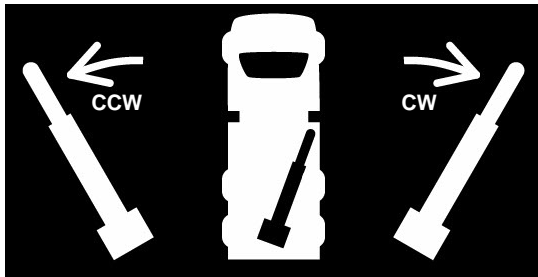
The boom swings from the passenger side around the rear of the unit until it reaches the driver side of the tank. Built in stops prevent it from going over the tank.

Boom Motion

All the boom's motions are controlled hydraulically. The boom can extend and retract, move up and down, and rotate with a hydraulic gear motor. The gear motor meshes with a gear on the bottom of the boom turret. Hydraulic oil flow to the gear motor is controlled by an electric over hydraulic solenoid operated by a switch on the various controls.

Boom Controls

The boom is operated by either a wired or wireless pendant.



The boom can rotate all the way around to the other side of the unit from the parked travel position. It can be raised or lowered or extended and retracted. When being extended or retracted the end hose slides along the trough at the end of the boom. The results in the hose end being raised as the boom extends or lowered as the boom retracts.

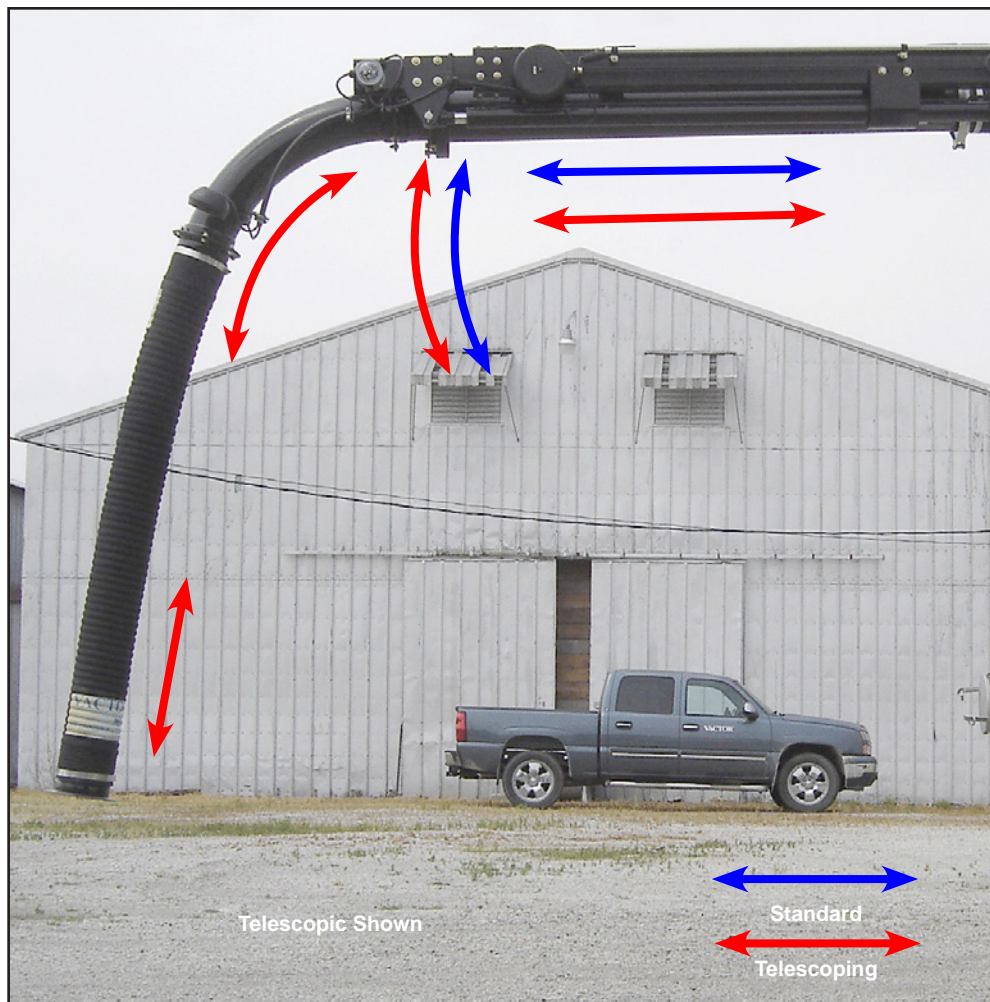
The optional telescopic boom is similar except that the boom hose moves with the end of the boom as it extend or retracts. This gives more precise control of the boom hose at the working end.

NOTICE

Boom Can Be Damaged

Never use the boom as a crane to lift loads, as it could bend the frame or strain and weaken the hinge points.

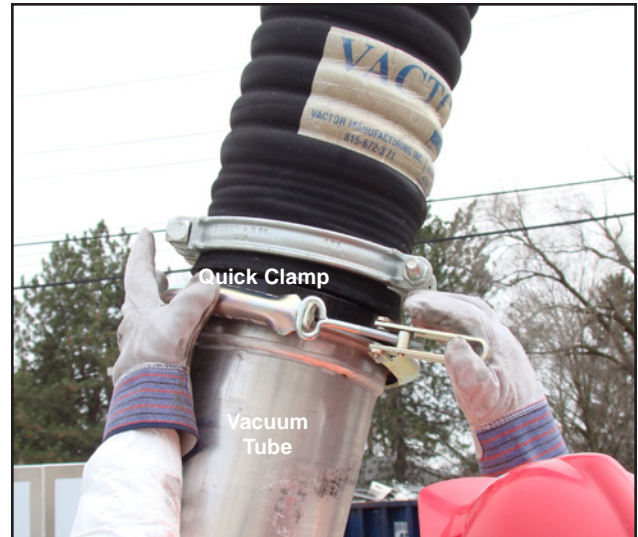
- Rope or other supports should be provided to support the run. Hose and tube assemblies are not intended to support their weight on vertical drops or runs up.
- Long hose/tube runs should be supported at multiple locations to prevent tip overs and connection failures.
- Hose and tubes can pull connections and hoses apart in operation from the added weight of the material being vacuumed.
- Inspect all connections prior to operation and periodically during operation.



The vacuum tube is maneuvered and controlled using the boom controls. The vacuum must be off when attaching or removing vacuum tubes.

1. Remove the boom from its stored position and swing boom from its stowed position into position.
2. Stand the nozzle on the ground.
3. Lower the boom until the vacuum tube and nozzle are joined.
4. Install the quick clamp to fasten the nozzle to the vacuum tube.

To remove the vacuum tube lower the end of the tube to the ground to relieve tension in the joint.



WARNING

Vacuum Hazard

Cutting, crushing, suffocation or body rupture from the forces of vacuum could result in serious injury or death.

Stay clear of the suction hose inlet end.

Turn vacuum off before attaching hose, pipe or accessories.

Keep suction hose inlet end near ground level when vacuum is operating.

Refer to **SAFETY** manual for details.



ADVERTENCIA

Riesgo Por Altovació

Trituración, asfixia, amputación o desgarre corporal por las fuerzas altovació pudieran resultar en lesiones serias o mortales.

Manténgase lejos de la boquilla de la manguera de succión.

Apague el compresor de altovació antes de conectar la manguera, tubos o accesorios.

Mantenga el extremo de la manguera de succión cerca del nivel del suelo cuando esté funcionando el compresor de altovació.

Refiérase a la sección de **SEGURIDAD** en el manual para detalles.



1800174

The pendant is a portable control used by the operator to direct the operation of the boom among other operations. Actual configuration may vary with model and options. The function of the buttons normally mimic the master control panel unless otherwise noted here.

The joystick is a momentary switch and upon releasing the button, the boom will cease moving.

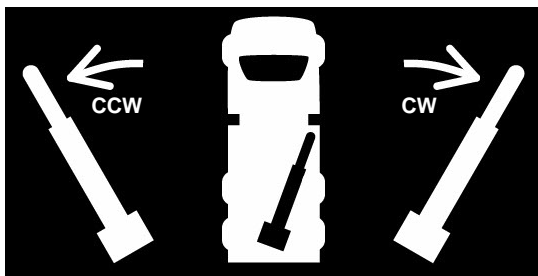
The vacuum relief on/off button relieves the air flow at the boom inlet in an emergency.

Units normally come equipped with a wireless remote and **wireless** emergency **shutoff** wrist strap (WSO).

The ring on the wireless remote and wireless emergency shutoff is normally attached to the lance and the module to one of the operator's arms. If the operator loses control of the lance the attached cord will trigger the wireless emergency shutoff.

SAFETY INSTRUCTIONS

Unit operator must hold the pendant/remote during vacuum operations and stay within line of sight of the hose end operation. In an emergency, use the E-stop or pendant/remote to disable the vacuum. Maintain clear access to all E-stops and place an operator near one.

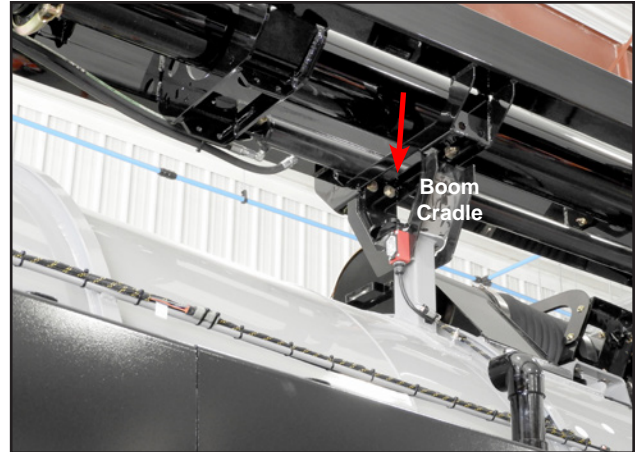


To take the boom out of its stored position, the boom must be raised slightly to clear the boom cradle that it rests upon. Once clear of the cradle, it can be raised, lowered or rotated horizontally. Further it can be extended or retracted as circumstances dictate.

Storing the Boom

The boom must be lowered and parked in the boom cradle for transport. Swing it into position over the top of the tank and allow it to seat in the boom cradle. Lower the boom, until it firmly rests in the cradle. While lowering the end of the hose should be guided onto the hose keeper.

Note: Rotate the boom out about three feet before raising the debris body to keep the hose end from rubbing on the silencer.



⚠ WARNING

Vacuum Hazard

Cutting, crushing, suffocation or body rupture from the forces of vacuum could result in serious injury or death.

Stay clear of the suction hose inlet end.

Turn vacuum off before attaching hose, pipe or accessories.

Keep suction hose inlet end near ground level when vacuum is operating.

Refer to SAFETY manual for details.



⚠ ADVERTENCIA

Riesgo Por Altvacío

Trituración, asfixia, amputación o desgarre corporal por las fuerzas altvacío pudieran resultar en lesiones serias o mortales.

Manténgase lejos de la boquilla de la manguera de succión.

Apague el compresor de altvacío antes de conectar la manguera, tubos o accesorios.

Mantenga el extremo de la manguera de succión cerca del nivel del suelo cuando esté funcionando el compresor de altvacío.

Refiérase a la sección de SEGURIDAD en el manual para detalles.



1800174

Located on the boom cradle is a boom out-of-position sensor. This provides a way to notify the operator if the boom is not in its stowed position. The boom must be stowed before transit.

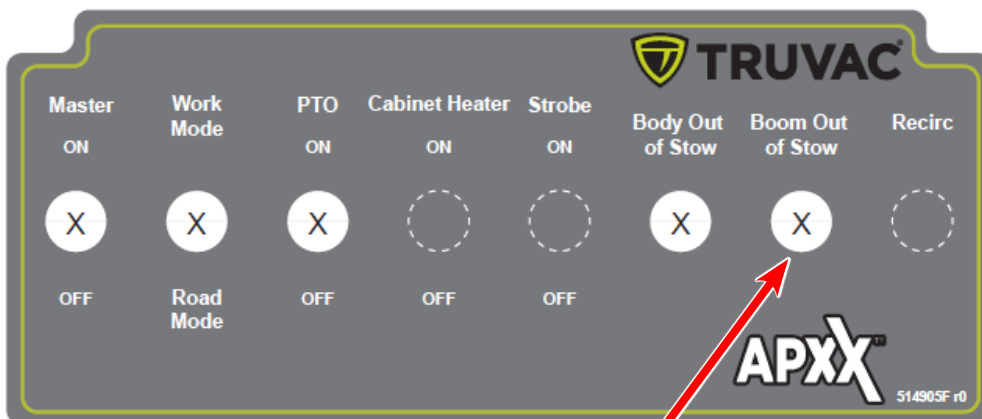
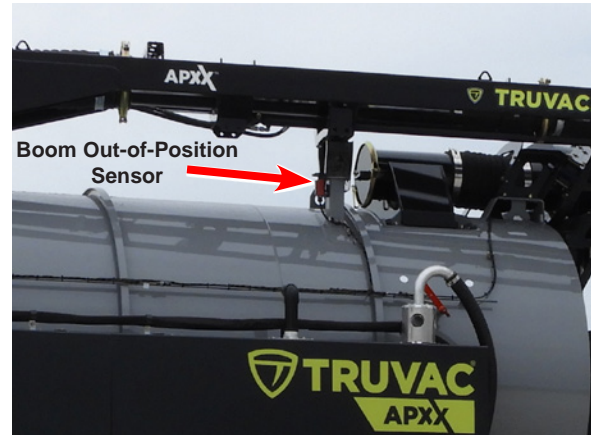
Functionality

Park Brake Set

1. Red light for boom out-of-position illuminates

Park Brake Released

1. Red light for boom out-of-position illuminates
2. Alarm sounds



Some units will have a vertical switch pad as shown to the right. Others will have the horizontal layout as shown above. Reference "Boom Out of Stow" locations.

1



Inspect all vacuum hoses, tubes and connectors before each use. Leaks reduce vacuum efficiency and may result in spills.

1. Dents or kinks in the hose reduce air flow.
2. Do not pile hose as the weight of the piled hose can crush or kink it.
3. Always use the correct hose clamp for the hose. Vactor recommends common cream type hand cleaner as a lubricant to assemble hose to the fittings. Do not use grease as it may allow the hose to pull off the fitting much easier.
4. Route hose away from traffic other work to avoid damage.
5. Verify the hose is suitable for the material and temperatures being vacuumed.
6. Store hose in a cool, dry, dark and clean place.
7. Verify all electrical connections are good for proper static protection.

Vacuum line routing

Generally the shorter the run the better. Large easy curves reduce wear on the hose. Eliminate unnecessary bends or turns. Eliminate as much corrugated hose as possible as it lessens vacuum efficiency. Use as short and direct a route as possible. Rotating the hose regularly will also increase the usable life. The hose run should be well supported without any large sags when crossing open areas.

Hose and tube assemblies are not intended to support their weight on vertical drops or runs up. Rope or other supports should be provided to support the run. The assembly should be supported at multiple locations so it can not tip over if a connection should become disconnected. In operation the added weight of the material being vacuumed along with the hose and tubes can pull connections and hoses apart.

Generally, the hose diameter should be larger than the maximum lump size handled. For heavy materials, the larger hose diameters provide more efficient pneumatic conveying and also can handle higher blower speeds for additional carrier air volume.

Use as large a tubing as possible. Light weight, smooth, bore flexible hose is recommended at the working end. Use rigid, aluminum tubes for longer runs, this reduces losses due to friction and have a longer life.

Do not reduce the diameter of hose in the middle of a run. For example 8" from the unit for 100 feet then reduced to 4" for 20 feet then back up to 6" for 50 feet. The change in air flow and velocity can result in debris plugging the hose closest to the unit.



If a smaller hose is needed, install a reducer at the truck and run the smaller hose all the way through. Use the largest size that can be handled safely and easily.

Always use a vacuum nozzle at the working end of the tube.

Before connecting the last section of hosing, install the in-line vacuum relief valve. Leave the in-line vacuum relief valve open until vacuum operations are ready to begin.



Shown is an example of a good vacuum hose run. The hose is the same size from the truck to the hose end. The Safety tee is located for good operator access and a hose end is being used.

Multiple Hose Runs

Multiple lines should all be the same length.

Three 2" hoses = 4" hose run

Nine 2" hoses = 6" hose run

Four 3" hoses equals 6" hose run

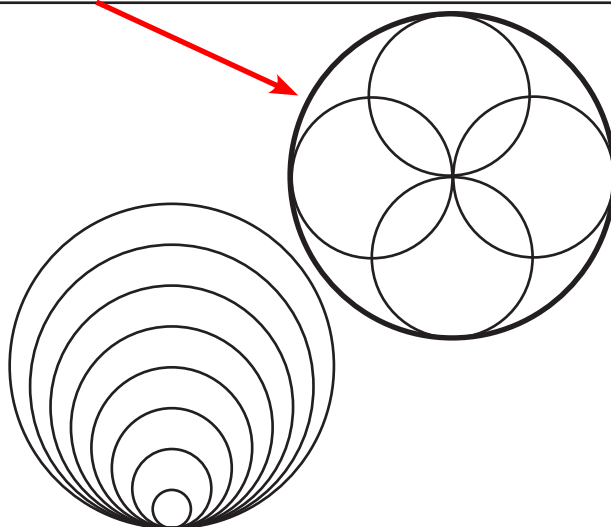
Two 4" hoses equals 6" hose run

Sixteen 2" hoses = 8" hose run

Seven 3" hoses = 8" hose run

Four 4" hoses equals 8" hose run

Hose Restriction				
Hose Dia. Inches	Hose Area square/inches	Orifice Area	Orifice Area	Orifice Area
8	50.3	100.0%		
7	38.5	76.6%		
6	28.3	56.3%	100.0%	
5	19.6	39.1%	69.4%	
4	12.6	25.0%	44.4%	100.0%
3	7.1	14.1%	25.0%	56.3%
2	3.1	6.3%	11.1%	25.0%
1	0.8	1.6%	2.8%	6.3%



Overview

Vacuum relief valves are installed on vacuum trucks that use positive displacement vacuum pumps. The blowers require free air for start up to prevent overloading the drive engine, and for shutdown to prevent reversal damage to the blower and drive engine. Hand operated and operator triggered (air actuator, etc.) automatically operated valves are the two styles typically used. Lower vacuum units are also equipped with spring loaded automatic relief valves to protect the blower by limiting the vacuum level.

Vacuum reliefs are normally labeled enable/disable.



Application on PD blower vacuum trucks

Vacuum relief valves are not meant to be a substitute for the safety tee during most vacuum operations. Operators of PD blower vacuum trucks are typically working close to the hose ends and can become entrapped. In most situations a safety tee is required and the operator and/or their observer would release the safety tee to relieve the system vacuum in an emergency.

In applications where the hose is supported vertically from a boom and the operator does NOT manually manipulate the hose, a safety tee is not practical nor necessary.

High vacuum PD blower trucks are typically equipped with a hand operated vacuum relief valve so that the valve can be throttled to control the amount of fresh air allowed into the system. This feature is usually used to control the air temperature while vacuuming hot materials to prevent overheating the vacuum pump.

Most PD blower trucks are equipped with an operator triggered vacuum relief valve. This is usually a large valve located near the vacuum pump inlet. All units require that this valve be open during startup to prevent the drive engine from stalling. It is also opened before shutdown so that the system vacuum does not attempt to reverse the airflow through the vacuum pump. Reversed flow can damage the vacuum pump, drive engine and drivelines. They are also used to quickly relieve system vacuum to correct hose blockage or other emergency situations.

Application on sewer cleaner vacuum systems

Sewer cleaner vacuum systems that use positive displacement vacuum pumps are equipped with an operator triggered vacuum relief valve. The main purpose in these applications is to quickly relieve system vacuum to correct hose blockage or other emergency situations. Typical sewer cleaner operations do not expose the operator to the vacuum hose inlet end as the hose end is normally in a confined space such as a manhole or catch basin. A safety tee is required when vacuuming any time the operator is exposed to the hose inlet end. Hand operated valves are not normally found on sewer cleaner vacuum systems as hot materials are usually not vacuumed. High vacuum sewer cleaners normally have an operator triggered vacuum relief system standard.

PD versus Fan vacuum relief operation

The method for disabling the vacuum is different on Fan and PD units.

On a FAN unit the inlet to the fan will be blocked off. This stops the flow of air from the debris body into the fan and therefore stops the flow of air from the hose into the debris body. A smaller valve opens at the same time to relieve the debris body vacuum.

On a PD unit the inlet to the blower is opened to external air, providing a path of least resistance for air into the blower. This stops the flow of air from the debris body into the blower and therefore stops the flow of air from the hose into the debris body.

The air operated vacuum valve is used to relieve the system if the vacuum hose, debris body or inlet filter become plugged or restricted. These valves are on all blower units. The valves are normally operated by a switch or E-stop button located on the master control panel, pendant, or wireless remote (if equipped). Proper operation should be verified daily while under vacuum. Actual location size and configuration of the valve varies by the model and options. Typical location is in the inlet piping of the blower.

Vacuum valves require regular inspection and periodic cleaning. Develop a regular program of visual inspection, looking for clogged drains and discharge pipe, dirt buildup in and around the valve seat, and broken or missing parts. Keep the valve and the area around the valve clean and free of any foreign material or substance.

⚠ Use proper hearing protection when in the vicinity of this device which emits a loud, sharp sound. Follow safety precautions to prevent injury from high velocity flow of materials.

Note: Keep foreign material from entering the valve. Never paint, oil, or otherwise cover any interior or working parts of any safety valve; safety valves do not require any lubrication or protective coating to work properly.

Note: Test all vacuum valves to ensure proper valve operation.

The switch controls an air valve which sends air pressure to the valve either opening or closing, whichever is selected. The vacuum valve needs to be closed for normal vacuuming using the boom and debris hose. When the vacuum valve is opened, air flow to the boom and debris hose is stopped.

The vacuum valve normally defaults to the disabled (valve open) position when the master switch is off, E-stop is activated or the unit is shut down. Verify how the vacuum valves operate on the unit before use.



The filtration system cleans the air coming into the system by removing dirt, dust and foreign matter. The filtration system's primary purpose is to protect the blower by removing material from the air stream before it reaches the blower. Fan units do not require the same degree of filtration.

There are four stages to the filtration system:

- First Stage: Debris body Collection
- Second Stage: Cyclone Filter
- Third Stage: Filter Element
- Fourth Stage: Strainer

Waste material first enters the Hydro-Excavator through the boom located on top of the debris body.

- 1 When material enters the debris body, the transition from a hose to the larger debris body causes the air speed to drop considerably. The incoming air strikes a specially designed deflector plate that directs the material flow downward.

The deflector plate knocks the bulk of the material out of the airstream and it falls to the floor of the debris body. The deflector plate is located inside the rear and at the top of the body. In the body, the air travel is slowed as it goes through it to the other end and leaves the debris body. The now slower airflow cannot sustain the debris in the air and the material falls into the body. This is the first of four stages of filtration.

- 2 Any lighter, powdery material still suspended in the airflow is conveyed to the cyclone chambers, the second filtration stage. There, due to the forced centrifugal action of the flow, most of the dust particles separate and collect in the dead air space of the hopper. By this stage of filtration, about 96% of the material has dropped out of the airflow. The air flows into the secondary prefilter or cyclone chamber. In the filter chamber, centrifugal force hurls the denser

particles toward the cyclone walls where they spiral downward into the collection hopper.

- 3 The lighter and by now relatively particle-free air is directed to the filter element.
- 4 The air stream leaves the filter element and enters the strainer section of the housing. It is the safety dropout point for any objects which may accidentally enter the filtration system. Finally, the air passes through the vacuum pump (blower) or fan.
- 5 The air passes out through the silencers.



Air leaving the float-ball vacuum shut-off in the debris body enters a cyclone housing. It protects the blower by removing material from the air stream before it reaches the blower.

Debris collects in the bottom of the cyclone and is removed through the clean-out port access door.

The vacuum filtration system requires some specific cleaning for optimal operation. The cyclones need to be cleaned when a job is completed, the unit will be driven and parked between work, or there will be more than a shift of downtime between work.

Some special conditions may require more frequent cleaning, such as high humidity combined with certain materials.

Access to the interior of the cyclone for cleaning purposes can be gained through the top and bottom. From the top of the cyclone, material and debris can be swept into the clean out ports along the perimeter of the housing. The clean out ports are openings in the top of the cyclone that allow debris to fall to the bottom of the cyclone for later removal. At the bottom of the cyclone housing, the access door can be opened and the material that has fallen and collected in the bottom of the housing can be completely removed.

After each operation clean and wipe down the access door on top of the cyclone, the door gasket and its mating surface.

Cleaning The Cyclones

Debris collects in the bottom of the cyclones. It is removed through the clean-out port access door. Clean it out daily.

1. Standing to the side, open the clean out port.
2. Remove any debris.
4. Close and secure the access door.

Note: When swinging the bottom access door open, it is advisable to stand to the side opposite of the opening. When the door is opened, excess material may be released.



From the cyclone outlet, air enters the strainer housing. The strainers are perforated screen filters located on the intake side of the blower. Their purpose is to prevent any objects or foreign matter that have entered the system from reaching the blower. The strainers are covered by an automotive style air filter element.

The air filters and strainers should be checked before each and every operation. Follow this procedure.

Draining - Service Daily

A drain plug is provided at the bottom of the strainer to drain any excess moisture that has collected in the strainer during operations. It is plugged during normal operations. At the end of each day, the drain plug should be removed to drain the water and left open until the next use.

The strainers should be checked daily.

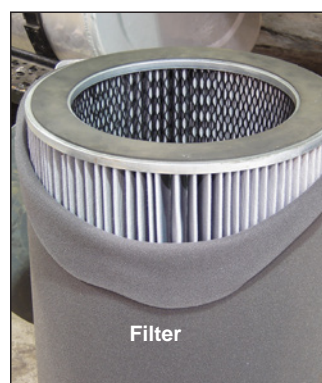
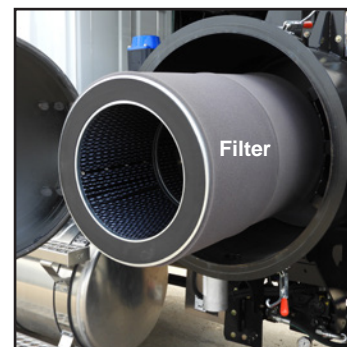
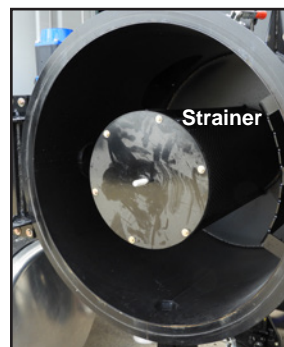
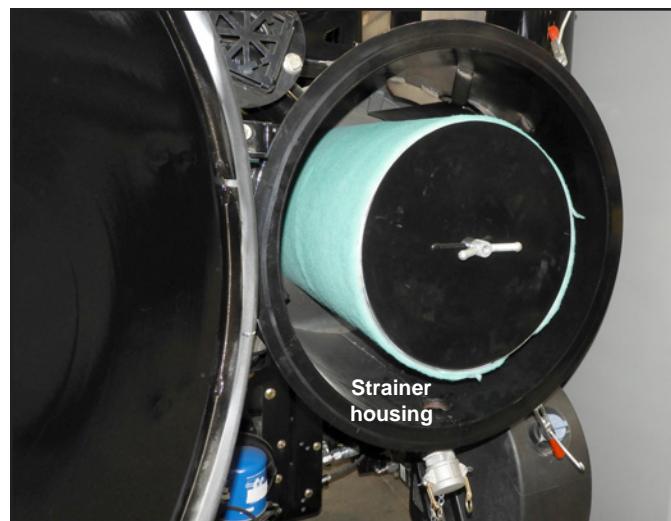
Cleaning the air filter and strainer and removing foreign matter.

1. Unlatched and swing the door open.
2. Remove wingnut securing each filter. Remove the upper filter first to avoid debris falling into the lower strainer.
3. Inspect the filter and remove any foreign matter or substance and clean if necessary.

The outer foam element can be removed for cleaning. The elements may be washed in warm soapy water, vacuumed, gently blown out or replaced. The filter should be dry before reinstallation.

Note: During initial start up of normal operations with a new filter, note the vacuum level with the air operated vacuum relief open. The filter should be cleaned or replaced when the vacuum level increases about 1 in-Hg above the initial clean filter level with the air operated vacuum relief open.

4. With the filter removed, inspect the interior of the strainer housing and remove any foreign matter or substance with a shop vacuum, and clean if necessary.
5. While the filter is removed, drain any moisture from the strainer housing by opening both drains located at the bottom of the strainer.



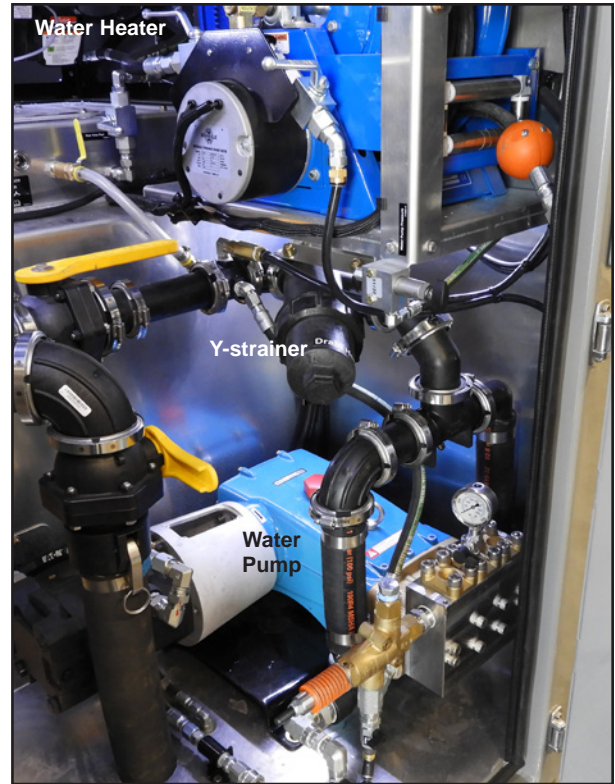
6. After the moisture has completely drained from the housing, close the drain and place the filters back in the housing in the same manner as it was removed. Apply some anti-seize grease to the wingnut threads for easier removal.
7. Close the strainer door and securely latch it.

Water is held in the water tank. It can be heated with the optional water heater for clay or cold weather applications.

Note: recirculator is used to keep it from freezing and to maintain a consistent temperature water.

Water is pumped out under pressure through a hose to the handgun or wand. The high pressure water is used to cut up soil into chunks small enough to fit in the vacuum hose.

The water system on this unit consists of a water tank, water filter, water pump, hose reel(s), a water heater, various size hoses with quick disconnect couplers, and ball valves. The various size hoses with quick couplers allows for easy connecting and disconnecting of the different systems for draining and storage.



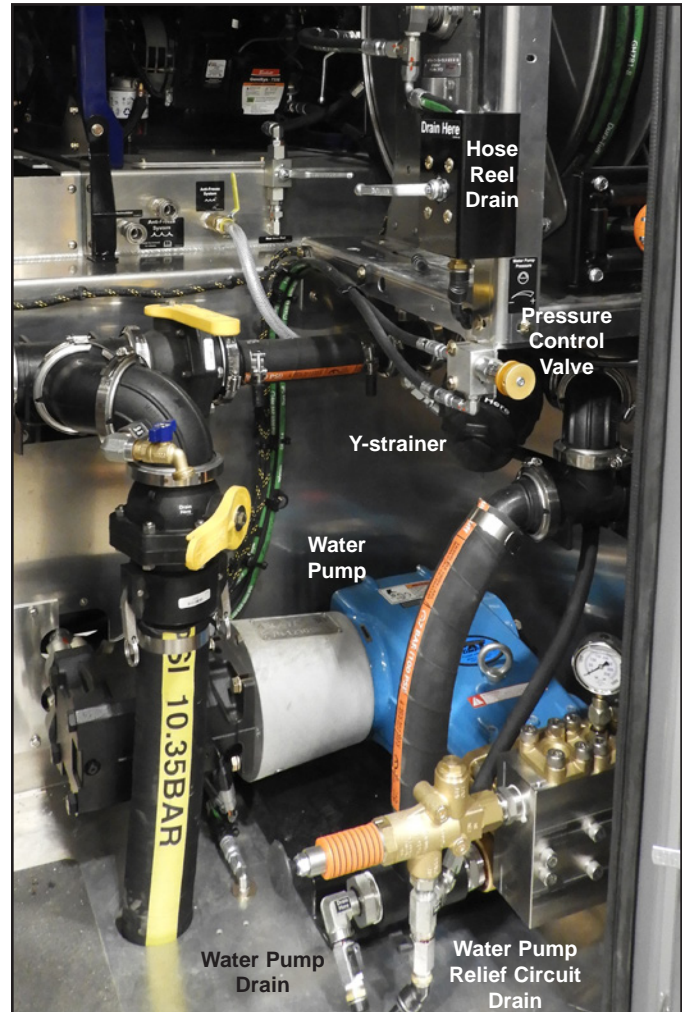
The standard water pump on this unit is capable of producing 10 gallons a minute (20GPM optional) at 3000 PSI. It is pressure compensated to ensure the operator achieves maximum performance with a variety of water nozzles.

The water pump is controlled by a manually operated pressure control valve located above the water pump inside of the cross cabinet. When the water pump switch is activated after the master control switch has been turned on, the pump pressure defaults to the control valve setting.

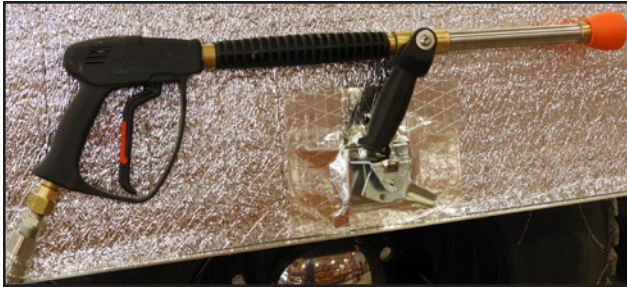
The water pump is hydraulically driven. Follow the step by step instructions located in the cab of the truck for proper engagement of the hydraulics. Prior to engaging the water pump, connect the hose reel hose to a water hand gun, a water wand or the recirculator.

Note: Good practice is to fill water system to full prior to connecting or turning on the water heater or water pump. Water suction ball valve should be open as well. The water heater will not fire if there is no water flow. See water heater instructions for proper operation of the water heater. Verify water flows through the system, water pump and handgun/lance nozzle before operating the water heater.

Once the hydraulics are engaged and all of the water hoses connected, turn the water pump switch to the ON position. Adjust the proportional valve (located above the water pump) to achieve the desired pressure. Flow will be in relation to the pressure setting, along with the nozzle being used.



This unit is equipped with a high pressure handgun. The high pressure handgun can only be connected to the hose reel located in the water pump cabinet. The high pressure water system uses up to the full water pump pressure of 3000 psi and can only be used with the special high pressure handgun, or a high pressure wand.



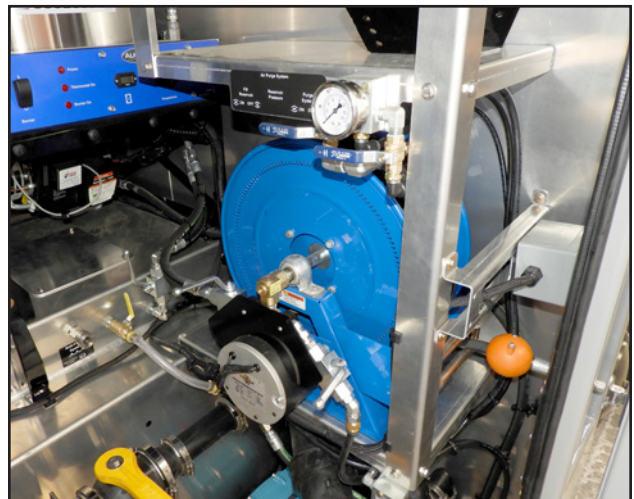
! WARNING

Handguns Use High Pressure Water

High pressure water can cause serious injury or death.



- Wear appropriate safety equipment including: Waterproof apparel, protective boots, insulated gloves, safety glasses or goggles, hearing protection (ear plugs and/or ear muffs) and a hard hat with a face shield.
- Never point the handgun at or near a person or animal.
- Bleed pressure from handgun by shutting off water pump pressure and pressing the trigger before disconnecting from high pressure connection.
- Use handgun and connection supplied with the unit; never use common low pressure handguns or connectors with the high pressure system.



Digging Faster With Less Water



The new HXXpose™ nozzle from Vactor blasts with a 0 degree stream of water up to 3000 PSI while rotating at a high speed to provide an 18 degree cone of coverage.

Productive:

- Ideal for potholing. The rotating water jet agitates a larger area of soil with the same amount of water as a straight jet nozzle for higher efficiency.

**Rugged:**

- High wear resistance tungsten carbide internals
- 1/2 inch FNPT stainless steel casing for corrosion resistance

Safer:

- Urethane outer coating protects from electrical conduction

Specifications:

Minimum Inlet Pressure: 1,000 PSI (69 bar)
Maximum Inlet Pressure: 3,000 PSI (207 bar)
Maximum Water Temperature: 180 degrees F (82 degrees C)
Housing Material: Stainless Steel
Coating Material: Urethane
Nozzle Tip Material: Tungsten Carbide
Inlet Connection Thread: 1/2 inch FNPT

Rebuild kits available



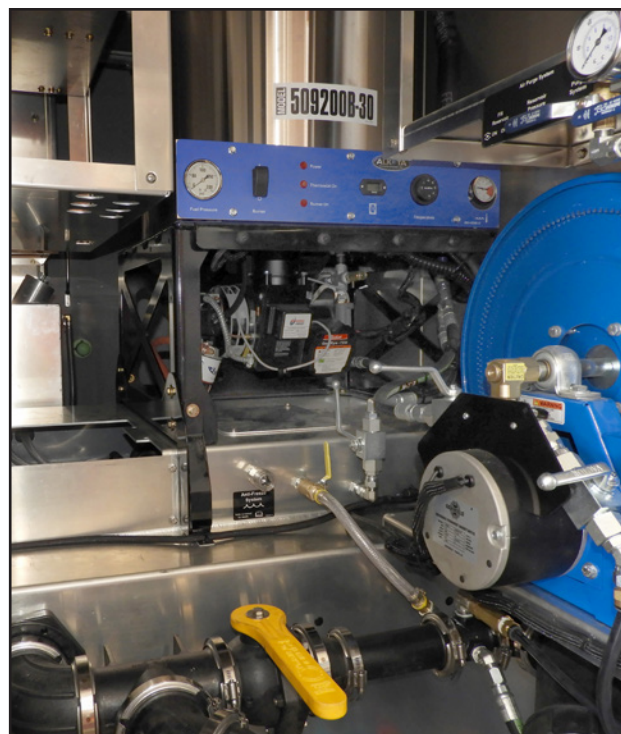
The APXX is equipped with the following nozzles:

1. 6 gpm
2. 8 gpm
3. 16 gpm
4. #10 Rotating Nozzle

The optional water heater is used for winter operation and in clay applications. Complete all necessary hose connections prior to turning on the water heater. Follow the supplied detailed instructions for the water heater supplied by the manufacturer of the water heater. Further operating instructions are supplied for the heater in the Options section.

Note: The 400K BTU water heater must have 3 gpm of water flow before it will ignite. The 800K BTU water heater must have 8 gpm of water flow before it will ignite. Heater controls are located below the heater.

The temperature gauge and heater settings are in Fahrenheit. Do not set temperature above 180° Fahrenheit.



WARNING

Hot Water Can Burn

Avoid contact with the water stream. The water heater can produce water at temperatures greater than 125° (F). and could result in death or serious injury from burns.



If the unit is equipped with the recirculator option, water can be recirculated through the water tanks, suction plumbing, and pressure side of the system to reduce risk of freezing. This function can be operated in stationary or mobile applications.

The adjacent picture shows where the hose reel, and supplied ball valve assembly, connects to the recirculator system. The water pump manual control valve will be non-functional during recirculator operation.

If the unit is equipped with a water heater, onboard water can also be pre-heated while unit is stationary. This function is separate from the recirculator option. The water heater cannot be used in conjunction with the recirculator. Pre-heated water can aid in cold weather applications, digging in certain soil types, and cleaning the APXX unit. At no point should the water temperature exceed 100°F/38°C.

Preheat - Stationary Only

In-Cab

1. Apply parking brake.
2. Fill water tanks.
3. Set Master switch to ON.
4. Depress clutch (manual trans only).
5. Set PTO switch to ON (Mode button).
6. Release clutch (manual trans only).

At Pump

1. Connect water hose to recirculator return line.
2. Set Water Pump switch to ON.
3. Set Boiler switch to ON and set temperature.

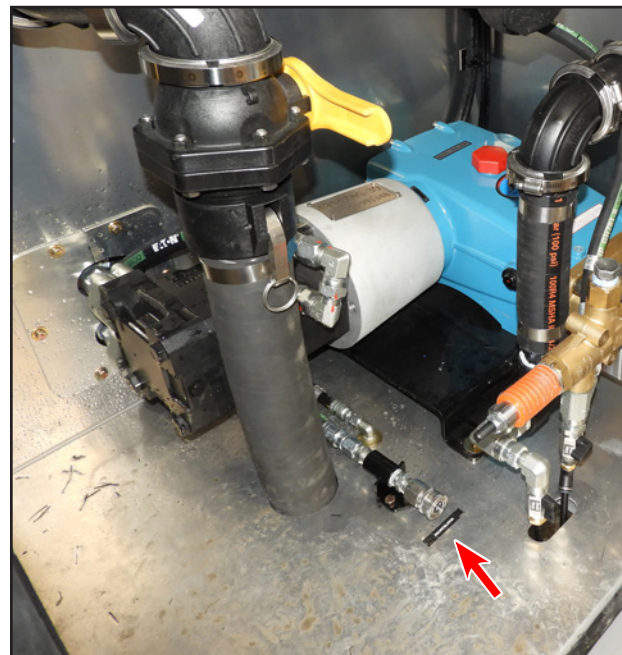
Note: Water must not be heated above 100°F/38°C.

NOTICE

Fire hazard

Do not use water heater when unit is in motion.

For proper combustion air flow and to avoid fuel build up the unit must be stationary and the cabinet door must be open during operation.



Recirculator Mode

1. Fill water tanks
2. Set to neutral and apply parking brake
3. Master switch to ON
4. Connect water hose to recirculator return line
5. Set water system to minimum pressure
6. Open hose reel ball valve
7. Set Mode button or set PTO switch to ON for manual transmissions
8. Set in cab Recirc switch to ON. Recirc switch will lite when pump is enabled
9. Release parking brake to drive

Exit Recirculator Mode to Work Mode

1. Set in cab Recirc switch to OFF
2. Follow instructions for desired mode

Refer to manual for details.



514660 rA

The air purge system uses compressed air to remove water from the water lines, hoses and some components prior to storage in cold weather. The controls are located inside the water pump cabinet.

Air from the chassis reservoir is used to pressurize an auxiliary air tank. An air protection valve located on the chassis reservoir protects the brake system. If air pressure in the chassis reservoir drops to a critical level, the protection valve closes to protect the brake system air pressure. The brake system has priority over any auxiliary components. As added protection, a check valve in the purge system allows air to flow into the water system but prevents water from entering the air system.

Note: It **IS** be necessary to refill the auxiliary tank multiple times to completely purge the water system.

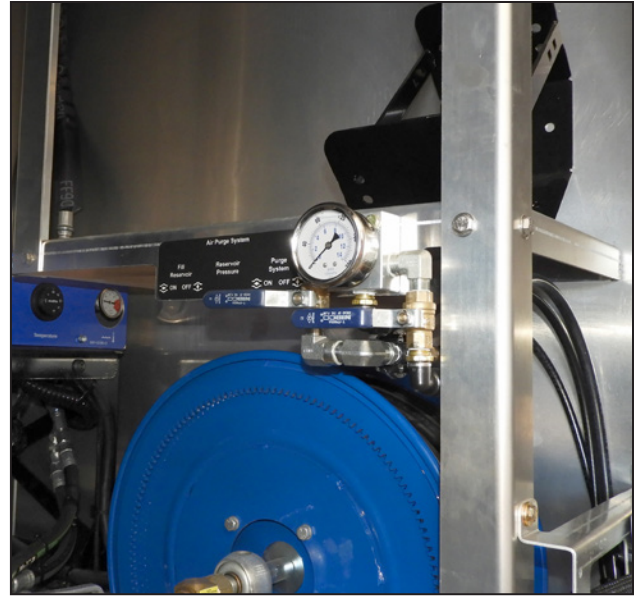
Purge the water system:

Follow the steps indicated below after each use for winterizing the water system.

If the unit is equipped with dual hose reels, the rear reel should be purged first. Isolate the front reel, purge the rear, then isolate the rear reel and purge the front reel.

Note: The water tank shut off valve should be closed. Refer to the water tank pages in this section.

1. Disconnect the ball valve assembly from the end of the hose reel hose so the male end of quick disconnect is open to allow the purge air to flow freely.
2. Pull all the hose off the hose reel and lay it flat on the ground to gravity assist the water bleeding process.
3. Verify hose end is pointed to a clear area to allow for residual water to be purged.
4. If single hose reel, ensure water pump drain valves are closed, to isolate reel.
5. Open the ball valve on the Air Purge panel marked FILL RESERVOIR, to charge. Close the ball valve when gauge shows 100psi.
6. Open the ball valve marked PURGE SYSTEM. Allow the air pressure to drop to 15psi. Close ball valve. Recharge tank to 100psi and repeat purging until all the water is drained from the reel(s).
7. Open two drain valves on the water pump, and isolate water pump from reels by closing shut off valves. If single reel, re-attach ball valve assembly to end of reel and close valve.



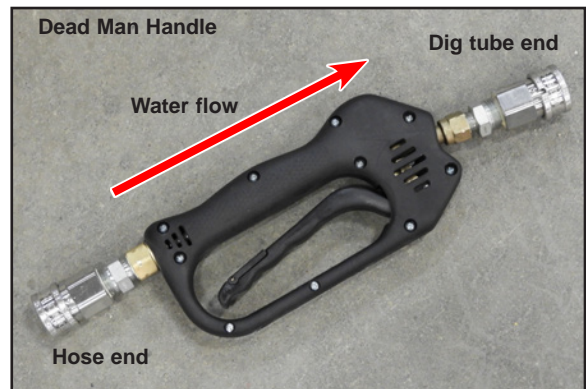
8. Activate the water pump not more than 5 seconds, without water on, at lowest speed.
9. Repeat charge and discharge process to purge water from water pump, expelling through lower two pump drains.
10. Place the FILL RESERVOIR and PURGE SYSTEM ball valves in the OFF position.
11. Allow the hose to go back on the hose reel(s) slowly. This will ensure all water has been drained from hose.
12. Remove Y-strainer.

Note: After the system is purged, open all drain and shutoff valves before storage or transport.

Various digging lance packages are available. All use the dead man handle to control flow to the nozzle. The dig tubes and nozzles are connected with quick couplers. Multiple tubes can be used for a longer reach as needed.

Note: Always connect the trigger handle as shown for correct operation.

The units can be used for air or hydro excavation work with suitable options, attachments and operator training.



The water tanks are used to hold water for use during operations. The tanks are located between the chassis cab and the debris tank.

The tanks are a composite material.

The watertanks should be filled prior to operating the water pump, but always flushed and stored empty when done.

NOTICE

The fill mechanism installed on the Vactor water system has an air gap as required by OSHA to prevent siphoning water out of the tank and back into the fire hydrant and water supply. Never modify or otherwise obstruct this passageway. Obstructions will cause water to be spilled and sprayed onto the operator and/or equipment or possibly contaminate the water supply.



Filling the Water Tank

1. Park the truck centered with the hydrant on the passengers side of the unit.
2. Remove the cap on the hydrant and flush the hydrant, or water supply, until water runs clear.
Note: Always follow procedures established by the water supplier.
3. Remove the water fill hose from its compartment and attach it securely to the hydrant or water source.
4. Make sure the water filter screen is clean and in place. Be sure both gaskets are on the filter housing cap.
5. Attach the other end of the water fill hose to the water tank hose connection located at the bottom and front of the tank.
6. Shut the valves on the bottom of the water tank.
7. Turn on the master switch on the main control panel so the water tank indicator lights work to show the water level in the tank.
8. Turn on the hydrant and allow the tank to fill.
9. Turn off the hydrant when the tank is full and disconnect the hose.
10. Replace any cap previously removed.
11. Drain any water from the hose and replace it in its storage compartment.

Monitor the lights on the control panel and be ready to turn the water supply off when the lights indicate full.

Note: Close the valve after the tanks have been filled with clean water.

NOTICE

- **Do not overload the vehicle. Due to weight restrictions, it may be better to fill the water tanks near the work site. Know the Gross Vehicle Weight Rating (G.V.W.R.). Know the vehicle axle capacities. Do not exceed the Gross Vehicle Weight (G.V.W.).**
- **Always follow procedures established by the water supplier.**
- **When connecting the fill hose, inspect the area around the fire hydrant and place hose in a position that will not impede traffic or cause vehicles to strike the hose.**

NOTICE**Pump Can Be Damaged**

Do not operate pump without water.

Refer to manual for details.



61721 rA

When not in use, typically overnight, the watertanks should be drained and empty. Drain the water system weekly to allow the components to air out.

1. Remove the Y strainer water filter and leave the filter out.
2. Open the tank drains and leave them open. Some units have more than one drain.
To open the water tank drain, pull the T handles located in the water pump cabinet.
3. Allow water to drain from the system.
4. Slowly cycle the T handled drain valves open and closed three times to drain any residual water in the valve housing. Leave the valves open when done.
5. Unwind all hose from the hose reel and open the ball valve at the end of the hose to allow the water to drain.
6. Turn the water pump on for no more than 10 seconds to push water out of the pump.
7. Slowly rewind the hose onto the hose reel. Leave all the drain plugs, ball valves, and petcocks in the open position.
8. Disengage the hydraulics as directed in the cab.

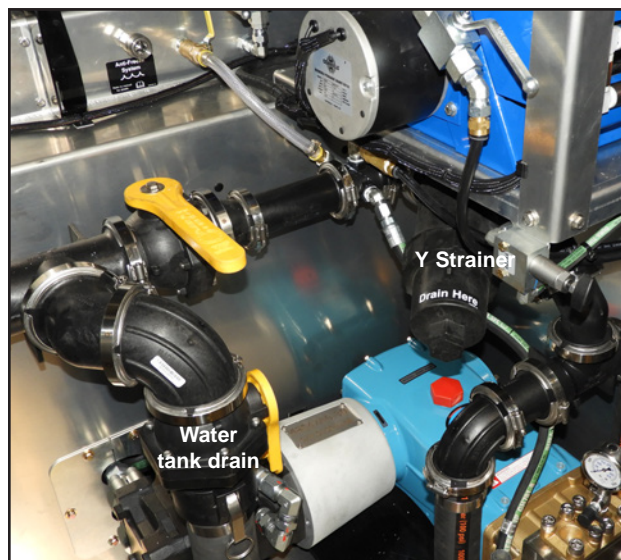
Note: All drain plugs should be left open to keep residual water from the tanks from migrating to the system during transport. Leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow any residual water to drain.

Note: The composite water tank is made in multiple sections. The main drain valve will drain most of the water out.

NOTICE

Water System Can Be Damaged By Freezing
Ice in the water system can severely damage components. To avoid ice damage:

- Verify that water flows when valves or plugs are opened. Insure that ice has not plugged drain lines, valves or drain plugs.
- Leave all drain plugs open to keep residual tank water from the tanks from migrating to the system during transport.
- Leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow residual water to drain.
- If the unit cannot be properly drained, move the unit to a warm area and allow the water system to warm completely to drain.
- Never operate water pump(s) if system is frozen.



NOTICE

Water pump can be damaged

Do not operate water pump without water.

Water System Can Be Damaged By Freezing

Ice in the water system can severely damage components. To avoid ice damage:

- Verify that water flows when valves or plugs are opened. Insure that ice has not plugged drain lines, valves or drain plugs.
- Leave all drain plugs open to keep residual tank water from the tanks from migrating to the system during transport.
- Leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow residual water to drain.
- If the unit cannot be properly drained, move the unit to a warm area and allow the water system to warm completely to drain.
- Never operate water pump(s) if system is frozen.
- Run the water pump for a few seconds to clear any remaining water.



Refer to manual for details.

53732 rA

The composite water tank will greatly reduce the temperature drop of the water requiring far less preheating, thus saving time, energy and money. The water is also insulated from freezing without preheating for a longer time.

The tank is equipped with a temperature probe to monitor water temperature which is displayed at the master control panel. The water must not be heated above 100° (F) if heated. An alarm will display when the water exceeds 100° (F).

Capacity is about 1200 gallons.

Repair - repair of the tanks is limited to punches 1" diameter and smaller.

NOTICE

Overheating water tank can damage tank insulation.

Water must not be heated above 100° (F).

Consult the factory for additional information.

49857 rB

Note: Refer to the shift decals in your cab for specific operation.

Types of Hydraulic Pump Systems

Hydraulic power can be supplied by different hydraulic pump systems operated by either a PTO, or a transfer case (TC) mounted pump. All of the main functions of the various systems are activated by hydraulic power from these systems.

PTO

The power takeoff (PTO) on the truck transmission drives one hydraulic pump. On units with automatic transmissions, this pump is normally activated through the Mode switch in the cab.

The PTO driven pump normally runs the hydraulic cooling system fan, water pump and the optional recirculation system.

Transfer Case (TC)

The transfer case normally powers the blower on PD machines and if equipped some hydraulic systems with a hydraulic pump.

Engaging and Disengaging the Hydraulics

If hydraulics are required while not in blower mode, engage the hydraulics by following the instructions in the cab of the truck.

In normal operation all hydraulic systems must be running.

DANGER

Entanglement Hazard

Contacting moving parts with clothes or body can cause injury or death:



- Never go underneath the vehicle with the engine running.
- Never work near a rotating drive shaft.
- Never attempt to engage or disengage the pump or other driven equipment from underneath the vehicle with the engine running.
- Never attempt to engage or disengage any driven equipment from any position that could result in getting entangled in the drive shaft or moving parts.
- Never attempt to work on any installed driven equipment with the engine running.
- Remove the ignition keys and post a lockout/tagout sign on the chassis steering wheel and engine control panels as required.



The MODE switch is normally used on automatic transmissions.

The operator must be in the driver's seat in the truck cab to engage or disengage the blower or hydraulics.

Consult the chassis manual for additional details. Instruction decals are normally located in all cabs, usually on the back of the visor.

Engaging the Blower/Vacuum and Hydraulics

1. Make sure the vacuum relief valve is open.
2. With the parking brake on, start and idle the engine with the transmission in neutral.
3. Follow the instructions for engaging the hydraulics / setting the PTO to ON.
4. Set the master switch to ON.
5. Set the water pump switch to ON if used.
6. Set the multi-flow switch for the job at hand if used.
7. Set the fan/blower to ON. Only operate at an airflow level sufficient to convey the material without causing carryover.
8. Once the system is operating, set vacuum to ENABLE.

Note: When engaging or disengaging the blower, make sure the blower has completely stopped turning before attempting shift in or out of gear.

CAUTION

**Driveline can be damaged.
Open vacuum relief valve.**

**Lower engine RPM to idle
before engaging or
disengaging blower.**

Failure to open vacuum relief valve and lower engine RPM to idle before engaging or disengaging blower may result in serious engine, transmission or blower damage.

1800121A rA

For hydraulics and water

1. Set to neutral and apply parking brake
2. Master switch to ON
3. Press Mode button or set PTO switch to ON for manual transmissions

Vacuum - Blower Mode

1. Set to neutral and apply parking brake
2. Master switch to ON
3. Depress clutch (manual transmission only)
4. Set Blower/Road switch to Blower mode. Blower switch will lite when the TC has shifted into blower mode
5. Select DRIVE on shift selector or shift to designated gear (manual transmission only)
6. Release clutch (manual transmission only) after TC has shifted
7. Press Mode button or set PTO switch to ON (manual transmission only)

Road Mode

1. Set Mode button to OFF or set PTO switch to OFF (manual transmission only)
2. Depress clutch (manual transmission only)
3. Shift to Neutral
4. Set Blower/Road to Road Mode. Wait until Blower switch light goes out. TC has shifted out of blower mode.
5. Release clutch (manual transmission only) after TC has shifted
6. Set Master switch to OFF

Refer to manual for details.



514660 rA

NOTICE

Machine Can Be Damaged

NEVER turn the chassis ignition off, disengage the clutch (if equipped) or change modes (if equipped) while operating the blower/fan, hydraulic system, or drive train.

- Always allow the engine to return to idle before engaging/disengaging the blower/fan.
- NEVER operate the blower/fan more than its rated rpm or vacuum rating.
- Always open the vacuum relief before shutting down. Stored energy from vacuum can back-drive the system.
- Always disengage PTO(s) before shutting down.
- Always allow the driveline to stop before switching to driving mode.
- NEVER engage/disengage PTO(s) while driving. PTO should only be engaged while moving if equipped with a recirculation system.

Before taking the Vactor to the job site, be sure to follow the checklist for maintenance and lubrication in the Maintenance Section of this manual.

Visual Inspection

The operator should make a visual inspection of the Vactor unit before use. A properly conducted pre-trip inspection will prevent safety hazards and extend the life of the Vactor unit.

1. Make a visual inspection of the engine compartment for oil or water leaks and loose or worn belts. Check and adjust fluid levels as needed. When finished under the hood, securely fasten the hood straps.
2. Begin at the hose reel and inspect the condition of the hose. Look for wear on the exterior of the hose and damage such as blisters, bubbles or knots. Check that the fittings are neither too loose, have no excessive play nor are too tight, cutting into the rodder hose. Do not use, but immediately repair or replace, that part of the hose that exhibits any of these characteristics.
3. Check the control panel for damage or water and oil leaks or both.
4. Listen around the hose reel for air leaks. Small leaks will get larger; repair immediately.
5. Check the tires for pressure and wear.
6. In the hydraulic fluid site gauges, the hydraulic oil should be at the proper level.
7. Look in the toolboxes to ensure all correct accessories for the day's assignments are present. Keep tools well organized to save time finding needed items. Greasy tools are slippery, hard to control and unsafe. Keep them clean.
8. Carefully inspect the ground or floor under the chassis for oil and water leaks. Listen for air leaks.
9. Visually inspect the rear door seal for leakage or damage.
10. Clean the windows and adjust the side mirrors, as necessary for safe driving.
11. Report all concerns found during inspection to a mechanic or supervisor, or both, so needed repairs can be evaluated and scheduled. If necessary, personally point out the exact location of each problem area.

Before starting any new job, meet with your supervisor to discuss details such as hoses and accessories needed to perform the job properly; any special considerations related to the work site or any anticipated hazards; and any safety precautions an operator should take to ensure correct setup and operations.

Be especially aware of underground utilities.

All aspects of safety need to be considered, no matter how routine using the equipment has become.

When Arriving at Work Site

When arriving at the work site, turn on the hazard and strobe lights. If equipped, the optional arrow board should also be turned on. When parking at the work site, position the truck between the work and oncoming traffic, if possible. This procedure uses the weight of the unit as a device to protect the operator from any driver who doesn't see or obey the safety cones set up around the work area.

All diesel engines should be allowed to warm up. This provides an opportunity to perform other vital checks over the entire truck.

After moving into position, set the transmission into neutral and then set the parking brake. Before leaving the cab, engage the hydraulic system by following the engagement procedure posted in the cab.

Detailed pages for PD and fan units follow.

Before taking your Vactor HXX to the job site, be sure to follow the check list for maintenance and lubrication in the maintenance section of your manual.

Visual Inspection

The operator should make a visual inspection of the Vactor HXX unit before use. A properly conducted pretrip inspection will prevent safety hazards and extend the life of the HXX unit. PD units:

1. Make a visual inspection of the engine compartment, for oil or water/coolant leaks and loose or worn belts and hoses. Check and adjust fluid levels as needed. When finished under the hood, securely fasten the hood straps.
2. Beginning at the front of the truck, inspect all lighting, head lights, running and marker lights and turn signals, beacon lights, engine hood, windshield, should be free of crack and excessive pitting and bumpers for condition and attachment.
3. Moving to the right side of the unit, inspect tires for tread depth, air pressure and securement, mirrors for vision and securement. Cab access for condition, doors operate smoothly and side glass for condition.
4. Battery box and batteries, check the tie downs, battery cable condition and tightness and the batteries should not signs of swelling which could indicate freezing or an overcharging condition.
5. Blower exhaust silencer, that it was drained the night before and the cap was left off, reinstall the drain cap. Inspect the blower outlet and inlet attachment for loose bolts or signs of excessive heat. Inspect the inlet silencer for condition. Both silencers are equipped with rain caps to prevent water from entering make sure they are in place and move freely.
6. Open the water heater cabinet and inspect the water heater for signs of excessive heat, water and fuel leaks. Inspect all wiring and valves to ensure the water heater is ready for service. Does the heater ignite, check this before going to a jobsite.
7. Open the water pump cabinet, check that the water filter/strainer was removed the previous day, reinstall it. Give a thorough inspection of the charge pump, hydraulic drive pump its coupler to the CAT pump and ensure all opened drain valves are closed. Ensure all ball valves operate freely and do not leak.
8. Inspect the air compressor hose and hose reel, make sure the hose coupler twist locks have the rubber gaskets and the hose is free of defects. Some air leaks may require the use of an electronic ear/listening device to pinpoint air system leaks
9. Inspect the vacuum nozzle for wear and holes, inspect the elbow transition to the upper boom.
10. Inspect the water tanks for leaks and over condition, open the control panel cabinet and ensure the water level indicator is functioning, since the water system was drained the previous day the level indicator should be reading empty.
11. Open the master control cabinet. Ensure the cabinet is fully stocked with the needed tools and remotes to operate the unit, does the wireless remote activate are the batteries in adequate stage of charge? Does the wired pendant controller operate the controlled functions? Are there extra clamps for the vacuum hose sections? Do all the switches on the panel work?
12. Open any remaining tool boxes and check their inventory.
13. Deploy the ladder (if equipped) and inspect the boom, boom seals, boom pivot, hydraulic motor for leaks and ensure the turret gear has been lubricated. Inspect the boom hydraulic for condition and the wire harness going to the boom solenoid valves is secured.
14. Rear hose reel cabinet, some cabinets are equipped with heaters ensure the heaters are operational if equipped, inspect the hose and reel in this cabinet, extra lance or wand section if needed. Make sure the hand gun is in one of the cabinets.
15. Check the rear lighting, brake lights, four ways, running and clearance light, license plate light and back up lights, The backup alarm should sound when the reverse lights come on. If equipped with an arrow board that it flashes in both directions, or a beacon light is operational and visible from the rear of the unit.
16. Rear bumpers are in place secure and labeled with conspicuity tape according to your local DOT requirements.

17. Inspect the rear door seals for evidence of leaks or improper sealing, the best time to see a leak at the seal is when the debris body is full, remember to care for the seal and its mating surface after each dumping.
18. Inspect the hydraulic cylinders for actuation and leaks. Make sure the door latches are engaging the latches and they enter approximately the same distance for uniform clamping pressure.
19. Ensure the rear door safety props are in place and functional.
20. If equipped with the optional sludge pump inspect its mounting and when not in use the hydraulic lines must be connected to the dummy plugs on the rear door.
21. Inspect any rear door decants for leaks and function.
22. Inspect the wire harness and hydraulic lines up the side of the body for attachment and condition.
23. Inspect the condition of the debris body as you walk around the unit, note any discrepancies and report to maintenance.
24. Inspect the make/break seal at the body to cyclone transition for evidence of leaks, this seal must be washed at each dump cycle.
25. Open any tool box or cabinet and inventory for jobsite needs. Clamps, auxiliary lighting, hydrant wrenches spare batteries etc.
26. Inspect the hydraulic oil cooler for cleanliness, it must be washed once a week to ensure adequate heat transference.
27. Inspect and clean the cyclonic cleanout, this door must remain open after dumping and cleaning to allow the cyclones to dry out.
28. Open the air compressor cabinet and inspect the air compressor for fluid levels, air filter cleanliness and overall condition.
29. Inspect the hydraulic tank, proper level with the correct fluid, the PD units have a separate filter head and cartridge located on the return line to the reservoir, ensure the restriction indicator is operating in the "green" zone if not the filter must be serviced. NOTE: cold hydraulic fluid can cause a false reading on the restriction indicator, allow the fluid to reach operating temperature before condemning the filter.
30. Inspect the rubber hose coming from the cyclonic filter housing, the clamps are in place and the tube is free of holes.
31. Inspect the Final Filter, the prefilter should be free of dried mud and allow free air flow to the element, if it is restrictive it can be washed in warm soapy water and dried. The filter element should be clean allowing air to flow freely to the blower inlet without creating any restriction. One way to know filter condition, when the filter is new observe the vacuum gauge on the control panel, when the airflow reveals an increase of 1" of Hg or more the filter needs servicing.
32. Crack the air tank bleeder petcocks open to expel any accumulated moisture, just because the unit may be equipped with an air dryer doesn't exclude the air tanks from a little preventative maintenance.
33. Check the level of the DPF reservoir, if low fill to the appropriate level. The location of the DPF reservoir will vary by chassis manufacturer.
34. Fill the unit with diesel fuel daily.
35. Inspect the exhaust system for leaks and the clamps are secure.
36. Inspect all hydraulic component for leaks and ensure they function when the function is activated.
37. Inspect all fluid levels for the transfer case and blower reservoirs. The site gauge should have a ¼" air bubble in the top of the gauge.

Before starting any new job, meet with your supervisor to discuss details such as hoses and accessories needed to perform the job properly, any special considerations related to the work site or any anticipated hazards, and safety precautions an operator should take to ensure correct setup and operation.

Be especially aware of underground utilities.

All aspects of safety need to be considered, no matter how routine using the equipment has become.

Upon arriving at the job site, turn on the strobe lights and arrow-boards to alert any traffic that may be in the area.

Plan your parking spot to optimize safety and ease of work. Inspect the work site for overhead power lines before positioning the truck. Be aware of underground utilities.

Put the vehicle in the best possible position for the easiest and safest access to the work site and material to be loaded. Park on firm level ground and ensure the ground is stable enough to hold the truck securely.

Observe the job site carefully. Look for overhead obstructions, traffic movement, pedestrian walkways, and for places where traffic control devices should be positioned. Always use a co-worker's assistance when spotting the vehicle.

Once you have decided on a parking spot, park the vehicle. Set the parking brake and turn on flashers. Whenever possible, park the truck between yourself and oncoming traffic when working in traffic areas.

Chock the wheels. Set out road cones, if necessary, to keep traffic and people away from the hydro excavation activities. Place the cones at a distance so water and debris spray can be contained within the work area.



Always set the brake. Chock the wheels to prevent it from rolling.

⚠ WARNING

50 Feet Max.

SAFETY RELIEF VALVE

Vacuum hazard

Never operate at the hose end without a properly installed safety relief valve.

Failure to do so could result in serious injury or death.

Safety relief valve must be installed within 50 feet of hose length of the working end. Relief valve tether line must be within line of sight of valve and attached to operator. Adjust tether line to have minimal slack so the relief valve can readily be opened.

Consult the OPERATOR's manual for complete details.

1800132 rev A

Vacuum Tubing

Remove the boom from its stowed position. Add the vacuum tubes necessary for the job at hand. Clamp the vacuum hose to the end of the boom.

Continue attaching hose or tubing to the required length. Use a short and direct route, making sure that hose runs are as straight and have as few bends and turns as possible. Make any unavoidable turns gradual.

Use rigid aluminum tubes for longer runs. Lightweight, smooth bore flexible hose is recommended at the working end. Only use vacuum hose that has a smooth bore. This reduces loss of air velocity due to friction.

Install the tube with a rubber end at the working end of the tubing. The rubber end prevents damage to utilities and the holes allow extra air to enter the system.

Install the vacuum relief valve according to the Vactor/Guzzler Safety Manual. The pull cord should be tethered to the belt of the hose handler so the vacuum pressure can be relieved in an emergency. Leave the relief valve open during setup.

Use as large tubing as possible. To reduce the risk of a plugged vacuum hose do not reduce the diameter of hose in mid-stream. If a smaller hose is needed, install a reducer at the truck and run the smaller hose all the way through. Use the largest size that can be handled safely and easily.

Ground the hose pipe and the truck as routine safety precaution to eliminate static electricity buildup while excavating.

Keep the pendant switch for the vacuum relief valve as close to the working end of the hose as possible. This is to break the vacuum in an emergency.

Water Hose

Open the water pump cabinet and roll out enough high pressure hose to reach the work area. Allow sufficient excess to avoid hindering operator movement, but not so much as to create an excessive tripping hazard.

Thoroughly inspect the hose and high pressure handgun for wear, damage, or loose fittings.

Select the nozzle tip for your specific application.

WARNING

Vacuum Hazard

Cutting, crushing, suffocation or body rupture from the forces of vacuum could result in serious injury or death.

Stay clear of the suction hose inlet end.

Turn vacuum off before attaching hose, pipe or accessories.

Keep suction hose inlet end near ground level when vacuum is operating.

Refer to SAFETY manual for details.



ADVERTENCIA

Riesgo Por Altovacío

Trituración, asfixia, amputación o desgarre corporal por las fuerzas altovacío pudieran resultar en lesiones serias o mortales.

Manténgase lejos de la boquilla de la manguera de succión.

Apague el compresor de altovacío antes de conectar la manguera, tubos o accesorios.

Mantenga el extremo de la manguera de succión cerca del nivel del suelo cuando esté funcionando el compresor de altovacío.

Refiérase a la sección de SEGURIDAD en el manual para detalles.



1800174

Master Control Panel

These functions are performed at the master control panel located on the passenger side of the exterior of the truck.

- ① Engage the blower according to the instructions in the cab.
- ② Increase the engine rpm with the throttle switch until the engine rpm is 800 or 1200 rpm depending the chassis. This is a starting point and will be adjusted later as required to efficiently vacuum site material.

Note: Only operate the blower at a level sufficient enough to efficiently convey the material. If the blower is operated at too high an rpm, fuel will be wasted and the material will not properly separate from the air stream.

- ③ Activate the remote pendant. If used, install the optional wired remote pendant by inserting it into the plug located at the bottom of the master control panel.

Note: Vacuum Relief Valves – The air operated vacuum relief valve needs to be closed. If not closed, there will be no air flow to transfer the material.

- ④ Enable the vacuum.



SAFETY INSTRUCTIONS

Unit operator must hold the pendant/remote during vacuum operations and stay within line of sight of the hose end operation. In an emergency, use the E-stop or pendant/remote to disable the vacuum. Maintain clear access to all E-stops and place an operator near one.

After securing the work area, chocking the wheels, engaging the parking brake, choosing a nozzle, assembling the hoses and vacuum tubes, turning on the water pump, and putting on PPE, you can begin the hydro excavation process.

Verify all safety devices, especially relief valve, operate properly prior to beginning operations.

The operator holds the remote. In event of an emergency, the vacuum can be relieved quickly and easily.

Teamwork

Work as a team when trenching and digging large holes. One person operates the wand or handgun. The other person positions the vacuum tube so it is in the right position to move material.

Vacuum the material as soon as it breaks away. It is not productive to try to wash the material to the nozzle or to try to vacuum the material a great distance to the nozzle.

WARNING

Vacuum Hazard

Cutting, crushing, suffocation or body rupture from the forces of vacuum could result in serious injury or death.

Stay clear of the suction hose inlet end.

Turn vacuum off before attaching hose, pipe or accessories.

Keep suction hose inlet end near ground level when vacuum is operating.

Refer to SAFETY manual for details.



ADVERTENCIA

Riesgo Por Altovacío

Trituración, asfixia, amputación o desgarre corporal por las fuerzas altovacío pudieran resultar en lesiones serias o mortales.

Manténgase lejos de la boquilla de la manguera de succión.

Apague el compresor de altovacío antes de conectar la manguera, tubos o accesorios.

Mantenga el extremo de la manguera de succión cerca del nivel del suelo cuando esté funcionando el compresor de altovacío.

Refiérase a la sección de SEGURIDAD en el manual para detalles.



1800174

Setting Up

Open the water pump cabinet and roll out enough high pressure hose to reach the work area. Allow sufficient excess to avoid hindering operator movement, but not so much as to create an excessive tripping hazard.

Thoroughly inspect the hose and high pressure hand gun for any wear, damage, or loose fittings.

Selecting a Nozzle

Select the nozzle tip for your specific application. All nozzles are rated in gallons per minute. Be sure there is enough water flow to moisten the material adequately to prevent carryover of debris through the debris body and into the vacuum source.

Nozzle head design is important in different soil conditions. Hard or rocky conditions, one or two orifices in the nozzle head works best. Soft or sandy conditions, three or four orifices work best. There is not one nozzle that works best in all conditions.

Low flow nozzle advantages: More precise, less water, more efficient water use, less pressure, safer process.

High flow nozzle advantages: Greater digging production, less wear on the vacuum system.

High flow nozzle disadvantages: More frequent dumping, messy dump area, fatigued operators, larger, more water use and longer cleanup procedures.

Cutting the Soil

Use the high pressure hand gun to cut the soil into chunks small enough to fit into the vacuum hose.

Select a water flow rate that moistens the material enough to vacuum it adequately to prevent carryover of debris to the vacuum source, but not so much as to make mud. Just enough to cut the soil into moist chunks.

WARNING

Handguns Use High Pressure Water

High pressure water can cause serious injury or death.



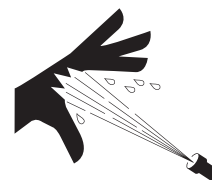
- Wear appropriate safety equipment including: Waterproof apparel, protective boots, insulated gloves, safety glasses or goggles, hearing protection (ear plugs and/or ear muffs) and a hard hat with a face shield.
- Never point the handgun at or near a person or animal.
- Bleed pressure from handgun by shutting off water pump pressure and pressing the trigger before disconnecting from high pressure connection.
- Use handgun and connection supplied with the unit; never use common low pressure handguns or connectors with the high pressure system.

WARNING

High pressure water

High pressure water can cause serious injury or death.

The handgun operates under high pressure. Never point the handgun at another individual. Severe injury can result from the high-pressure water.



Special safety equipment is required when operating the high-pressure handgun. Always wear safety toe shoes or boots (waterproof shoes or boots preferred), coveralls, face shield and safety goggles and gloves (waterproof gloves preferred).

Vacuuming the Soil

When ready to begin, the truck must be running. Use the following procedures.

1. Communicate with the hose handler. When hose handler is ready, use the throttle control to adjust the fan/blower speed to the desired rpm.

Note: The appropriate level of rpm is the lowest rpm that will readily convey the material into the hose and carry it to the tank. This will depend on the density of the material, and the distance it has to travel to the tank as well as the type of hose used. The blower should not be operated at idle rpm. Maintain at least 1200 rpm to reduce wear on the transfer case.

2. Position the vacuum hose near the material to be vacuumed.

Keep the suction end of the pipe or hose slightly above the material to be vacuumed. Never submerge the tube. Make sure it is always receiving both air and material. Submerging the nozzle in the material cuts off the air flow preventing material movement. This also creates a loading and unloading effect on the blower when the nozzle is lifted. This load / unload effect can cause undo stress on bearings and hydraulic components in the system which creates premature failure of the component.

3. Begin vacuuming taking care to allow some air to enter the hose along with the debris.

All vacuum trucks move material through air conveyance. They rely on air movement to entrain and carry away the debris. For proper operation the end of the vacuum tube must be just above the debris so that an air stream is maintained. Various optional vacuum tubes like the Higbee nozzle are available to permit vacuuming under water by providing, in effect a snorkel to get air to the vacuum tube nozzle end.

Use the boom to lower the nozzle into the material to be removed. With most material, it helps to move the nozzle up and down using the boom controls. Lower the nozzle into the material and raise the nozzle enough for the bottom of the nozzle to clear the material, and then back down into the material. Using this up and down motion will help loosen the debris, especially compacted material.

When picking up water or slurries, allow the tip of the nozzle to just clear the top of the water or slurry.

As material is removed, the nozzle can be tipped, or the pipe and boom moved horizontally to reach other material. Continually working the nozzle this way enables the operator to observe the work area. If the material to be picked up is not in a pile, use a shovel, rake or hoe to work the material into the nozzle. The handgun stream can be used to move material toward the tip of the nozzle.

Determining Blower Speed

Do not over speed the blower. Over speeding the blower will create excessive overflow of the debris into the cyclone chamber resulting in a drop in efficiency. It will also make the engine work harder than it really has to, decreasing the overall life of the unit.

Air Flow

It is the air flow that takes the material with it into the debris body. If there is no air flow, there is no material flow either.

If the flow is non-existent or sluggish, increase the rpm in steps and observe the vacuuming and flow rate. Stop raising the rpm when satisfactory flow of material is achieved.

If the air flow is not large enough to carry the material, increase the rpm at the control panel to just a little more than required to have a free flow of the material.

As the debris body fills, the air speed increases, leading to material carryover. Gradually reduce the vacuum speed as the debris body fills to reduce carryover.

Debris Level

During operation, observe the debris body level gauge. When the indicator is horizontal the body is full and must be drained and/or dumped.

Check the debris level if air flow diminishes suddenly.

Operations Tips

- Always use the vacuum tube with the rubber end at the working end of the tube.
- Never hold the open end of the hose with your hand while vacuum system is on. Always open vacuum relief valves and reduce rpm before attempting to dislodge any obstruction in the vacuum tube.
- For best performance, run the vacuum pump at a lower rpm.
- Do not bury the nozzle in the material. Air flow is required to convey the material through the tube.
- If air flow is not sufficient to convey the material, increase the rpm in moderation.
- Eliminate unnecessary bends or turns in the tube.
- If there is a sudden drop in air flow, check the debris level.

Safety Tips

- Never wear loose clothing or untied hair when working on or near the unit or the open end of the tube.
- Always check the working condition of all safety devices before starting the Vactor unit.
- Observe all safety instructions and markings on the unit. Use ear plugs, safety glasses and gloves.
- Be aware that the air system becomes hot during vacuum operations.
- Never attempt to “guide” or push debris to the open end of the vacuum hose with your foot or hand. Vacuum suction is powerful enough to suck a limb into the hose.
- Never remove obstructions from the nozzle while the system is operating.
- Never hold the open end of the hose with your hand while vacuum system is on.
- Never reach into a vacuum hose to free clogs. Always open vacuum relief valves, reduce rpm before attempting to dislodge any obstructions in the vacuum hoses.

**SAFETY
INSTRUCTIONS**

**In an EMERGENCY the
VACUUM and WATER
must be stopped
Activate the E-Stop**

To shut down the system:

- Stop vacuuming.
- Enable vacuum relief valves.
- Reduce engine/blower/fan RPM.
- If required, shut down the engine.

**! WARNING****Vacuum Hazard**

Cutting, crushing, suffocation or body rupture from the forces of vacuum could result in serious injury or death.

Stay clear of the suction hose inlet end.

Turn vacuum off before attaching hose, pipe or accessories.

Keep suction hose inlet end near ground level when vacuum is operating.

Refer to SAFETY manual for details.

**! ADVERTENCIA****Riesgo Por Altorvacio**

Trituración, asfixia, amputación o desgarre corporal por las fuerzas altorvacio pudieran resultar en lesiones serias o mortales.

Manténgase lejos de la boquilla de la manguera de succión.

Apague el compresor de altorvacio antes de conectar la manguera, tubos o accesorios.

Mantenga el extremo de la manguera de succión cerca del nivel del suelo cuando esté funcionando el compresor de altorvacio.

Refiérase a la sección de SEGURIDAD en el manual para detalles.



1800174

When ready to begin, the truck must be running and the following procedures should be followed:

1. Communicate with the hose handler. When hose handler is ready, increase the rpm to the desired level.

Note: The appropriate level of rpm is the lowest rpm that will readily convey the material into the hose and carry it to the tank. This will depend on the density of the material, and the distance it has to travel to the tank as well as the type of hose used. The blower should not be operated at idle rpm. Maintain at least 1200 rpm to reduce wear on the transfer case.

Start vacuuming. If the flow is non-existent or sluggish, increase the rpm in steps and observe the vacuuming and flow rate. Stop raising the rpm when satisfactory flow of material is achieved.

2. Position the vacuum hose near the material to be vacuumed.
3. Begin vacuuming taking care to allow some air to enter the hose along with the debris.

Note: It is the air flow that takes the material with it into the debris body. If there is no air flow, there is no material flow either.

Never attempt to “guide” or push debris to the open end of the vacuum hose with your foot or hand. Vacuum suction is powerful enough to suck a limb into the hose. Similarly, never reach into a vacuum hose to free clogs. Always open vacuum relief valves, reduce rpm before attempting to dislodge any obstructions in the vacuum hoses.

If the air flow is not large enough to carry the material, increase the rpm at the control panel to just a little more than required to have a free flow of the material. Do not over speed the airflow as that will create excessive overflow of the debris into the cyclone chamber resulting in a drop in efficiency. It will also make the engine work harder than it really has to decreasing the overall life of the unit.



Vacuum Hazard

NEVER operate the vacuum system without the Vacuum Relief Valve being installed. Failure to install and operate the Vacuum Relief Valve properly may result in serious injury and / or death.

The INLINE VACUUM RELIEF VALVE must be INLINE within 50 feet from the end of the hose or pipe for proper operation.

All vacuum trucks move material through air conveyance. They rely on air movement to entrap and carry away the debris. It is very important to keep the suction end of the pipe or hose in the right position so it is always receiving air and material. Submerging the nozzle in the material cuts off the air flow preventing material movement. This also creates a loading and unloading effect on the blower when the nozzle is lifted. This load / unload effect can cause undue stress on bearings and hydraulic components in the system which creates premature failure of the component.

It is very important when trenching and digging large holes that you work as a team. One person is operating the wand or hand gun. The other person is positioning the boom so the vacuum tube is in the right position to move the material as soon as it breaks away. It is not productive to try to wash the material to the nozzle or to try to vacuum the material a great distance to the nozzle.

Use the boom to lower the nozzle into the material to be removed. With most material, it helps to move the nozzle up and down using the boom controls. Lower the nozzle into the material and raise the nozzle enough for the bottom of the nozzle to clear the material, and then back down into the material. Using this up and down motion will help loosen the debris, especially compacted material.

When picking up water or slurries, allow the tip of the nozzle to just clear the top of the water or slurry. As material is removed, the nozzle can be tipped, or the pipe and boom moved horizontally to reach other material. Continually working the nozzle this way enables the operator to observe the work area. If the material to be picked up is not in a pile, use a shovel, rake or hoe to work the material into the nozzle. The water stream can be used to move material toward the tip of the nozzle.



Freezing Temperatures

Blower speed rpm is important when working in freezing or near freezing temperatures. High speeds or rpm's cause high wind chill factors due to the large air velocity being created. This can lead to ice buildup in the vacuum nozzle or boom which blocks material movement.

Use hot water, when available, and lower fan / blower speeds to reduce the problem. If you do get an ice build up in the boom, shut the vacuum system down. Use hot water to heat the boom tubes or get the unit inside where it can warm up. Once the boom tubes are warm, slowly retract the boom.

Start the vacuum system. If hot water is available, spray the hot water in the suction hose / nozzle. This will allow the ice to move into the debris body. You may need to do this in one to two foot increments, in order to fully retract the boom.

Any time the blower/unit will sit after use during freezing weather the blower should be run 3-5 minutes with the vacuum relief open to dry out the blower. This will reduce the risk of the blower freezing up. Depending on weather conditions it may even be necessary before the operators go to lunch and at the end of the daily operation.

Rocky Ground

Blower/fan rpm is important in rocky ground. Set the air velocity so rocks don't hang in the pipe. Air tends to move around rocks causing them to hang in the air stream. Adjust the rpm to the lowest setting to move the material efficiently. You may need to increase speed for larger rocks. This is especially true in freezing conditions.

NOTICE

Machine Can Be Damaged

If ice builds up in the boom, shut down the vacuum system. Use hot water to heat the boom tubes or move the vehicle to a warm place. Slowly retract the boom when the tubes have warmed up. Do not retract the boom with ice build up in the vacuum tube. Damage to the boom and/or seal can occur. If hot water is available, start the vacuum system and spray hot water into the vacuum tube/nozzle. As the ice breaks away it will be carried to the debris body.



Operating Instructions

1. It is important to remember that the vacuum tube uses air flow and not vacuum to pick up material. Keep the suction end of the nozzle in the right position to receive air and material
2. Submerging the nozzle in material stops air flow and prevents material movement. The catch basin nozzle is designed to pull air into the pipe to move material. The end is serrated with small holes; if the end is submerged, air is pulled in through the holes.
3. The weather and operating conditions cannot be controlled, but the blower speed, water volume and water pressure can be. The blower speed controls the volume of air and the speed of air movement through the pipe and into the debris body.
4. If the soil or material breaks up easily, the blower can run at higher speeds and allow faster material pickup. The blower speed must be adjusted to move maximum amounts of material without carry-over into the blower.
5. Blower/fan speed is important when working in freezing temperatures. High blower speeds cause wind chill conditions because of the air velocity. The wind chill conditions cause ice build-up in the vacuum tube or boom, which blocks material movement.
6. Proper speed will vary depending on the material moved. Air velocity should be set so material does not hang in the pipe. Adjust RPM to the lowest setting to move the material efficiently. Increase the speed as needed to pick up large rocks or heavy sludge. Watch the blower exhaust for carry-over material. Any type of carry-over should be avoided.
7. The further the distance from the work site to the debris body, the higher the blower speed should be. The shorter the distance, the lower the blower speed. Material moving through a pipe or tube creates a friction factor. The longer the tube or pipe, the higher the friction factor - called friction loss. Pipe and tube diameter is a major factor when moving material.

NOTICE**Machine Can Be Damaged**

- **Beware of carry over material from debris body through the blower or fan.**
- **Running the blower/fan too fast with light material can carry the material over into the blower or fan. This can cause premature wear.**
- **Over filling the debris body can cause carry over and damage to the fan/blower.**
- **A build-up of material on the fan will cause an out-of-balance condition. Operating an out-of-balance fan can cause damage to the fan, fluid drive, spindle box or auxiliary engine. If necessary, remove the intake elbow for proper cleaning.**

The weather and operating conditions cannot be controlled, but the blower speed, water volume and water pressure can be.

Blower Speed

The blower speed controls the volume of air and the speed of air movement through the pipe and into the debris body.

Use a higher rpm for heavier material. Lower rpm for lighter. Higher air speed causes a wind chill factor, causing ice buildup.

Material

Proper speed will vary depending on the material moved. Air velocity should be set so material does not hang in the pipe. Adjust RPM to the lowest setting to move the material efficiently. Increase the speed as needed to pick up large rocks or heavy sludge.

If the soil or material breaks up easily, the blower can run at higher speeds and allow faster material pickup.

Freezing Temperatures

Blower/fan speed is important when working in freezing temperatures. High blower speeds cause wind chill conditions because of the air velocity. The wind chill conditions cause ice build-up in the vacuum tube or boom, which blocks material movement.

Carryover

Watch the blower exhaust for carry-over material. Any type of carry-over should be avoided.

The blower speed must be adjusted to move maximum amounts of material without carry-over into the blower.

Distance

The further the distance from the work site to the debris body, the higher the blower speed should be. The shorter the distance, the lower the blower speed.

Material moving through a pipe or tube creates a friction factor. The longer the tube or pipe, the higher the friction factor - called friction loss. Pipe and tube diameter is a major factor when moving material.

Debris Level

As the debris body fills, the air speed increases, leading to material carryover. As the debris body fills, gradually reduce the fan speed to reduce carryover.

NOTICE**Machine Can Be Damaged**

If ice builds up in the boom, shut down the vacuum system. Use hot water to heat the boom tubes or move the vehicle to a warm place. Slowly retract the boom when the tubes have warmed up. Do not retract the boom with ice build up in the vacuum tube. Damage to the boom and/or seal can occur. If hot water is available, start the vacuum system and spray hot water into the vacuum tube/nozzle. As the ice breaks away it will be carried to the debris body.

Water Pressure

Be sure to wear all proper safety equipment prior to operating any high pressure hand gun or wand. Adjust the pressure for the job at hand. Keep in mind that different units may have different pressure ratings.

Lower pressures are good in easy digging conditions and when working around older utilities where the protective cover may be in poor condition. It is also safer and uses less water. Keep the nozzle as close to the ground that you are cutting to maximize the water pressure. In general, 2000 psi at the nozzle is more than enough for excavating in the worst conditions. Higher pressures get into higher safety concern. Any gain is far outweighed by the safety issues.

Remember, the number of orifices divided into the water volume you want determines the water flow for each nozzle. If you have 3 gpm and two nozzles then 1.5 gpm goes out each nozzle. Refer to the nozzle chart in the Water System section.



Typical nozzles



Water Volume

This is the most important factor in productive and profitable hydro-excavating. Several factors determine the proper water volume to be used.

How damp is the material?

The material must be wet enough to prevent any dust from carrying over into the blower.

How far do you have to haul the debris and how long will it take to dump?

If you can dump on site and not travel far, higher water volumes are more productive (4-8 gpm). If you have to travel longer distances to dump, an hour or more round trip, lower volumes are more productive (3-4 gpm).

What are the soil conditions?

Soft or sandy soils allow for higher water volumes to move more material faster. Hard packed, clay or rocky soils require lower volumes and slower working conditions to cut the soil into chunks small enough to fit in the vacuum hose or tube.

What are you doing?

Digging pot holes or locating utility lines requires lower volumes. Digging trenches or larger holes, where you are in one area for a longer time, higher volumes work better. You may need to experiment with different volumes to determine what is most productive.

Example: Using lower volumes took longer to dig the pole hole but were able to dig twice as many holes in a day because the debris box didn't fill up as fast with water, therefore less time dumping!

What nozzle head are you using?

Nozzle head design is important in different soil conditions. Hard or rocky conditions, one or two orifices in the nozzle head works best. Soft or sandy conditions, three or four orifices work best. There is not one nozzle that works best in all conditions. Keep in mind that water nozzles wear out. Pay attention to how much water is used in an hour or two to check water flow.

Operations can continue until the debris body capacity is reached, at which time all operations must cease.

Note: Never overfill the debris body. Normally, if it does not exceed the GVWR (gross vehicle weight rating), the debris body should not be filled more than 60% - 75% of its rated volumetric capacity.

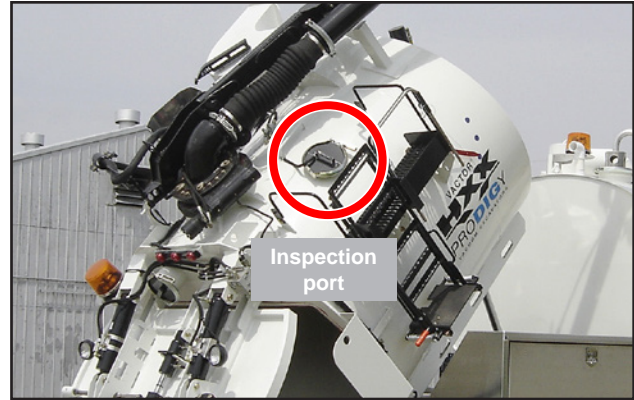
In liquid vacuuming, the level indicator or the change in the sound of the blower (the float ball will get sucked up) will indicate a full tank and time to stop vacuuming.

If equipped the level can be checked by looking through the inspection port. To check the level of solid debris in the tank, open all vacuum relief valves, reduce the blower RPM and open the inspection port. Use a flashlight to get a clearer view of the content level.

If the unit is not equipped with an inspection port, pay attention to the amount of debris that has been vacuumed. Experience will tell when the debris body is ready to be dumped. If the debris body is full, vacuuming operations must cease.

Ceasing Operations

1. Remove the vacuum hose from the work area. Let it suck air for some time to allow any material still in the hose to be carried into the tank. Then run some water through the suction tube to clean the inside of the suction tube, hose and boom.
2. **Disable the vacuum.**
3. **Set water system to off.**
4. Reduce the rpm to idle.
5. Inside the truck cab, disengage the blower following the blower shut down procedure.
6. Disconnect water wand or high pressure hand gun and store in cabinet.
7. Hold onto water line and let it rewind slowly onto hose reel.
8. Disconnect digging tubes and store them.
9. Remove any safety equipment and store in cabinet.



NOTICE

To avoid transmission and/or PTO damage

When not in use, the PTO should be disengaged. Always check for the red PTO warning light before driving truck. This light indicates that the PTO is engaged. Never drive truck with the PTO engaged unless using recirculation mode or vac-on-go intended for use while driving.

Never attempt to engage PTO while the truck is moving.

NOTICE

Machine Can Be Damaged

NEVER turn the chassis ignition off, disengage the clutch (if equipped) or change modes (if equipped) while operating the blower/fan, hydraulic system, or drive train.

- **Always allow the engine to return to idle before engaging/disengaging the blower/fan.**
- **NEVER operate the blower/fan more than its rated rpm or vacuum rating.**
- **Always open the vacuum relief before shutting down. Stored energy from vacuum can back-drive the system.**
- **Always disengage PTO(s) before shutting down.**
- **Always allow the driveline to stop before switching to driving mode.**
- **NEVER engage/disengage PTO(s) while driving. PTO should only be engaged while moving if equipped with a recirculation system.**

NOTICE**Preparing for Transport**

Prior to transport secure all tools, hoses and all miscellaneous items in their storage locations.

- All items in tool trays and racks need to be secured or tied down.
- If equipped, secure boom in transport mode.
- If equipped, lower debris body, close rear door.
- If equipped, secure all hose ends on hose reels.
- Close and secure all cabinet, tool box and control panel doors and covers.
- Remove and stow all hoses, suction tube, extension pipes and accessories.
- Disengage the hydraulic, vacuum and water systems.
- Check and clear the area around the unit before moving.

Vactor/Guzzler/TRUVAC

DUMPING BEST PRACTICES

- Maneuver the unit to the dump site and park on firm/level ground. Make sure the ground in that area is compact enough to prevent the truck from getting stuck.
- Ensure there are no overhead obstacles that will interfere with raising the debris body.
- Engage the parking brake.

Dumping Safely & Effectively

NOTE: If equipped with a boom, stow the boom so that the hose clears the unit's components when raising the debris body.

- Read the in-cab or manual instructions on how to properly engage the hydraulic system.
- Keep one operator on the hydraulic controls for safety, and to cease operations if an emergency arises. Ensure the operator is proficient with the controls.
- Monitor the dump site area for anyone or anything that may interfere with the safe operation of the unit.
- Check behind the unit for people or obstacles before opening the rear door to avoid harming anyone or causing damage.
- The rear door **MUST** be opened before the front of the debris body is 3 feet above the chassis frame.
- During decanting or off-loading liquids, only raise the body no more than 3 feet, enough to allow the liquid out and not plug the ports.
- Observe the material as the debris body raises to make sure it is coming out. Do not continue raising the body if the material is not moving. High pressure water or mechanical removal may be necessary.

NOTE: If equipped with dump tubes, as the debris body is being raised the dump tube doors located on each side of the debris body will automatically open.



⚠ WARNING

TIPPING AND CRUSHING HAZARD
Unit can tip over when the body is raised while loaded.
To avoid serious injury or death:

- NEVER raise the debris body while on unlevel ground or in motion.
- NEVER leave body raised or partly raised while vehicle is unattended.
- NEVER move the unit with the debris body in a raised position.
- ALWAYS open rear door before fully raising debris body and/or dumping.
- When using vibrator, raise body 3 feet and pulse to dislodge debris before fully raising. Repeat as needed.
- If equipped with chassis air ride suspension, ALWAYS dump air suspension so that the rear of the unit is at its lowest point (not applicable on TRXX).

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NOTE: If equipped with the optional vibrator, it can be used to dislodge any material that is attached to the sides of the debris body. Make sure to raise debris body 3 feet and pulse vibrator to dislodge debris. Activate the vibrator mechanism intermittently with the switch on the master control panel until debris starts to move. Only use short vibrating blasts. **DO NOT** use long or continuous blasts. **DO NOT** raise body fully and then activate vibrator as extreme weight shift could cause unit to tip/roll.

- Deploy the rear door safety props to secure the door from accidentally falling during cleaning operations. Never enter the debris body without thoroughly cleaning it first. Be aware of the dangers of confined spaces and request a confined space permit if required.
- Using the hand gun, wash out the debris body, paying particular attention to the door seal, lock bolts, level indicator, float balls, screens, etc. and the inside of the rear door.

Transportation Precautions

- NEVER leave the debris body raised or partly raised while the unit is unattended, nor when in motion.
- NEVER move the unit with the debris body in the up or raised position.
- ALWAYS disengage the PTO when hoist is not in use or when moving the unit.

<p>! WARNING</p>  <p>Crushing hazard. Serious injury or death can result from falling debris body. Never go under a raised debris body without the safety prop(s) in place. Debris body must be clean and empty for service work. On firm level ground raise the body above the height of the props. Tilt the prop(s) in place. Lower debris body until it just rests on the prop(s). Use all props. Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine. Refer to manual for details. </p>	<p>! WARNING</p>  <p>Crushing hazard. Serious injury or death can result from falling rear door. Never go under the rear door when open. Use door prop(s) or safety pin(s) to secure door before entering body, working under or around the door. Open the rear door to just clear the prop(s) and lower door until it just rests on the prop(s). On units that use a safety pin(s) open the door until the pin holes are aligned and insert pin. Use all props or pins. Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.</p>	<p>! WARNING</p>  <p>Electrocution hazard. Serious injury or death can result from electrocution. Check for overhead wires and obstructions before raising debris body, opening rear door or raising optional equipment. Never leave debris body, rear door or optional equipment raised or partly raised while vehicle is unattended. Never move vehicle with debris body, rear door or optional equipment raised. Be aware of the vehicle's surroundings before operating any of the hydraulic functions to prevent death, injury or equipment damage.</p>	<p>! WARNING</p>  <p>Electrocution hazard Serious injury or death can result from electrocution. Check for overhead wires and obstructions before raising or moving boom. Do not leave boom raised while vehicle is unattended. Do not move vehicle unless boom is in travel mode. Do not allow boom to contact the vehicle or any obstruction. Be aware of the vehicle's surroundings before operating any of the boom functions to prevent death, injury or equipment damage. Refer to SAFETY section in manual.  1800149A rev A</p>
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! WARNING

Crushing Hazard

NEVER leave body raised or partly raised while vehicle is unattended or while performing maintenance or service under body unless body is propped to prevent accidental lowering. [Always disengage PTO when hoist is not in use or when moving vehicle.] The debris body **MUST BE** empty for service work.

NEVER attempt to raise body when vehicle is on unlevel ground.

Rear door **MUST BE** opened before the front of the body is 3 feet above the chassis frame. Operator must remain at controls during all operations.



SAFETY INSTRUCTIONS

Best Practices for Dumping

- Position unit on level, stable ground.
- Check for overhead wires and obstructions
- Operator must remain at controls during all operations.
- During decanting or offloading liquids, only raise the body no more than three feet, enough to allow the liquid out and not plug the ports.
- Open rear door before dumping.
- Observe the material as the debris raises to make sure it is coming out. If equipped use the vibrator. Do not continue raising if the material is not moving. High pressure water or mechanical removal may be necessary.
- **NEVER** move the unit with the debris body in the up or raised position.

Vibrator (if equipped)

- The vibrator can be used to dislodge any material that is attached to the sides of the debris body while raising. Only use short vibrating blasts.

Debris body and rear door controls are located on the master control panel. The unit's hydraulics must be engaged for these controls to function.

When the Rear Door Open switch is activated, the locks disengage and the rear door opens.

Rear Door Close closes the door and then the locks engage.

Dumping the Debris Body

The truck engine must be running to dump the debris body. The engine provides the power to the hydraulic system, which lifts the front of the body and opens the rear door.

1. Back the unit up to the dump site and park on firm level ground.
2. Ensure there is adequate clearance overhead for the debris body to rise.
3. Set the parking brake.
4. If truck is equipped with air ride suspension, dump air suspension so that the rear of the truck is at its lowest point.
5. Inspect the rear of the unit and the area that the material will be dumped.
6. Engage the hydraulics.
7. Stow and extend the boom so that the hose clears the water cabinet and silencers when raising the debris body.
8. Open the rear door.
9. Raise debris body and allow material to fall out.
10. Clean and lower the body according to the procedures in this manual.

Vibrator (optional)

After the body has been raised, the vibrator can be used to dislodge any material that is attached to the sides of the debris body. Activate the vibrator mechanism intermittently with the switch on the master control panel. Only use short vibrating blasts. **Do NOT use long or continuous blasts.**

WARNING

Crushing / Tipping Hazard

To avoid injury or death:

- Position unit on level stable ground.
- Open rear door before dumping.
- **NEVER** move the unit with the debris body in the up or raised position.



WARNING

Crushing Hazard

Unit can tip over when the body is raised while loaded. During decanting or offloading liquids only raise the body no more than three feet, enough to allow the liquid out and not plug the ports.

NEVER attempt to raise body when vehicle is on unlevel ground or in motion.

After decanting or offloading liquids, rear door **MUST BE** opened before the front of the body is 3 feet above the chassis frame.

Operator must remain at controls during all operations.



Set the rear door safety props to secure the door from accidentally falling during cleaning operations.

Using the handgun, wash out the debris body, paying particular attention to the door seal, lock bolts, level indicator, float balls, screens, vacuum enhancer (if equipped), etc. and the inside of the rear door.

Visually inspect door seal. The door seal and mating surface on the debris body should be completely cleaned so it forms a complete seal when it is closed.

Lower the debris body to the down position. Lower the rear door and wash the rear door and rear of the unit. The rear door must close with an air and watertight seal. Make sure all debris is removed from the seal before closing the door.

Turn off the water pump and put the wash hose and gun away.

Lowering Debris Body/Closing Door

After the debris body has been emptied and the seal cleaned, store the rear door props and lower the body to its original operating position.

Disengage the hydraulics.

The body should always be lowered first and then the door closed. Never raise a loaded body unless the rear door is open and you intend to empty the debris body.



NOTICE**Rear Door Can Be Damaged**

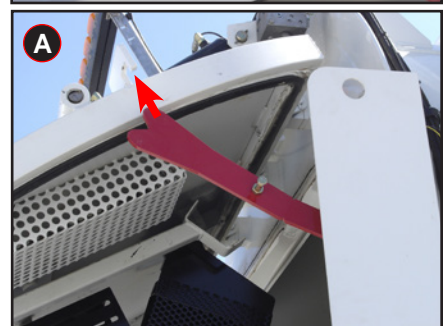
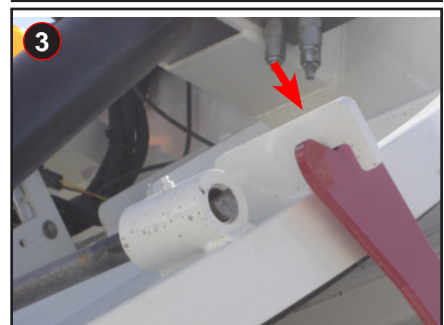
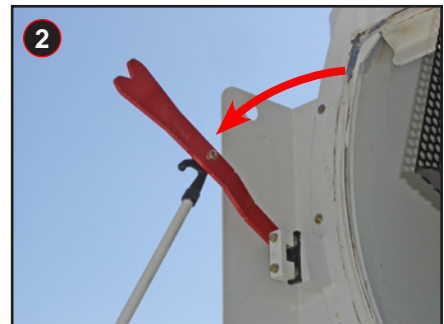
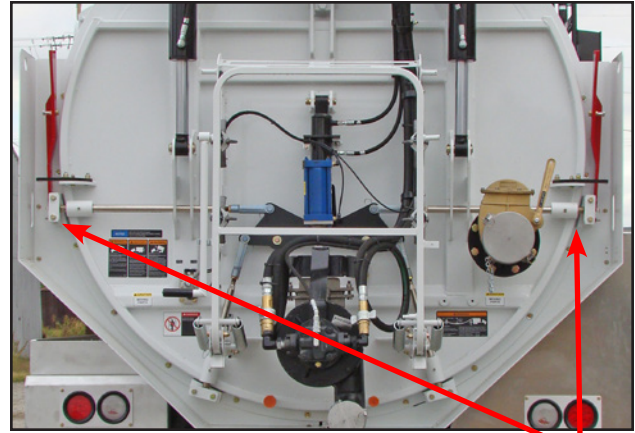
To avoid twisting damage to rear door always use the rear door prop(s). Lower rear door until it just touches both prop(s). Never power door down onto prop(s).

When access is required inside the debris body all safety precautions must be followed for confined space. The inside of the debris body must be fully cleaned prior to entry.

1. Unlock and open the rear door enough to set the props in place.
2. Using the reach pole slightly raise up and pull out both body props. **Both props must always be used.**
3. Lower the door so it just touches both props. If the door is powered in to the props there will be a popping sound of the prop break away feature. If this happens immediately stop closing the rear door. Refer to the maintenance section for how to service.
4. Verify the prop is properly seated in to the socket as shown. If not raise the door enough for the prop to clear and lower again.

Disengaging Safety Prop

- A. Raise the door to just enough for the prop to clear the door.
- B. Push the prop to the stored position.
- C. The door can now be closed.

**NOTICE****Rear Door Can Be Damaged**

Remove safety support(s) before closing door to avoid damage. Open rear door before raising the debris body. Make sure rear door attachments clear the bumper and ground when raising the debris body.

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At any time the debris body is raised to obtain access to the underside of the debris body, all safety precautions must be followed. The debris body should be stabilized and secured before entering any space below it. The unit should be parked on a flat level surface.

The unit is equipped with a safety prop that is raised in place from the passenger side of the unit. The handle to operate it is normally located in the water pump cabinet.

The debris must be empty before using the safety prop.

1. Raise the debris body so that the body clears the safety prop.

Note: It must be high enough in the air to allow the safety prop to clear the body and swing fully into position with the prop rest under the body.

2. Rotate the safety prop towards the prop rest.
3. Lower the body until the prop is just resting in the prop rest. Do not power the debris body down on to the prop. This will secure the body from falling.

Disengaging Safety Prop

1. Raise the debris body just enough to clear the safety prop, rotate the prop back to the stored position.
2. The debris body can now be lowered.
3. Store the handle for later use.



Before and after all work serious issues need to be addressed which include:

1. Has the unit been thoroughly cleaned?
2. Will any of the debris react with any of the components of the unit?
3. Has the debris been positively identified?
4. In the case of a spill, there may be cross contamination issues with material soaked into the surrounding area.

Cleaning

The owner, operator and user are responsible for determining what level of cleaning is required for the specific job due to the possibility of cross contamination of chemicals. Two common resources for information are shown here for reference.

Things to consider when cleaning:

1. Visually inspect the debris body, cyclone(s), baghouse(s) and all material flow paths. They should be clean and clear of all visible debris and should be dry.
2. Replace all filter media in the debris path.
3. Disassemble and clean all filter screens and hoses.
4. Dispose of all waste in accordance with federal, state, and local laws and regulations.
5. Maintain an MSDS/SDS for all materials the units is used for.
6. A procedure should be developed and strictly followed to track the last material the unit was used for and cleaning. A sample form is included here.



Cross Contamination Hazards

Serious hazards from poison gasses, fire and explosions are possible when the wrong chemicals or materials come in contact with each other.

Serious injury or death may result if cleaning procedures are not followed.

Safe Operation of Vacuum Trucks in Petroleum Service

API RECOMMENDED PRACTICE 2219

Additional copies available from API Publications and Distribution:
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202-682-8000



Available from the WJTA:
Recommended Practices for the Use of Industrial Vacuum Equipment.



Vactor

LAST USE CLEANING/SAFETY FORM

OPERATION

Unit		
Work performed by		Date
Notes		
Areas NOT decontaminated		
1		
2		
3		
4		
5		
Last material in unit		
MSDS/SDS attached		Yes - No
Cleaning agents used		Yes - No
MSDS/SDS attached		Yes - No
Other		
1	Unit fully winterized?	Yes - No
2	Water tanks drained and flushed?	Yes - No
3	All filters, strainers, filter bags cleaned or replaced?	Yes - No
4	Exterior of unit cleaned?	Yes - No
5	Debris body, cyclone(s), bag house(s), dump tube(s) cleaned?	Yes - No
6	All other areas material passes or accumulates cleaned?	Yes - No

Units used around or for sewer work present some special handling issues due to biological hazards. This also includes all of the unit's exterior that may have come in contact with waste material. The unit's water tanks, debris body, pumps, filters and plumbing can all become contaminated in use. Recycling units will require additional cleaning before servicing.

Thoroughly flushing with fresh water is the first step to cleaning a unit. A wide variety of chemicals and procedures are available for decontamination. Machine components and seals can be damaged by some chemicals. Consult Vactor Service before use. The owner, operator and user are responsible for determining what level of cleaning is required.

WARNING

Biological hazards



Germs and other biological hazards are common in sewers. All operators must wear safety apparel: hard hat, visor and / or goggles, ear protection, rain suit, safety-toe shoes or boots with non skid soles and water proof gloves are recommended to avoid injury and contamination. Additional equipment may be required as determined by an on site safety assessment.

Immediately treat all abrasions, cuts and nicks for contamination. Get medical attention for injuries associated with cleaning sewers, drains and catch basins if biological contamination is suspected. Serious illness may result if this procedure is not followed.

NOTICE



Consult OEM chassis and engine operation and maintenance manuals for complete details on operation.

For reliable operation these items should be reviewed daily for proper operation. Perform a walk around to verify all items are properly secured for travel.

Note: A printable checklist is in the Maintenance section.

Under the hood: check all fluids, belts and hoses. Fill fuel tanks.



Check all lights including brake and running.



Check tire pressure and condition.



Check brakes, driving and parking.



Fill diesel exhaust fluid tank if equipped.



Wheel chocks should be available on the unit.



Drain air tank(s) and check air dryer system.



For reliable operation these items should be reviewed daily for proper operation.

- Verify all safety decals are in place and legible
- All safety equipment should be with the unit including a safety tee if required

Note: All drain plugs should be left open to keep residual water from the tanks from migrating to the system during transport. Leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow any residual water to drain.

Perform a walk around to verify all items are properly secured for travel.

Note: A printable checklist is in the Maintenance section.

Check all hydraulic and electrical functions for proper operation.



Verify the correct operation of all manual and automatic vacuum relief valves.



Activate the E-Stop to verify it functions correctly and that no error message appear on the display (if equipped).



Verify all drains have been drained and all drain caps are with the unit.



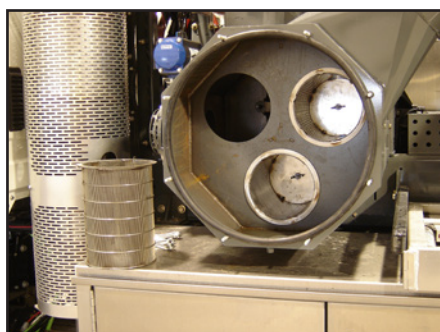
Verify all that all blower, transfer case, pump and gearbox fluid levels are correct.



Check filters if equipped. Replace any that have excessive build up.



Check all micro-strainers and strainer baskets as equipped.



Verify ground bonding cable.





NOTICE



Consult OEM chassis and engine operation and maintenance manuals for complete details on operation.

Changes to the emissions systems may require the operator to perform additional procedures while operating the equipment not required on prior years trucks. The EPA requires a 50% reduction in Nitrogen Oxides (NOx) which are created by the high temperatures and speed of combustion. NOx creates ground level ozone formation and smog.

To comply changes in engines have been made that include:

- Exhaust systems with a Diesel Particulate Filter (DPF) and Diesel Oxidation Catalyst (DOC) unit.
- Larger cooling packages to remove the added heat.
- Require Ultra Low Sulfur Diesel fuel
- Require low ash oils to extend service intervals







A Diesel Particulate Filter (DPF) is a porous ceramic filter to capture the soot particles. It is larger than normal exhaust mufflers and provides maximum ash storage capability between periodic cleanings. The smaller DOC unit is after the DPF to complete the processing of the exhaust.

A process called regeneration oxidizes the soot naturally at high exhaust temperatures to eliminate it. The truck is equipped with a regeneration system that operates automatically under proper conditions or manually when conditions require.

Prolonged operations at low engine rpm may not permit the automatic regeneration cycle. This may require parking the unit for regeneration. Some longer operations like vacuuming fly ash at low rpm are more likely to require parked regeneration. It may be more efficient for an operator to perform a manual regeneration as part of the pre-job preparations to reduce the need for regeneration any time during that day.

Note: The regen process will not function if the check engine light has been activated. The unit must be serviced to allow the regen process to function.

Typical cab instruction decal (IH shown)

EMISSION SYSTEM INSTRUCTIONS				
 (Solid)	 (Flashing)	 (Flashing)  (Solid)	 (Solid)	
LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	Exhaust System Temperature is HOT
Exhaust filter regeneration required.	Exhaust filter is full.	Exhaust filter is full. Engine performance LIMITED .	A serious engine problem has occurred. Exhaust filter may be overfull. Engine may SHUTDOWN soon.	WARNING: Exhaust components and exhaust gas are at extremely high temperatures. When stationary, keep away from people and flammable materials, vapors, or structures or STOP ENGINE .
Drive on highway at highway speeds OR start *Parked Regeneration to prevent loss of engine power.	Pull vehicle safely off roadway and start *Parked Regeneration to prevent loss of engine power.	WARNING: Pull vehicle safely off roadway and start *Parked Regeneration to prevent engine stopping.	WARNING: Pull vehicle safely off roadway, turn on flashers, place warning devices, and STOP ENGINE . Seek service immediately.	
* See Operator's Manual for Further Details				
WARNING: When performing *Parked Regeneration, make certain vehicle is safely off roadway and exhaust system is away from people, or any flammable materials, vapors, or structures. Parked Regeneration may increase engine speed.		WARNING: Failure to follow these instructions may result in a loss of engine power, vehicle speed, increased exhaust temperatures, and may cause an accident or fire resulting in property damage, personal injury, or death.		

Installed on this truck is a supplemental engine and diesel particulate filter warning system, consisting of a horn and flashing external lights, which is designed to augment, not replace, the standard warning system in the cab.

This system will sound a horn and flash the external mirror lights in conjunction with the engine and diesel particulate filter warning lamps located in the instrument cluster.

No liability or warranty is assumed by or provided on this secondary external warning system, as the primary in cab warning and derate system remains in place. Observance of the warning lamps must be adhered to and acted upon as directed in the chassis owner's manual.

External Alert System

This unit is equipped with an external alert system. Park brake must be applied to enable system. External mirror lights will flash and horn will sound when DPF and /or check engine indicators are illuminated in dash panel.

Consult chassis operator's manual for service details.

Newer chassis are often equipped to accommodate the California Air Resources Board (CARB) requirement to shut down the engine after five minutes of non-use idle time. Operators need to be aware of this feature as it may interfere with operations. Refer to the chassis manufacture manuals for details and to verify if the chassis is equipped. Typically on Vactor units the throttle switch must be set to ON and the unit in work or blower mode to override the five minute shutdown feature.

Note

There are many misconceptions — mainly that turning the engine off and restarting it several times a day will increase wear. “Starting and stopping the engine is actually easier on the engine than prolonged idling,” says Brian Lindgren, vocational sales director, Kenworth Truck Co. “It is a good idea to have a good set of batteries and a high-quality starter and alternator to ensure sufficient power to start the engine numerous times if it is not run long enough to recharge the batteries.”

Mike Powers, product development manager for Caterpillar Global On-Highway, agrees, noting, “There is no additional wear when shutting the truck on/off several times a day. There are benefits in fuel economy and wear/durability when shutting the truck down rather than idling.”

According to Christy Nycz, Cummins Inc., an idling engine in a Class 8 truck will consume roughly 1 gal./hour of fuel at 1,000 rpm and .5 gal./hour at 650 rpm.

“The fuel consumption depends on the application, load factor on the engine, etc.,” Powers adds. “It is very difficult to quantify exact savings. But if you decrease your idle time from 50% to 25%, it could improve your fuel economy by up to 4%.”

http://articles.directorym.net/Crack_Down_on_Idle_Time-a878668.html

NOTICE



Jump Starting Or Welding Can Damage Electrical System

To avoid damage:

- Disconnect ECU, control modules and batteries before welding on unit.
- Disconnect control modules before jump starting. Consult chassis service manual for details on jump starting.
- Never use a test light when troubleshooting. Only use digital multimeter on all circuits. Test lights and older analog meters can damage the electronic systems.
- Set all ignition switches to OFF before testing CANbus system.

NOTICE



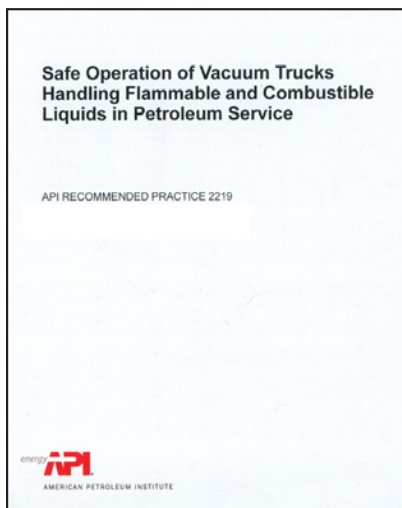
Follow recommended safety practices while performing all work. Refer to the FS Solutions/Guzzler/Vactor/TRUVAC/Westech Safety Manual for additional information.

This manual is available at: www.vactor.com

The owner, operator and user are responsible for determining if static grounding is required and what level of protection is required for the specific job. Due to the possibility of static electricity build up in the system we recommend grounding the unit in all applications.

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**American
Petroleum
Institute**

1229 L Street, Northwest
Washington, D.C. 20005-4070
202-682-8000



Typical static cable and clamp

The American Petroleum Institute provides additional resources and programs to industry which are based on API Standards. For more information, contact:

- | | |
|---|---------------------------------------|
| • Training/Workshops | Ph: 202-682-8490
Fax: 202-682-8222 |
| • Inspector Certification Programs | Ph: 202-682-8161
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Get The Job
Done Right.™**

In addition, NFPA 77 Recommended Practice on Static Electricity provides more detailed grounding methods. This can be obtained from the National Fire Protection Association at www.NFPA.org (800-344-3555).

These three references are recommended to help in making good decisions in the proper use of vacuum truck technology. Other references are also available.

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3 Park Avenue
New York, New York 10016-5901

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Avoiding Static Ignition Hazards in Chemical Operations

A CCPS CONCEPT BOOK

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AMERICAN INSTITUTE OF
CHEMICAL ENGINEERS



CENTER FOR
CHEMICAL PROCESS SAFETY

CENTER FOR CHEMICAL PROCESS SAFETY
of the

American Institute of Chemical Engineers

3 Park Avenue, New York, New York 10016-5901 USA

If use of Vactor equipment results in exposure to potentially hazardous dust, employers and users should consult any applicable SDS as well as OSHA regulations, guidelines, and information to ensure safety of operators. Under these circumstances, users should pay particular attention to possible increased exposure when dumping debris hoppers and changing bag filters. Wearing appropriate respirator during dumping operations and wetting down filter bags before service or removal may reduce exposure to certain dusts such as silica dust. To reduce exposure in presence of potentially hazardous dusts, employers should consider use of upgraded filters, broken bag detectors, and ensure that any leaking gaskets and seals are promptly serviced. Employers should monitor exposure of operators and ensure compliance with applicable OSHA regulations and standards.

Some common practices to reduce exposure include:

1. Upgrading filters
2. Servicing gaskets and seals if leaking
3. Wetting down filter bags, if appropriate before servicing or removal.
4. Operators wearing appropriate respirators when servicing, dumping or during air excavation.

Combustible dusts

Materials that are, or could produce, combustible dusts must be handled in such a way as to prevent combustible dust explosions and deflagrations (fires).

Combustible dusts consist of the following dust types as per NFPA 70: National Electrical Code 2014 Edition

- Group E - Metallic Dusts
- Group F - Carbonaceous Dusts
- Group G - Organic Dusts

It is the responsibility of the owner to insure that all of the following steps are taken before using any air mover unit on combustible dust materials.

5. All employees involved in handling combustible dusts must be trained as to the combustible dust hazards as part of their HAZCOM training. See: OSHA 3371-08 2009 - Hazard Communication Guidance for Combustible Dusts
6. Consult the SDS(s) of the material(s) for the recommended Safe Handling Procedures and Fire and Explosion potentials.
7. Dry materials and low relative humidity increase the dangers of handling combustible dusts.
8. Never dry sweep or *Blow Down* the dusts with compressed air to form piles for easier vacuum removal. Both of these methods can create conditions for a dust explosion to occur.
9. Position the air mover so that the top baghouse doors, which are the emergency relief vent in the event of an explosion, do not create a greater hazard should an explosion occur within the unit. Keep all personnel clear of the baghouse and cyclone clean out doors which may also vent should an explosion occur.
10. The air mover itself contains many possible exterior ignition sources (electrical and heat). Never operate the unit in an area containing airborne combustible dust.
11. Insure the grounding cable on the unit is properly mounted, bare metal bottom of the grounding reel to bare metal mounting surface on either the frame or bed of the unit, and that the grounding cable and clamp are in good condition.

12. Ground the unit to an approved grounding point or grounding rod. If using a grounding rod(s), it must be designed for grounding and driven firmly into the soil per the site requirements. The grounding point should be wire brushed to remove oxidation or other materials that might prevent the free flow of electricity.
13. For rear loading air movers, a rubber baffle placed over the diverter plate is strongly recommended to prevent any potential metal to metal contact during vacuuming. This is essential when vacuuming metal combustible dusts.
14. All components of the vacuum line must be bondable. This includes: nozzle, hoses, pipes, fittings, safety tee, trunk hose.
15. Never use any non-conductive materials in any part of the vacuum line (PVC Pipe or Plastic Hose).
16. Never use bare copper wire inside or outside of the vacuum line as a jumper across non-conductive components.
17. Rubber hoses must include a continuous wire helical stiffener. The wire should be stripped 4-6" on each end of the hose, the bared wire pushed into the hose opening and then the metal hose shanks pressed in to the hoses and clamped together.
18. All bonds and grounds must be tested with a suitable Ohm meter to verify the bonding and grounding meet the site requirements.
19. Do not restrict the air flow to the unit to prevent overheating of the blower. Restricting the air flow could cause the blower to become an ignition source for dusts. Use multiple smaller hoses if a larger hose is not practical.
20. Run the unit at the lowest RPM that moves the material. Excess RPM's create excess heat in the blower.
21. If the unit begins to blow dust from the discharge silencer, immediately shut the unit down, disconnect the vacuum line, repair any broken or unseated bags in the bag house, rinse any dust out of the silencer, clean or purge any dust remaining in the unit between the top of the bag house and the blower and finally reconnect the vacuum line and resume work. Failure to do so could result in a dust explosion.
22. Upon completion of the job, insure the air mover has been cleaned of any combustible dust residue.

Vactor can not possibly, know, evaluate, and advise the service trade of all conceivable ways in which operation or service might be done or the possible hazardous consequences of each way. Anyone who uses operational procedures, service procedures, or tools, whether recommended by Vactor or not, must first satisfy himself thoroughly that neither his safety nor the product safety will be jeopardized by the methods he shall select.

Vactor vacuum systems are designed to user specifications. The owner/operator/user is responsible for the safe use and application of this equipment and proper waste disposal. Transportation and disposal of waste may be subject to local, state or federal laws.

There is an increased risk of fire and/or explosion from combustible dust. The following section provides resources will assist in solving those issues.

General Information

FM Global, "Prevention and Mitigation of Combustible Dust Explosions and Fire", Data Sheet No. 7-76, January 2005.

Eckhoff, Rolf K. "Dust Explosions in the Process Industries," 3rd Edition, Gulf Professional Publishing, 2003.

Bartknecht, W. "Dust Explosions: Course, Prevention, and Protection," Springer- Verlag, 1989.

Hatwig, M., and Steen, H. (eds.), "Handbook of Explosion Prevention and Protection," Wiley-VCH, 2004.

Frank, Walter. "Dust Explosion Prevention and the Critical Importance of Housekeeping," Process Safety Progress, vol. 23, no. 3, September 2004, pp. 175-184.

Amyotte, P., Kahn, F., and Dastidar, A. "Reduce Dust Explosions the Inherently Safer Way," Chemical Engineering Progress, vol. 99, no. 10, October 2003, pp. 36-43.

Ebidat, Vahid. "Is Your Dust Collection System an Explosion Hazard?" Chemical Engineering Progress, vol. 99, no. 10, October 2003, pp. 44-49.

Center for Chemical Process Safety (CCPS). "Guidelines for Safe Handling of Powders and Bulk Solids." CCPS, American Institute for Chemical Process Safety, New York, New York, January 2005.

Code of Federal Regulations (CFR) [Standards]

U.S. Government Printing Office
732 N. Capitol Street, NW Washington, DC 20401
Telephone: 1-866-512-1800 (toll-free)
OSHA Standards, Interpretations, and Publications
U.S. Department of Labor/OSHA OSHA Publications Office
200 Constitution Ave., NW, N-3101
Washington, DC 20210
Telephone: (202) 693-1888
or by Fax: (202) 693-2498

Related OSHA standards found in 29 CFR:

1910.22 - General Requirements: Housekeeping

1910.94 - Ventilation

1910.107 - Spray Finishing Using Flammable and Combustible Materials

<http://www.dustexplosion.info/>



An online refresher course, OSHA's Combustible Dust National Compliance Directive, is available through Federal Signal. The course can be accessed at the following web address:

www.fssolutionsgroup.com/Training/OnlineCourses/tabid/115/Default.aspx

National Fire Protection Association (NFPA)

1 Batterymarch Park
Quincy, MA 02169-7471
Telephone: (800) 344-3555

Related NFPA Standards:

- NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
- NFPA 68, Guide for Venting of Deflagrations
- NFPA 69, Standard on Explosion Prevention Systems
- NFPA 70, National Electrical Code 2014 Edition
- NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids
- NFPA 120, Standard for Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities
- NFPA 432, Code for the Storage of Organic Peroxide Formulations
- NFPA 480, Standard for the Storage, Handling, and Processing of Magnesium Solids and Powders
- NFPA 481, Standard for the Production, Processing, Handling, and Storage of Titanium
- NFPA 482, Standard for the Production, Processing, Handling, and Storage of Zirconium
- NFPA 484, Standard for Combustible Metals, Metal Powders, and Metal Dusts
- NFPA 485, Standard for the Storage, Handling, Processing, and Use of Lithium Metal
- NFPA 495, Explosive Materials Code
- NFPA 499, Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
- NFPA 505, Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation
- NFPA 560, Standard for the Storage, Handling, and Use of Ethylene Oxide for Sterilization and Fumigat
- NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
- NFPA 655, Standard for Prevention of Sulfur Fires and Explosions
- NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
- NFPA 1124, Code for the Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnic Articles
- NFPA 1125, Code for the Manufacture of Model Rocket and High Power Rocket Motors

NFPA 68

Standard on
Explosion Protection by
Deflagration Venting



NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

NFPA

77

Recommended Practice
on Static Electricity
2019



NFPA

654

Standard for the Prevention of
Fire and Dust Explosions from
the Manufacturing, Processing,
and Handling of Combustible
Particulate Solids



OSHA[®] FactSheet

Hazard Alert: Combustible Dust Explosions

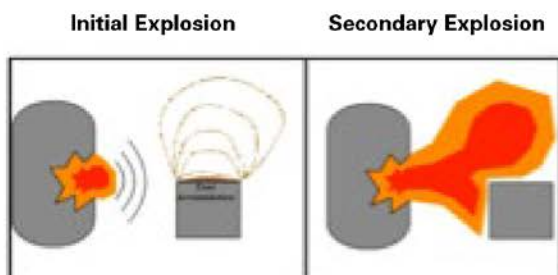
Combustible dusts are fine particles that present an explosion hazard when suspended in air in certain conditions. A dust explosion can be catastrophic and cause employee deaths, injuries, and destruction of entire buildings. In many combustible dust incidents, employers and employees were unaware that a hazard even existed. It is important to determine if your company has this hazard, and if you do, you must take action now to prevent tragic consequences.

How Dust Explosions Occur

In addition to the familiar fire triangle of oxygen, heat, and fuel (the dust), dispersion of dust particles in sufficient quantity and concentration can cause rapid combustion known as a deflagration. If the event is confined by an enclosure such as a building, room, vessel, or process equipment, the resulting pressure rise may cause an explosion. These five factors (oxygen, heat, fuel, dispersion, and confinement) are known as the "Dust Explosion Pentagon". If one element of the pentagon is missing, an explosion cannot occur.

Catastrophic Secondary Explosions

An initial (primary) explosion in processing equipment or in an area where fugitive dust has accumulated may dislodge more accumulated dust into the air, or damage a containment system (such as a duct, vessel, or collector). As a result, if ignited, the additional dust dispersed into the air may cause one or more secondary explosions. These can be far more destructive than a primary explosion due to the increased quantity and concentration of dispersed combustible dust. Many deaths in past incidents, as well as other damage, have been caused by secondary explosions.



A pharmaceutical plant after a dust explosion.

Industries at Risk

Combustible dust explosion hazards exist in a variety of industries, including: agriculture, chemicals, food (e.g., candy, sugar, spice, starch, flour, feed), grain, fertilizer, tobacco, plastics, wood, forest, paper, pulp, rubber, furniture, textiles, pesticides, pharmaceuticals, tire and rubber manufacturing, dyes, coal, metal processing (e.g., aluminum, chromium, iron, magnesium, and zinc), recycling operations, fossil fuel power generation (coal), and additive manufacturing and 3D printing.

Prevention of Dust Explosions

To identify factors that may contribute to a explosion, OSHA recommends a thorough hazard assessment of:

- All materials handled;
- All operations conducted, including by-products;
- All spaces (including hidden ones); and
- All potential ignition sources.

Dust Control Recommendations

- Implement a hazardous dust inspection, testing, housekeeping, and control program;
- Use proper dust collection systems and filters;
- Minimize the escape of dust from process equipment or ventilation systems;
- Use surfaces that minimize dust accumulation and facilitate cleaning;
- Provide access to all hidden areas to permit inspection;
- Inspect for dust residues in open and hidden areas at regular intervals;
- If ignition sources are present, use cleaning methods that do not generate dust clouds;
- Use only vacuum cleaners approved for dust collection; and
- Locate relief valves away from dust deposits.

Ignition Control Recommendations

- Use appropriate electrical equipment and wiring methods;
- Control static electricity, including bonding of equipment to ground;
- Control smoking, open flames, and sparks;
- Control mechanical sparks and friction;
- Use separator devices to remove foreign materials capable of igniting combustibles from process materials;
- Separate heated surfaces from dusts;
- Separate heating systems from dusts;
- Select and use industrial trucks properly;
- Use cartridge-activated tools properly; and
- Use an equipment preventive maintenance program.

Injury and Damage Control Methods

- Separation of the hazard (isolate with distance);
- Segregation of the hazard (isolate with a barrier);
- Deflagration isolation/venting;
- Pressure relief venting for equipment;
- Direct vents away from work areas;
- Specialized fire suppression systems;
- Explosion protection systems;

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

- Spark/ember detection for suppression activation;
- Develop an emergency action plan; and
- Maintain emergency exit routes.

Applicable OSHA Requirements Include:

- §1910.22 Housekeeping
- §1910.307 Hazardous Locations
- §1910.1200 Hazard Communication
- §1910.269 Electric Power Generation, Transmission and Distribution (coal handling)
- §1910.272 Grain Handling Facilities
- General Duty Clause, Section 5(a)(1) of the *Occupational Safety and Health Act* (Employers must keep workplaces free from recognized hazards likely to cause death or serious physical harm).

Resources

Readily available from www.osha.gov are:

- Combustible Dust National Emphasis Program
- Safety and Health Information Bulletin (SHIB) (07-31-2005) *Combustible Dust in Industry: Preventing and Mitigating the Effects of Fires and Explosions*

See the SHIB or www.osha.gov for other applicable standards.

The primary National Fire Protection Association (NFPA) consensus standards related to this hazard are:

- NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
- NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
- NFPA 484, Standard for Combustible Metals
- NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
- NFPA 655, Standard for the Prevention of Sulfur Fires and Explosions
- See www.nfpa.org to view NFPA standards.

For assistance, contact us. We can help. It's confidential.



www.osha.gov (800) 321-OSHA (6742)



U.S. Department of Labor

DSG FS-3791 05/2015



OSHA's Respirable Crystalline Silica Standard for Construction

Workers who are exposed to respirable crystalline silica dust are at increased risk of developing serious silica-related diseases. OSHA's standard requires employers to take steps to protect workers from exposure to respirable crystalline silica.

What is Respirable Crystalline Silica?

Crystalline silica is a common mineral that is found in construction materials such as sand, stone, concrete, brick, and mortar. When workers cut, grind, drill, or crush materials that contain crystalline silica, very small dust particles are created. These tiny particles (known as "respirable" particles) can travel deep into workers' lungs and cause silicosis, an incurable and sometimes deadly lung disease. Respirable crystalline silica also causes lung cancer, other potentially debilitating respiratory diseases such as chronic obstructive pulmonary disease, and kidney disease. In most cases, these diseases occur after years of exposure to respirable crystalline silica.

How are Construction Workers Exposed to Respirable Crystalline Silica?

Exposure to respirable crystalline silica can occur during common construction tasks, such as using masonry saws, grinders, drills, jackhammers and handheld powered chipping tools; operating vehicle-mounted drilling rigs; milling; operating crushing machines; using heavy equipment for demolition or certain other tasks; and during abrasive blasting and tunneling operations. About two million construction workers are exposed to respirable crystalline silica in over 600,000 workplaces.

What Does the Standard Require?

The standard (29 CFR 1926.1153) requires employers to limit worker exposures to respirable crystalline silica and to take other steps to protect workers. Employers can either use a control method laid out in **Table 1** of the construction standard, or they can measure workers' exposure to silica and independently decide which dust controls work best to limit exposures in their workplaces to the permissible exposure limit (PEL).

What is Table 1?

Table 1 matches 18 common construction tasks with effective dust control methods, such as using water to keep dust from getting into the air or using a vacuum dust collection system to capture dust. In

some operations, respirators may also be needed. Employers who follow **Table 1** correctly are not required to measure workers' exposure to silica from those tasks and are not subject to the PEL.

Table 1 Example: Handheld Power Saws

If workers are sawing silica-containing materials, they can use a saw with a built-in system that applies water to the saw blade. The water limits the amount of respirable crystalline silica that gets into the air.

Table 1: Specified Exposure Control Methods When Working With Materials Containing Crystalline Silica

Equipment/ Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hrs/ shift	> 4 hrs/ shift
Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • When used outdoors. • When used indoors or in an enclosed area.	None	APF 10
		APF 10	APF 10

Excerpt from Table 1 in 29 CFR 1926.1153

In this example, if a worker uses the saw outdoors for four hours or less per day, no respirator would be needed. If a worker uses the saw for more than four

hours per day or any time indoors, he or she would need to use a respirator with an assigned protection factor (APF) of at least 10, such as a NIOSH-certified filtering facepiece respirator that covers the nose and mouth (sometimes referred to as a dust mask). See the respiratory protection standard (29 CFR 1910.134) for information on APFs.

Alternative Exposure Control Methods

Employers who do not fully implement the control methods on Table 1 must:

- **Determine the amount of silica that workers are exposed to** if it is, or may reasonably be expected to be, at or above the **action level of 25 µg/m³** (micrograms of silica per cubic meter of air), averaged over an 8-hour day;
- Protect workers from respirable crystalline silica exposures above the **PEL of 50 µg/m³**, averaged over an 8-hour day;
- Use **dust controls** and safer work methods to protect workers from silica exposures above the PEL; and
- Provide **respirators** to workers when dust controls and safer work methods cannot limit exposures to the PEL.

What Else Does the Standard Require?

Regardless of which exposure control method is used, all construction employers covered by the standard are required to:

- Establish and implement a **written exposure control plan** that identifies tasks that involve exposure and methods used to protect workers, including procedures to restrict access to work areas where high exposures may occur;
- Designate a **competent person** to implement the written exposure control plan;
- Restrict **housekeeping** practices that expose workers to silica, such as use of compressed air without a ventilation system to capture the dust and dry sweeping, where effective, safe alternatives are available;
- Offer **medical exams**—including chest X-rays and lung function tests—every three years for workers who are required by the standard to

wear a respirator for 30 or more days per year;

- **Train workers** on the health effects of silica exposure, workplace tasks that can expose them to silica, and ways to limit exposure; and
- **Keep records** of workers' silica exposure and medical exams.

Additional Information

Additional information on OSHA's silica standard can be found at www.osha.gov/silica.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education.

OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing and improving safety and health management systems. To locate the OSHA On-Site Consultation Program nearest you, call 1-800-321-OSHA or visit www.osha.gov/consultation.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.



Applying water to the blade of a handheld power saw reduces the amount of dust created when cutting.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.



U.S. Department of Labor



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Options

Options

AIR EXCAVATION

Air excavation is similar to hydro-excavation in operation.

Vactor offers Air-Spade® digging tools for use with the optional air compressor system. Refer to the manufacturer's manual for operation, service and maintenance.

Air-based vacuum system offers the same benefits of the water-based vacuum excavation trucks with the following advantages:

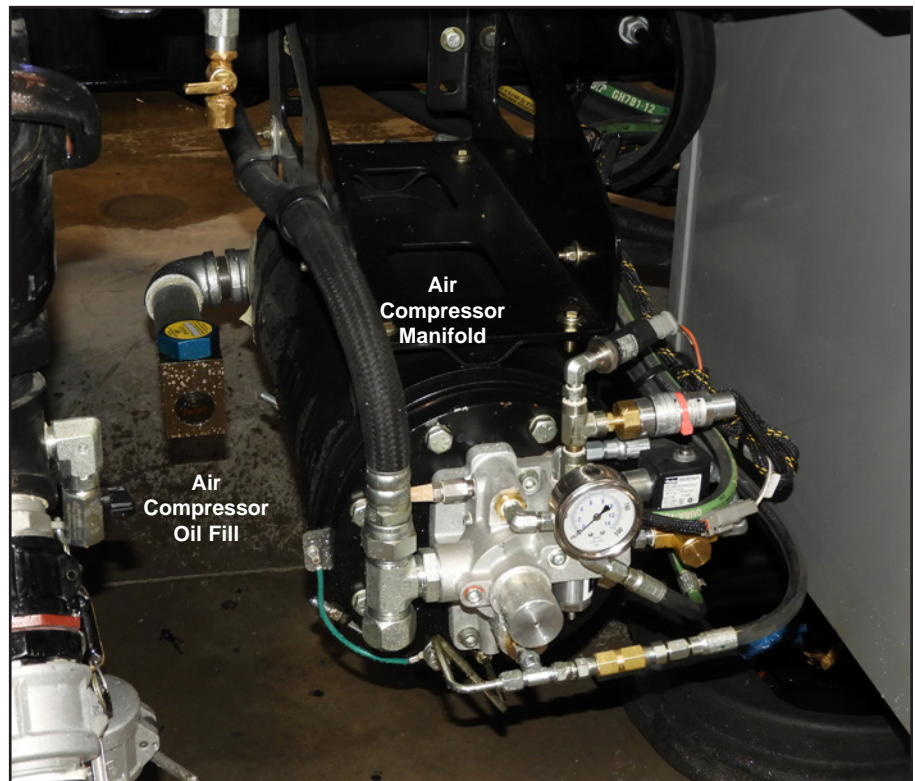
- With air, spoils stay dry so they can be used for backfilling
- Air eliminates mud disposal problems
- Air reduces erosion of road base or around utilities
- Air units are smaller and more versatile and can get into tight areas.
- Air units are quieter and therefore less disruptive

Note: Working with air will require more frequent maintenance of the air filter.

Refer to manufacturer's manual for service.



Air Compressor Option - Up will activate the air compressor in high pressure mode for excavation, down will activate in low pressure mode for tools.



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WATERHEATER - ALKOTA - OVERVIEW

The water heater is designed to control the temperature of the water. The heater output temperature is controlled by an adjustable thermostat control. The water heater normal ratings are 800,000 BTU at 3 to 30 GPM.

A water heater with an electronic temperature control will allow the water heater to heat different volumes of water without overheating and going into steam. The electric temperature control has a microprocessor in it that senses a rapid heat rise and shows the accent of the heat. The electronic temperature control will typically have 4 to 5 on/off cycles in 60 seconds at 2.8 to 6 GPM. At volumes over 6 GPM the E.T.C. will typically run solid during operation.

The adjustable temperature control is similar to the electronic control except the temperature is set with a calibrated dial.

The primary controls are designed with a safety system that shuts down after about 13 seconds if no flame is detected.

Routine Maintenance

The system should be run for at least 15 minutes every month to maintain proper operation. Inspect for road debris and animal nesting before use. Clean as needed before operation.



NOTICE

Fire hazard

Do not use water heater when unit is in motion.

For proper combustion air flow and to avoid fuel build up the unit must be stationary and the cabinet door or window must be open during operation.



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WATERHEATER - ALKOTA - CONTROLS

The controls are located under the water heater inside the cabinet on all versions.

Burner ON/OFF - Master switch to operate or shut down water heater.

Hour Meter - Hours unit burner switch is on.

Power indicator light - indicates there is power at the primary control.

Fuel Solenoid indicator light - indicates that the fuel solenoid is active.

Temperature Control - Turn to adjust to desired water temperature. The burner will not operate in the OFF setting.

Pressure indicator light - indicates that the minimum flow and pressure of water is moving through the system. This light is triggered by the pressure switch located inside the water pump cabinet (may also be located in heater cabinet). To achieve the minimum hydraulic pressure to activate the flow switch requires proper water nozzle selection.



CAUTION



Fire hazard

Do not use water heater when unit is in motion.

For proper combustion air flow and to avoid fuel build up the unit must be stationary and the cabinet door must be open during operation.

Refer to manual for details



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High Temperature Relief Valve

This valve will relieve the system to a drain hose when the system overheats or reaches 5000psi. This is a fail safe type of valve and must be replaced if activated.



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WATERHEATER - ALKOTA - GENERAL OPERATION

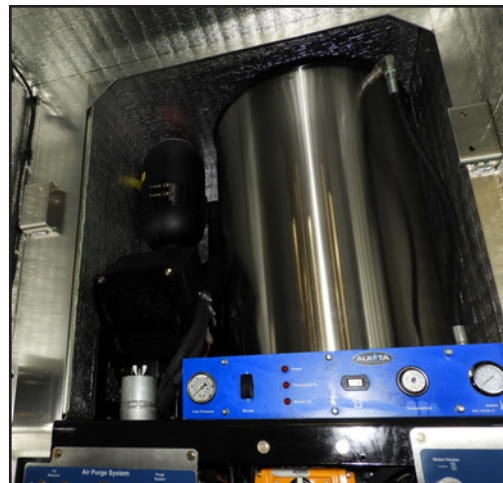
1. Check to make sure fuel tanks have at least a $\frac{1}{4}$ tank of fuel. Heater will not ignite if fuel falls below this level.
2. Ensure water tank has water in it.
3. Open door or window on heater cabinet, one must remain open during operation to provide adequate air flow to the burner and to prevent overheating of the system.
4. Turn burner power switch to the "ON" position.
5. Set desired water temperature. Do not exceed 180° F.
6. Turn on water pump and begin digging.
7. The green flow indicator light will light when proper water flow/pressure is sensed by the pressure switch. Proper nozzle selection is required to produce needed flow.
8. When green indicator light is on the burner will receive the signal to ignite.
9. Burner will turn on/off automatically to keep water temperature within the set range.

If for any reason the water heater does not fire after 15 seconds, the fuel solenoid will lock out due to no flame. This can be reset by turning the burner power switch "off" and waiting 10 seconds. Return the burner power switch to the "on" position. If after 3 consecutive attempts and the burner does not ignite, discontinue use, start trouble shooting the water heater (refer to water heater troubleshooting section). The fuel solenoid indicator light will be on when the fuel solenoid is powered.

10. At lower water volumes the burner will cycle on/off as much as 4 to 5 times per minute. At higher volumes the burner will run continuously.
11. It is recommended the water heater be turned off and allowed to cool with water flowing through the coil. This will decrease the amount of scale build-up in the coil.

It is recommended to change the fuel nozzle after every 1000 hours of operation.

Some locations do not require heat for operation due to higher temperatures or soft materials being vacuumed. It is recommended to start your burner and let it run for 10-15 minutes once per month to ensure proper operation and prevent fuel from draining back to tank or debris from accumulating on the coils.



NOTICE

Fire hazard

Do not use water heater when unit is in motion.



For proper combustion air flow and to avoid fuel build up the unit must be stationary and the cabinet door or window must be open during operation.

Notes:

- Enabled when water pump is ON in stationary mode (does not work in road mode)
- Does NOT run in recirculation mode
- Disabled if water tank temperature is at least 100° F and water return line temperature is at least 120° F. (Does not apply to 2100 Plus CB units)

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WATERHEATER - ALKOTA - PERFORMANCE

Burner performance is not affected until the elevation is over 2000 ft. As elevation increases above sea level, the ambient air contains less oxygen. Because there is less available oxygen per Cubic foot of air, the burner must deliver a higher volume flow (cfm) of air to provide the proper amount of oxygen for the amount of oil being burned. This is the reason that an increase in the burner air setting or a fuel nozzle downsize may be required as elevation increases. For every 1000 ft. above sea level there is a 1.84% rate reduction in the burner.

During normal operation there should not be any visible smoke. If smoke is observed shut down and correct the burner setup. If not corrected the heat exchanger will be covered in soot and efficiency will be reduced.

The water flow determines the on/off cycle rate of the burner and the resulting temperature rise.

All burner nozzles sizes are in gallons per hour at 100psi fuel pressure.

High Elevation Nozzles	
Part No.	Description
49785A	ALKOTA 400K NOZZLE 4000-8000 X 2.5GPM
49785B	ALKOTA 400K NOZZLE 8000+ X 2GPM
49785C	ALKOTA 800K NOZZLE 4000-8000 X 4.5GPM
49785D	ALKOTA 800K NOZZLE 8000+ X 4GPM

ANTI-FREEZE TANK

The anti-freeze tank provides a supply of anti-freeze that can be drawn into the water pump system to reduce the risk of freezing during transport. There is a sight tube to indicate the liquid level that can be seen by looking way back underneath the air purge panel. The control valves are located inside the water pump cabinet.

Prepare for transport

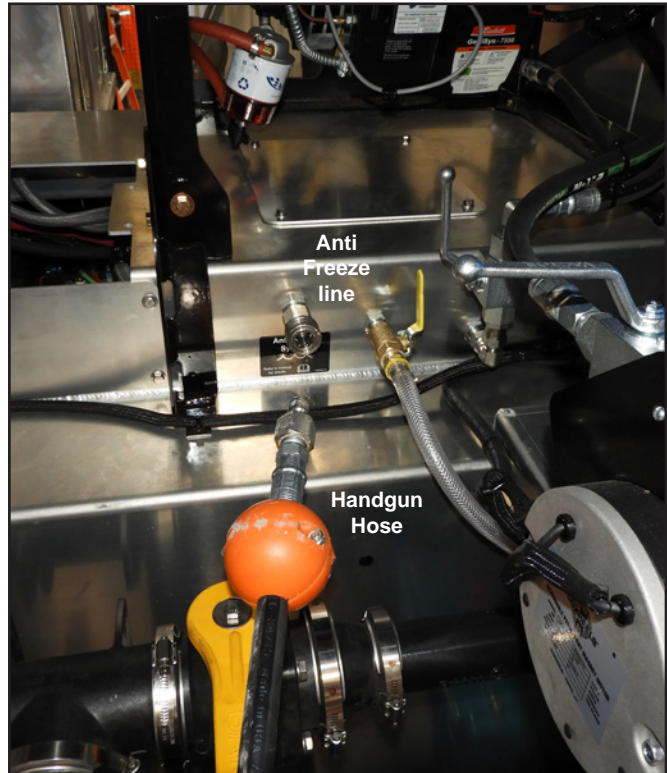
1. Turn off the water to the water pump.
2. Before operating the handgun open the anti-freeze tank and pump valves.
3. Operate the handgun at low speed until anti-freeze can be seen coming out the nozzle.
4. Stop the handgun and shut down the water pump.
5. Close the anti-freeze tank and pump valves.
6. The water pump is now ready for transport.

Prepare for use

1. Turn off the water to the water pump.
2. Attach the handgun hose to the quick coupling.
3. Operate the water pump at low speed until all the anti-freeze has been pumped from the system. This should only take a few seconds.
4. Shut down the water pump.
5. The water system is now ready for use.

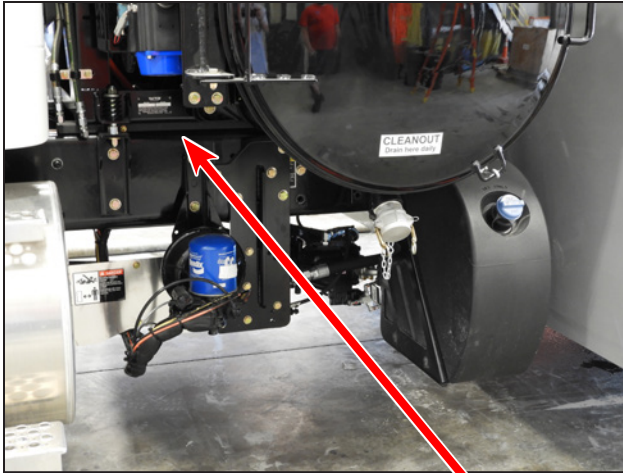
Maintenance

On a yearly basis at the end of the cold weather, flush and drain the anti-freeze tank and system.



Maintenance

Maintenance



Perform these items in addition to all other service and lubrication requirements.

New Unit First Time Service & Lubrication Checklist				
	ITEM	When	Performed By	Date
1	Service chassis (consult manufacturer's manual)			
2	Inspect all door seals	1st week		
3	Inspect all vacuum hoses	1st week		
4	Wash and clean entire truck	1st week		
5	Inspect all safety equipment, guards, etc.	1st week		
6	Drain air tanks	1st week		
7	All grease zerks (unless otherwise noted)	1st week		
8	Lift cylinder	1st week		
9	Debris body hinges	1st week		
10	Rear door hinges	1st week		
11	All clamp and lid screws	1st week		
12	Change blower oil if equipped	100 hours		
13	Change transfer case oil if equipped	100 hours		
14	Change hydraulic oil filter	100 hours		
15	Driveline joints	1st week		
16	Grease boom	1st week		
17	Inspect / repair leaks	1st week		
18	Change oil & lube water pump	50 hours		
19	Air compressor if equipped (see manufacturer's manual)			



Confined Space Hazard

Entering a confined space without proper precautions can lead to death or serious injury. Before entering the debris body, watertank or filter housing comply with all work rules and applicable federal, state, and local regulations.

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SERVICE CHECKLIST

MAINTENANCE

The system should be serviced according to the following schedule. Proper service of the system includes proper lubrication. Consult the lubrication checklist in conjunction with the service

checklist. The following time intervals are based upon a normal eight hour working day. Frequency of maintenance may have to be increased if the system is placed into operation for longer periods of time.

Service Checklist						
	ITEM	8 Hrs. or each shift	25 Hrs. or Weekly	100 Hrs. or Monthly	500 Hrs. or Every 6 Months	1000 Hrs. or Every 12 Months
1	Check blower oil level	X				
2	Check hydraulic oil level	X				
3	Service chassis (consult manufacturer's manual)	X	X	X	X	X
4	Inspect all door seals		X			
5	Inspect all vacuum hoses	X				
6	Wash and clean entire truck		X			
7	Inspect all safety equipment, guards, etc.	X	X			
8	Inspect, drain and clean blower micro strainer	X				
9	Inspect all warning labels		X			
10	Inspect proper functioning of vacuum relief valves	X				
11	Inspect and clean debris body screens	X				
12	Inspect make/break seals	X				
13	Drain air tank(s)	X				
14	Drain silencer(s)	X				
15	Inspect and clean cyclone & dust box	X				
16	Check transfer case oil level if equipped	X				
17	Check water Y-strainer Filter Screen	X				
18	Check Body/Boom Seals for Leakage & Condition		X			
19	Check all chassis fluid levels	X				
20	Flush high pressure water pump		X			
21	Inspect and rotate vacuum suction hose			X		
22	Inspect water heater for leaks, damage, etc		X			
23	Inspect and clean water tank sensor probes				X	
24	Inspect high pressure wand and hand gun for damage	X				
25	Water pump oil and piston lube points	X				
26	Run water heater for 15 minutes if equipped			X		
27	OMSI transfer case air shift - drain air filter if equipped	X				
28	OMSI transfer case air shift - check air dryer if equipped	X				
29	Check Y-strainer screens	X				
30	Check blower driveline	X				
31	Inspect water & hydraulic hoses for wear or damage	X				
32	Inspect hoses and gaskets for leaks and wear	X				
33	Inspect make/break and boom tube seals		X			
34	Check pressure limiting devices (hydraulic and water reliefs)		X			
35	Air compressor if equipped (see manufacturer's manual)	X	X	X	X	X
35	Service water pump (see manufacturer's manual)	X	X	X	X	X

All units are equipped with this general purpose decal, normally located on the passenger side, to assist operators.

DANGER

Confined Space Hazard

Entering a confined space without proper precautions can lead to death or serious injury. Before entering the debris body, watertank or filter housing comply with all work rules and applicable federal, state, and local regulations.

WARNING

Vacuum Hazard

Cutting, crushing, suffocation or body rupture from the forces of vacuum could result in serious injury or death.

Stay clear of the suction hose inlet end. Turn vacuum off before attaching hose, pipe or accessories.

Keep suction hose inlet end near ground level when vacuum is operating.

Refer to **SAFETY** manual for details. 

WARNING

Cancer and Reproductive Harm

Required for compliance with California Prop 65. Refer to: www.P65Warnings.ca.gov

NOTICE

Boom Can Be Damaged


The boom should only be used for its published, intended and rated use. Do not overload. To avoid damage do not use as a lifting device.

Blower Oil Service



Check blower oil daily or the start of each shift.

All vacuum blowers are equipped with at least one sight glass at each end of the blower. Depending on blower configuration the sight glasses may be located on either side or the end of the blower at each end, and there may also be upper and lower sight glasses. The oil level must be checked at both ends of the blower while the unit is off and on level ground.

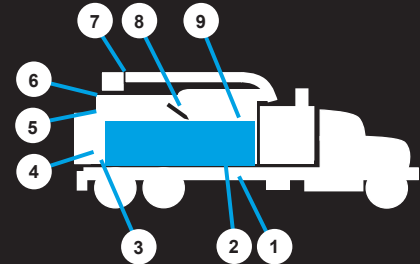
Refer to the maintenance section in the manual and the blower manufacturer's manual. 

General Operation

- Consult the OPERATOR'S manual for complete details on SAFETY and proper OPERATION of this unit.
- **Call 811** before all digging operations to locate and mark off all known utilities
- Verify all equipment is in safe working order and suitable for the work to be performed.
- Never operate without manual, automatic and safety vacuum reliefs installed and properly operating.
- Work as team with second operator
- Wear protective clothes and equipment
- Set up vacuum hose with the in-line vacuum relief valve and nozzle at the hose working end.
- The working end of the vacuum tube should be soft and non-conductive
- Follow site procedures for static electricity and ground truck
- Do not use excessive water pressure or temperature
- Cold weather operation - drain as required

Daily Service Check List

- Inspect all safety equipment, guards, etc.
- Check blower oil level
- Check hydraulic oil level
- Check transfer case oil level (if equipped)
- Service chassis (consult manufacturer's manual)
- Inspect all vacuum hoses
- Drain, inspect and clean micro strainer (if equipped)
- Drain, inspect and clean all air/water filters and Y-strainers
- Inspect for proper functioning of vacuum relief valves
- Inspect inlet head and inlet boot seals
- Inspect all high pressure hoses for excessive wear, damage or improper assembly of fittings
- Inspect hoses and gaskets
- Inspect and clean all door seals before closing doors
- Drain air tanks and silencers
- Inspect cyclones for excess material (if equipped)
- Inspect all safety equipment, guards, etc.



WEEKLY (25HRS) GREASE POINTS

1	ALL DRIVELINE JOINTS
2	LOWER HOIST CYLINDER BRACKET - Monthly
3	DEBRIS BODY MOUNTING HINGE
4	REAR DOOR LOCKS
5	REAR DOOR HINGE
6	BOOM GEAR TEETH & BEARING (use remote zerk)
7	BOOM & CYLINDER PINS - Monthly
8	LEVEL INDICATOR (location varies)
9	UPPER HOIST CYLINDER PINS - Monthly
-	ALL SMALL DOOR HINGES

Technical Service Hotline - 877-342-5374



Scan the QR Code with your mobile device or visit:
<http://www.fsessgsafety.com>
for the latest FSESG product and application safety information.



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LUBRICATION CHECKLIST

MAINTENANCE

Lubrication Checklist						
	ITEM	8 Hrs. or each shift	25 Hrs. or Weekly	100 Hrs. or Monthly	500 Hrs. or Every 6 Months	1000 Hrs. or Every 12 Months
1	All grease zerks (unless otherwise noted)		x			
2	Lift cylinder		x			
3	Box hinges			x		
4	Rear door hinges			x		
5	All clamp and lid screws		x			
6	Change blower oil			First	x	
7	Change transfer case oil			First	x	
8	Change hydraulic oil and filter as indicated on gauge or:			First Filter		x
9	Driveline joints		x			
10	Check the tightness of the blower oil case plugs			x		
11	Grease boom swivel bearing (2)		x			
12	Grease boom sleeve (3)			x		
13	Grease boom lift Cylinder (1)			x		
14	Grease boom hinge pin (1)			x		
15	Grease boom pivot pin			x		
16	Grease Debris Body Hoist Cylinder (2)			x		
17	Grease Debris Body Hinge (2)			x		
18	Grease Debris Body Door Hinge (4)			x		
19	Grease Debris Body Rear Door/Hyd. Locks (4)		x			
20	Grease Debris Body Fill Indicator (1)		x			
21	Place 3 drops of oil in each oil hole on Cat water pump			x		
22	Grease hyd pump front drive shaft (3) and PTO shaft (3)		x			
22	Air compressor if equipped (see manufacturer's manual)			grease	oil	
23	Water pump (see manufacturer's manual)		500 hrs or 3 months			

Grease - Unless otherwise noted grease all zerks and required surfaces with Castrol Pyroplex Protection ES Synthetic EP Grease NLGI #2 (purple) or equivalent. Special operating conditions (excessive temperature or speed) may require a different type of grease (consult the factory). Do not over grease.

Note: Keep grease fittings clean, accessible, and free from damage. Grease fittings should be checked every week. Examine for broken fittings and replace broken fittings.

All clamp and lid screws should be lubed with an anti-sieze compound.

Chassis service - refer to the chassis manual

DANGER

Entanglement Hazard

Contacting moving parts with clothes or body can cause injury or death:



- Never go underneath the vehicle with the engine running.
- Never work near a rotating drive shaft.
- Never attempt to engage or disengage the pump or other driven equipment from underneath the vehicle with the engine running.
- Never attempt to engage or disengage any driven equipment from any position that could result in getting entangled in the drive shaft or moving parts.
- Never attempt to work on any installed driven equipment with the engine running.
- Remove the ignition keys and post a lockout/tagout sign on the chassis steering wheel and engine control panels as required.

NOTICE

Keep grease fittings clean, accessible, and free from damage. Grease fittings should be checked every week. Examine and replace broken fittings.

NOTICE



Service Access

Never use access ladders or platforms with the unit running. Shut down and lock out the unit before all service to avoid injury. Refer to the unit manual and safety manual for details.

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Transfer Cases		
	OMSI	NOTES
1	BP Autran SYN 295	Standard Fill
-	API 80W-90 (hydrostatic drive box in creep drive rail units)	Standard Fill

Hibon Blower Lubricant		
	Fluid	NOTES
1	Castrol ALPHA HC 220/Isolube 220	Standard Fill
2	Castrol SHL Lubricant 220	
3	Conoco SynCon Synthetic R&O 220	
4	Mobil SHL 630	

Robuschi Blower Lubricant		
	Fluid	NOTES
1	Castrol ALPHA HC 220/Isolube 220	Standard Fill - refer to Robuschi manual for additional recommendations based on ambient conditions.

NOTICE

Machine Can Be Damaged

To avoid damage:

- Never overfill or under fill lubricant or fluid levels.
- Maintain proper fill levels.
- Always use the correct lubricant or fluid.
- Overfilling can cause overheating in gear lubrication systems.
- NEVER operate with either a malfunctioning lubrication system or indicator light ON (if equipped).

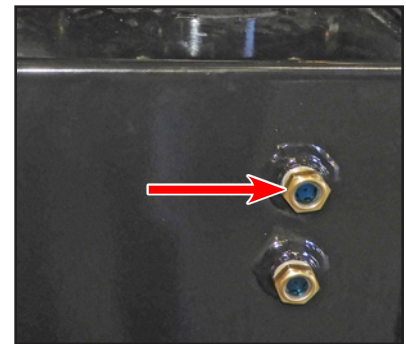
The hydraulic system leaves the factory filled with Castrol Hydraulic Dual Range 32 oil. This purple fluid is recommended for all normal operation conditions from -20° to 95° (F) ambient. For continuous operation above 95° (F) ambient Castrol Hydraulic Plus Blue 68 is recommended. For continuous operation below -20° (F) ambient grade 22 oil is recommended.

Other hydraulic oils, if used, should be a quality product carefully selected with assistance from a credible supplier. The oil should include thermal stability, sheer stability, low-temperature fluidity, anti-wear, anti-corrosion, anti-foaming and seal conditioning characteristics. Consult the factory for oil other than the recommended products.

The first change is for the filter at 100 hours and oil every 1000 hours or six months after that. Filters should be changed whenever indicated by the filter gauge. Contaminants allowed to remain in the circuit not removed by the filters will cause excessive wear and malfunctions.

The oil tank will normally feel hot to the touch.

Two sight eyes are installed to determine the oil level are mounted on the side of the oil reservoir tank. Proper oil level should not be less than 1/2 as viewed in the lower sight eye and not above 1/2 in the upper sight eye. The debris body should be down, rear door closed, boom stored, hose reel retracted and system off when checking level. Check the oil level every eight hours. If the oil level is low, add proper grade hydraulic oil.



Dual range - Viscosity is similar to a grade 46 oil at temperatures of 155° F and above. Viscosity is similar to a grade 32 oil at temperatures of 60° to 155° F. Viscosity superior to a grade 32 oil at temperatures of -20° to +60° F.

Anti-Wear Hydraulic Oils				
	GRADE	32	46	68
1	Gravity, API D 1298	32.2	29.3	28.5
2	Flash, COC, °F D 92.	410	440	460
3	Viscosity cSt at 40° C D 445	32	46	68
4	Viscosity cSt at 100° C	5.4	6.8	8.7
5	Viscosity SUS at 100° F	165	237	352
6	Viscosity SUS at 210° F	44.4	49	55.5
7	Viscosity Index D 2270	102	102	99
8	Emulsion at 130° F D-1401	Pass	Pass	Pass
9	Turbine Oil Stability Test D 943 Hours	5000+	5000+	5000+
10	Rust Test, SSW D 665B	Pass	Pass	Pass

The oil filters supplied by Vactor/Guzzler are equipped with a high efficiency absolute filtering media. Many common filters only give approximately thirty percent filtration of the particles in the hydraulic oil. These filters are referred to as nominal filters. Absolute filtering can give as much as ninety eight percent filtration of the particles in the hydraulic oil. Vactor/Guzzler uses and recommends only the use of absolute filters.

The hydraulic oil filter is normally located on the driver side above the hydraulic oil tank.

Filters should be changed whenever indicated by the filter gauge and any time the hydraulic oil is changed. More frequent replacement could be advisable, depending on operating conditions or oil changes at more frequent intervals may be necessary if oil condition becomes poor. Contaminants allowed to remain in the circuit not removed by the filters will cause excessive wear and malfunctions.

If equipped, the indicator on the filter automatically resets after maintenance and is color-coded as follows:

Green - Normal

Yellow - Warning

½ Yellow & ½ Red - Service

The indicator signals the following conditions:

- Clogged filter element
- Fluid temperature below normal
- Impending filter by-pass valve open condition



Hydraulic oil filters should not be cleaned. They should be replaced and the old filter properly discarded in compliance with all federal, state and local laws.

To change the filter, follow these steps.

1. Shut down the system and relieve pressure in the filter line.
2. Remove the over.
3. Install the new element.
4. Reinstall the over.
5. Start the hydraulic pumping system and check for leaks. If oil seepage is noted, apply additional hand torque to the canister until seepage stops.

The standard hydraulic oil filter element in the tank housing is part number: 507828-30.

All areas where material flows are subject to wear. The rate of wear varies greatly with the material and operating conditions. All models are equipped with a replaceable deflector to receive the highest wear and to reduce the materials wear on other parts of the system.

The deflector, cyclones, hoses, tubes, elbows, boom turret and all areas in contact with the moving material should be inspected monthly and repaired or replaced as required. Highly abrasive and/or corrosive materials will require more frequent inspections.



Follow precautions needed for confined space entry. Comply with all applicable federal, state, and local regulation.

APXX

PRE-JOB / DAILY CHECKLIST

MAINTENANCE

Pre-Job/Daily Checklist					
	Engine Off, Engine Cool			Engine ON	
Check	Item	Date	Check	Item	Date
	Radiator Coolant			Engine Sound and Exhaust	
	Battery Water			Foot Brakes	
	Hydrometer			Emergency Brake	
	Drive Belts			Power Steering	
	Fan			Cab Lights	
	Alternator			Headlights	
	Crankcase Oil			Taillights	
	Fuel Tank			Turn Signals, Rear	
	Transmission Fluid			Turn Signals, Front	
	Brake Function			Clearance Lamps, Front	
	Brake Fluid			Clearance Lamps, Rear	
	Instrument Gauges			Marker Lamps, Front	
	Windshield Wipers			Marker Lamps, Rear	
	Windshield Washers			Instrument Panel Lamps	
	Mirrors			Instrument Panel Gauges	
	Tire Wear			Horn	
	Tire Damage			Heating and Ventilating	
	Tire Inflation			Air Conditioning	
	Hoses			Mirrors	
	Frame			Test Drive	
	Engine Off			Engine On, Park Brake Set	
Check	Item	Date	Check	Item	Date
	Hydraulic Pump Oil Level			Open Rear Door	
	Blower Oil Level			Install Rear Door Safety Prop	
	Vacuum Relief Valves			Inspect Vacuum Float Balls	
	Transfer Case Oil Level			Inspect, Clean Rear Door Seal	
	Access Door Secured			Store Rear Door Safety Prop	
	Hoses, Tubing, and Loose Items Secured			Close Rear Door	
	Water Pump Case Oil Level			Hydraulic Pump ON when PTO is Engaged	
				Verify Blower Operation	
				Activate E-Stop - check for operation	
Notes:					
Copy and use this check list prior to each job. Failure to monitor the items included in the check list prior to each job will increase the risk of accidental injury to personnel and/or damage to the equipment.					

WARNING**Handguns Use High Pressure Water**

High pressure water can cause serious injury or death.

- Wear appropriate safety equipment including: Waterproof apparel, protective boots, insulated gloves, safety glasses or goggles, hearing protection (ear plugs and/or ear muffs) and a hard hat with a face shield.
- Never point the handgun at or near a person or animal.
- Bleed pressure from handgun by shutting off water pump pressure and pressing the trigger before disconnecting from high pressure connection.
- Use handgun and connection supplied with the unit; never use common low pressure handguns or connectors with the high pressure system.

NOTICE**Water pump can be damaged**

Do not operate water pump without water.

Water System Can Be Damaged By Freezing

Ice in the water system can severely damage components. To avoid ice damage:

- Verify that water flows when valves or plugs are opened. Insure that ice has not plugged drain lines, valves or drain plugs.
- Leave all drain plugs open to keep residual tank water from the tanks from migrating to the system during transport.
- Leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow residual water to drain.
- If the unit cannot be properly drained, move the unit to a warm area and allow the water system to warm completely to drain.
- Never operate water pump(s) if system is frozen.
- Run the water pump for a few seconds to clear any remaining water.



Refer to manual for details.

53732 rA

Follow the steps indicated below for winterizing the water system.

Note: The water system should be drained. See the section entitled “water tank” in the Operations Section.

- Open the ball valve at the end of the hose on the hose reel and pull the hose off the reel to allow all of the water to be purged from it.
- Turn water pump on for 10 seconds to push any water out of the pump.
- Open the ball valve on the Air Purge panel marked FILL RESERVOIR. Close the ball valve when the gauge shows 100 psi.
- Turn on the ball valve marked PURGE SYSTEM. Allow air pressure to drop to 40 psi. Close ball valve. Recharge tank to 100 psi and repeat purging the heater until all water is drained.
- Remove the Y-strainer water filter and leave off.
- Repeat purging procedure to blow out the hose reel and lines until all water is drained.
- Allow the hose to go back onto the reel slowly. This will ensure all of the water has been purged from it.

Note: There are multiple valves located in the water pump cabinet. All must be left open.

Note: The purging procedure should be repeated prior to starting a new job to be sure all lines are free of ice.

Note: The water tank is made in multiple sections. The main drain valve will drain most of the water out.



NOTICE

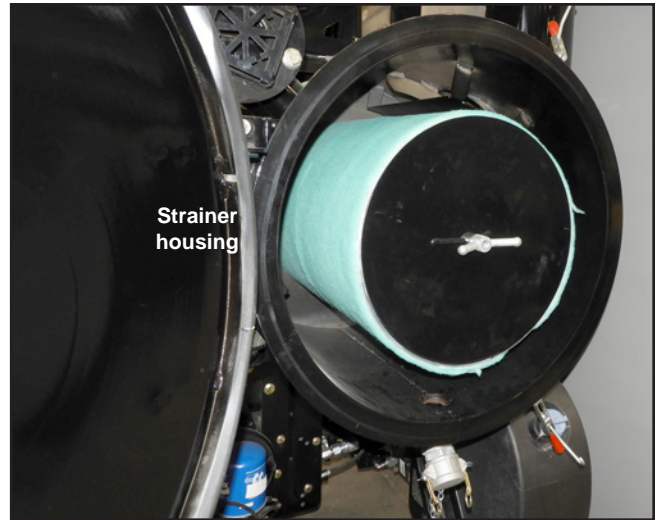
Water System Can Be Damaged By Freezing
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- Leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow residual water to drain.
- If the unit cannot be properly drained, move the unit to a warm area and allow the water system to warm completely to drain.
- Never operate water pump(s) if system is frozen.

A drain is provided at the bottom of the filter housing which is used to drain any excess moisture that has collected in the filter during operations.

Note: Further disassembly and cleaning of the filter may be required if a lot of material (water, etc.) comes out of the drain.

Note: when draining is completed leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow any residual water to drain.



Hose

The flexible hose connected to the boom should be rotated end to end as well as turned on its axis 180 degrees. This should occur on a regular basis and at least no later than 100 hours of operation. This will assure longer life of the hose so that material being vacuumed will not unduly wear on any one side of the vacuum hose.

Lubrication

Lubricate the boom bearing weekly, check for leaky hoses, loose connections, loose or broken wiring, and hardened vacuum hoses.

This unit is equipped with a special heavy-duty swivel bearing and a worm gear drive. The bearing has three grease zerks. Two are on the inside and one is on the external gear. This bearing must be lubricated weekly, or every 25 operating hours. The boom must be rotated in 45 degree increments when greasing. Coat the gear teeth with grease.

Note: Failure to rotate the boom when greasing can cause premature failure of the bearing. Any one of the grease fittings can be used. It is not necessary to grease all three fittings.

Grease all boom pivot points. Fully extend the boom and wash it down including the tube seals. Then grease the extension.

Note: If the seal is squeaking when extending or retracting, do not grease it. The seal is dry and/or dirty. Maintain a clean boom, inside and out, to alleviate problems.

Cleaning

A buildup of dirt in the hose will cause leaky boom seals and the majority of boom malfunctions. Run clean water through the boom at least on a weekly basis, preferably after each job is finished.

Rinse off the outside of the boom when extending or retracting to keep the seal moist and clean.



Grease Zerk Locations

	A	B	C	D	E	F	G	H	
○	1	2	3	4	5	6	7	8	○
	U	U	U	U	U	U	U	U	
ID	LOCATION								SCHEDULE
1	LEFT REAR DOOR CYL HINGE								M
2	RIGHT REAR DOOR CYL HINGE								M
3	LEFT REAR DOOR HINGE								M
4	MIDDLE REAR DOOR HINGE								M
5	RIGHT REAR DOOR HINGE								M
6	BOOM BEARING								M
7	BODY LIQUID LEVEL INDICATOR								W
8	LOWER BODY HOIST CYL								M
A	UPPER LEFT BOOM PIN								M
B	UPPER RIGHT BOOM PIN								M
C	LEFT BOOM CYLINDER PIN								M
D	RIGHT BOOM CYLINDER PIN								M
E	LOWER LEFT BOOM PIN								M
F	LOWER RIGHT BOOM PIN								M
G	UPPER LEFT BODY HOIST CYL PIN								M
H	UPPER RIGHT BODY HOIST CYL PIN								M

W - 25 hours or weekly
M - 100 hours or monthly

Refer to manual for details.



508186C r0

Boom Bearing Grease

This bearing must be lubricated weekly, or every 25 operating hours. The boom must be rotated in 45 degree increments when greasing. Coat the gear teeth with grease.

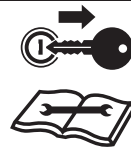
W - 25 hours or weekly
M - 100 hours or monthly

Refer to manual for details.



508186D r0

NOTICE



Service Access

Never use access ladders or platforms with the unit running. Shut down and lock out the unit before all service to avoid injury. Refer to the unit manual and safety manual for details.

507592 r0

The make break permits the debris body to easily be raised without having to disconnect hoses to the boom and air system.

When the vacuum system is engaged for vacuuming, it is important the debris body and the inlet seal be in good shape and not leaking. If torn, dirty or not adjusted properly, loss of airflow at the end of the debris hose will result. The seal can be adjusted in order to compensate for wear.

Adjustment is needed when the make break does not seal. Before making any adjustments position the unit on a flat level surface. While the debris body is down note how large the gap is between the outlet seal and the mating cone.

Raise and prop the debris body. It should normally only be necessary to loosen one of the three band clamps and move either the cone or outlet seal to take up the gap.

Lower the debris body and verify there is a good seal. Repeat as needed.



The oil level should be checked before beginning any operation. A sight glass for determining the oil level is mounted on the side of the back of the transfer case under the truck chassis. The sight glass can be viewed from the passenger side. Oil level should be in the center of sight glass.

Oil Level

A sight glass for determining the oil level is mounted on the side of the back of the transfer case which is under the chassis of the truck. The sight glass can be viewed from the passenger side. Oil level should be one-third to one-half as viewed in the sight gauge.

Note: The oil level should not be full as viewed in the sight gauge. Oil level should be checked only after unit has been shut down for a minimum of one-half hour. Checking the oil level too soon may give an incorrect reading. See manufacturer's manual for correct oil type. Fill the transfer case slowly with oil. Allow time for the oil to flow down into the transfer case.

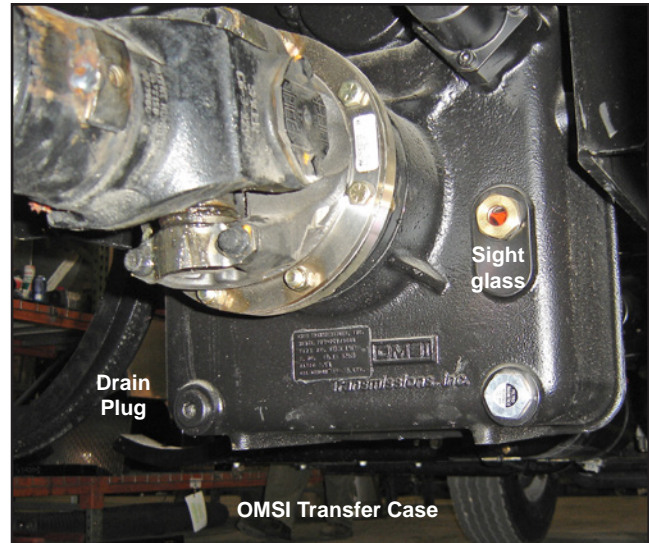
Check oil level daily and service as needed. Fill to center of sight glass. Every 500 hours or six months, whichever comes first, drain, flush and refill with BP Autran SYN 295 or equivalent. Verify with the case ID tag.

Note: Rail units with creep drive use a different lube. Always verify with the transfer case ID tag.

Oil Filling

Clean away all dirt around the filler plug before removing the plug. Refill with new oil of grade recommended for the existing season and prevailing service. Fill until the oil level is halfway as viewed in the sight glass.

Note: Do not overfill the transfer case. Overfilling usually results in oil breakdown due to excessive heat and aeration from the churning action of the gears. Early breakdown of the oil will result in heavy varnish and sludge deposits that plug up oil ports and build up on splines and bearings.



NOTICE

Machine Can Be Damaged

To avoid damage:

- Never overfill or under fill lubricant or fluid levels.
- Maintain proper fill levels.
- Always use the correct lubricant or fluid.
- Overfilling can cause overheating in gear lubrication systems.
- NEVER operate with either a malfunctioning lubrication system or indicator light ON (if equipped).

For blower description, maintenance, lubrication and operation, see the blower manuals supplied with the vehicle.

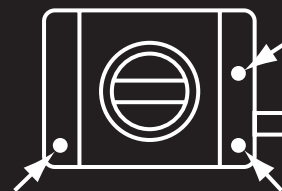
Freezing Weather

Any time the blower/unit will sit after use during freezing weather the blower should be run 3-5 minutes with the vacuum relief open to dry out the blower. This will reduce the risk of the blower freezing up. Depending on weather conditions it may even be necessary before the operators go to lunch and at the end of the daily operation.

Oil Level

There are normally three sight glasses on the blower. Locations will vary with the blower model and manufacturer. The unit should be on level ground and off. The oil should be filled to the center of these sight glasses. **Do not overfill.**

Blower Oil Service



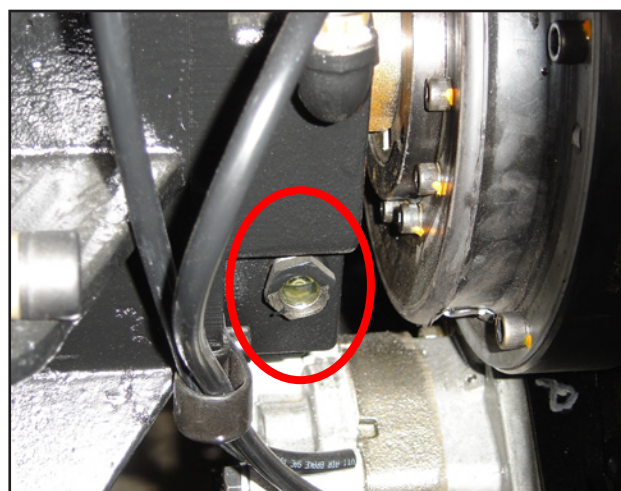
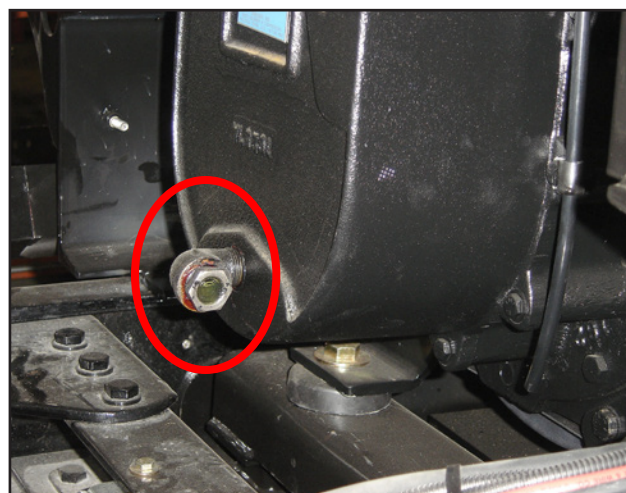
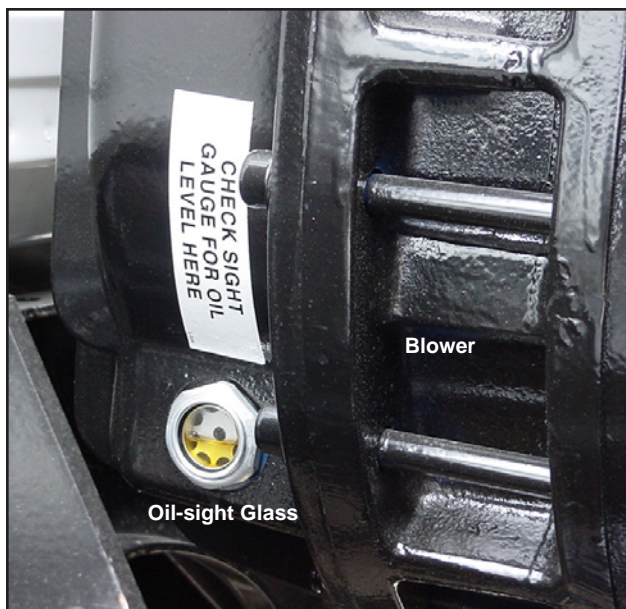
Check blower oil daily or the start of each shift.

All vacuum blowers are equipped with at least one sight glass at each end of the blower. Depending on blower configuration the sight glasses may be located on either side or the end of the blower at each end, and there may also be upper and lower sight glasses. The oil level must be checked at both ends of the blower while the unit is off and on level ground.

Refer to the maintenance section in the manual and the blower manufacturer's manual.



1800167



Blower oil should be drained and replaced every 500 hours or whenever it becomes contaminated by water, chemicals, or any material which could cause congealing or be abrasive.

Oil changes at more frequent intervals may be necessary if oil condition becomes poor.

Remove debris from the oil fill plugs and sight gauges of the blower.

Oil draining

In the event of temperatures below 68° F (20°C) let the machine run for several minutes in order to heat the oil and to make it more fluid.

1. Remove the upper fill plugs (one each end).
2. Remove the drain plug at each end and let the oil flow out completely.
3. Install and tighten the draining plug. Replace sealant on fill plugs (use LOCTITE PST56747 or equivalent).

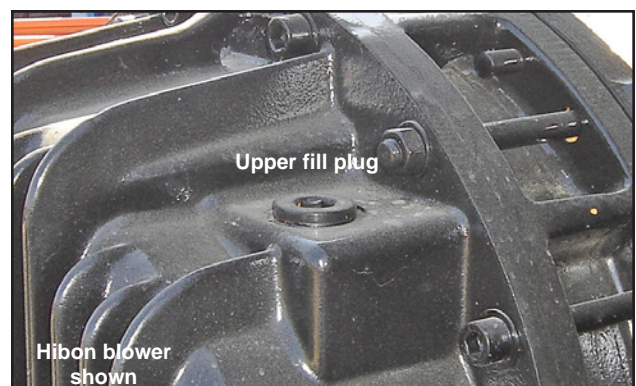
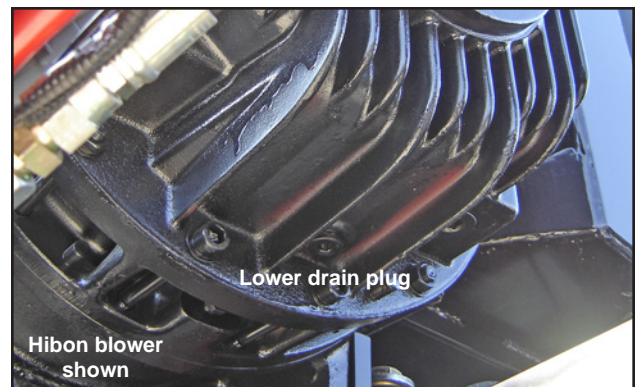
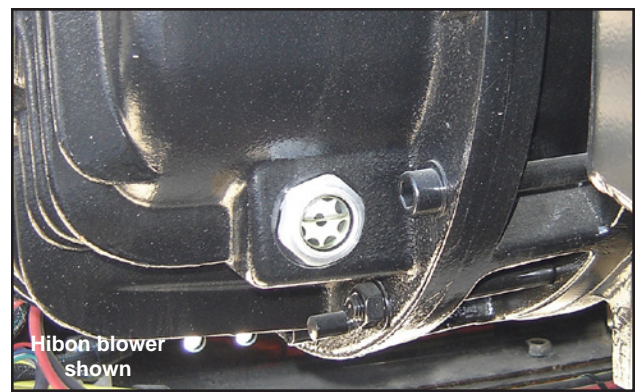
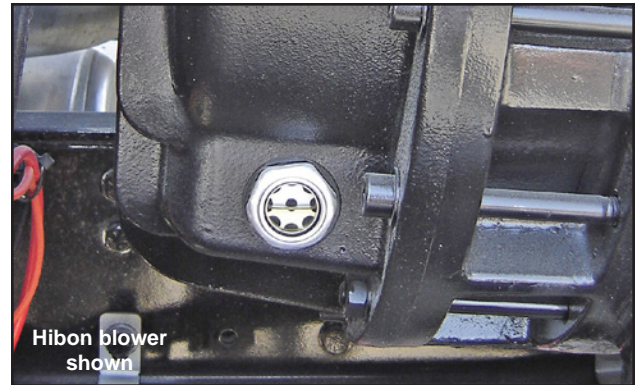
Oil filling

1. Remove the upper fill plugs (one each end).
2. Fill the tank to the maximum level in the sight gauge (about 3.15 quarts in each end).
3. Install and tighten the fills plugs.
4. Start the unit up and run the blower about 1000 rpm for 10 minutes Stop the blower and let the levels stabilize for about 30 minutes.
5. Check that the oil level at each sight gauge is correct. Add oil as required to bring it to the center of the sight gauge on the rear gauge. The front gauge should be in the middle of the upper half of the sight gauge window.

Note: Do not overfill the blower. Overfilling usually results in oil breakdown due to excessive heat and aeration from the churning action of the gears. Early breakdown of the oil will result in heavy varnish and sludge deposits that plug up oil ports and build up on splines and bearings.

Verifications and regular maintenance

If the oil sight gauges are dirty and make verification difficult, completely clean the cases and/or replace the gauges.

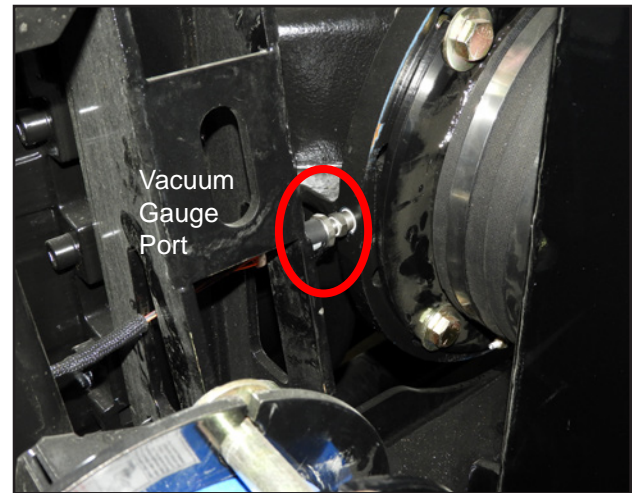
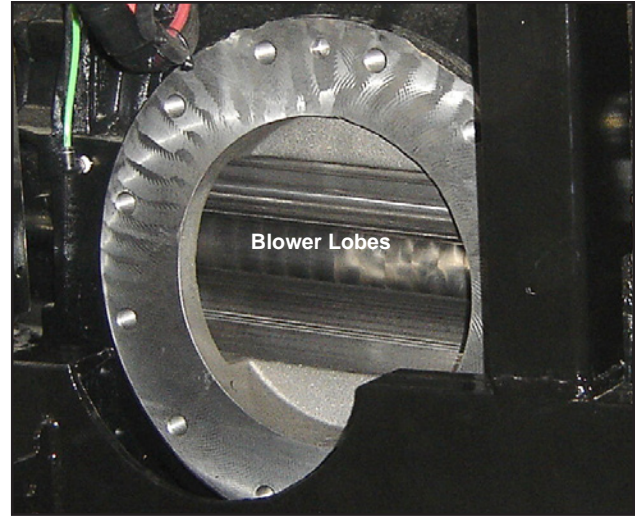


When the blower will not be used for any time beyond a few days there is risk the close fitting surfaces inside the blower will rust and increase blower lobe wear on startup. Refer to the blower manufacturer's manual for details on long term storage.

Units in extended storage or not being used should have the blowers operated at a minimum bi-weekly to ensure gear and bearing lubrication, and protects against failures due to condensation and moisture.

Short term in high humidity conditions allow the blower to run for 3-5 minutes with the vacuum relief open to dry out the system. Then with the blower at idle speed and the vacuum relief open spray up to 8 ounces of Liquid Wrench® NON-FLAMMABLE Penetrant and Lubricant L312 or L-412 or equivalent rust preventative in to the vacuum relief or in the vacuum gauge port (remove hose to gauge first).

Leave all drain plugs out when not in use. This prevents rain water from building up in the filter housing and silencers.

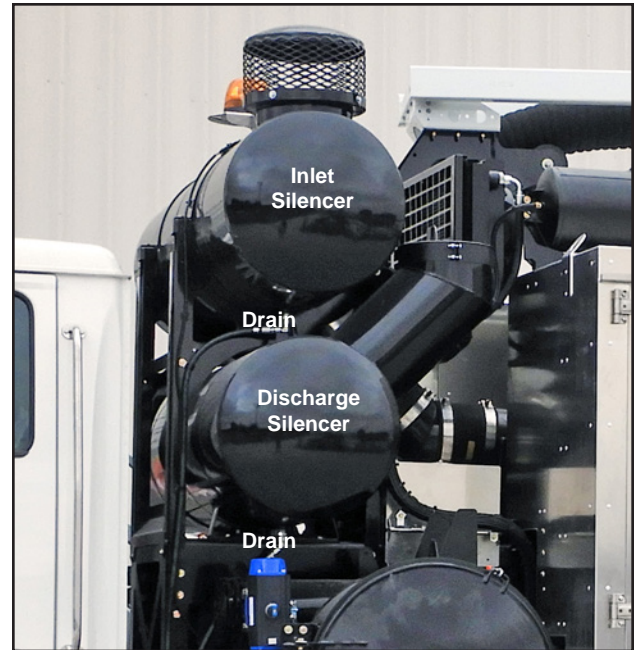


Vacuum gauge port location varies with blower

A drain plug is provided at the bottom of each silencer which is used to drain any excess moisture that has collected in the silencer during operations. It must be plugged during normal operations. The plug must be removed at the end of each day and the water drained out.

Leave the drain plugs out when not in use. This prevents rain water from building up in the silencer.

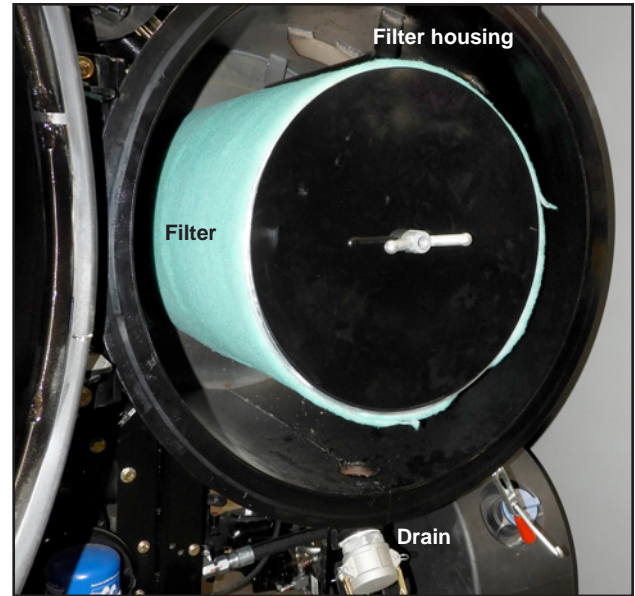
Verify the rain cap works correctly to assure rain and water cannot enter.



A drain plug is provided at the bottom of the filter housing which is used to drain any excess moisture that has collected in the filter housing during operations. It is closed during normal operations. At the end of the day, the drain plug is removed to drain the water.

Note: Further disassembly and cleaning of the filter may be required if a lot of material (water, etc.) comes out of the drain.

Note: when draining is completed leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow any residual water to drain.



Units may be equipped with a high pressure handgun system. The handgun system can be used to clean the unit, the inside of the debris body, screens, floats, the rear door seal; it can also be used to clean catch basins, to add water to material for easier pick-up, to flush streets around work sites, and to clean ladders and ledges. The system consists of a handgun assembly, a hose, and a quick-connect/disconnect system.

The handguns have long barrels to reduce the risk of operators spraying themselves. High pressure handguns are typically used with systems intended for hydro excavating and industrial applications.

Handgun pressure is controlled with the engine throttle. The handgun must not exceed 3000 psi or a maximum volume of 10 gpm when cleaning the unit. Use caution when washing around decals and labels, gear box or blower vents, all air vents or exhausts, painted surfaces, bearings, seals and other soft components to avoid damage. Never spray on or around electrical components. Keep the end of the nozzle at least two feet from the wash area and only work closer after verifying that no damage is occurring.

WARNING

Handguns Use High Pressure Water

High pressure water can cause serious injury or death.



- **Wear appropriate safety equipment including: Waterproof apparel, protective boots, insulated gloves, safety glasses or goggles, hearing protection (ear plugs and/or ear muffs) and a hard hat with a face shield.**
- **Never point the handgun at or near a person or animal.**
- **Bleed pressure from handgun by shutting off water pump pressure and pressing the trigger before disconnecting from high pressure connection.**
- **Use handgun and connection supplied with the unit; never use common low pressure handguns or connectors with the high pressure system.**

NOTICE

Machine Can Be Damaged During Cleaning

High pressure water can damage or remove safety decals, vents, paint, wash lubricants out of bearings, and damage seals or other soft components. Avoid spraying on or around electrical boxes and components.

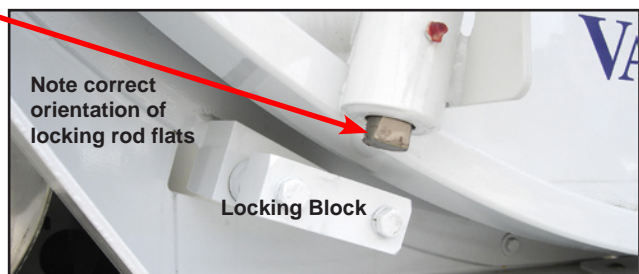
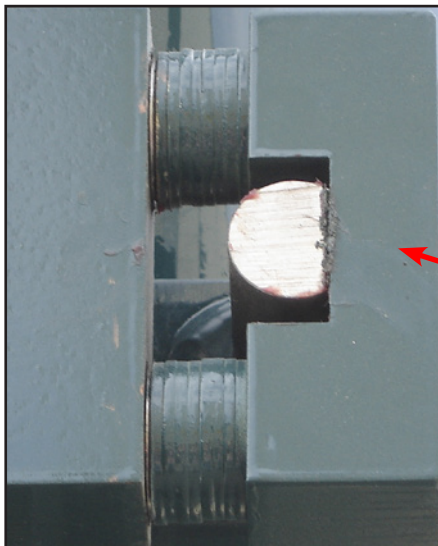
Never increase speed of engine above that which is necessary to obtain a maximum of 3000psi water pressure while hand gun is being used to prevent damage to the hose and hand gun.

To prevent rodder pump damage, if equipped, always open at least one ball valve before engaging the pump.



The rear door will need adjustment to compensate for seal wear. There are two adjustments available. The locking blocks are attached to the debris body and are used to set an even spacing for the door seal. These will not normally need to be adjusted.

The second are the locking rods. Unlock and open the rear door. Adjust one locking rod at a time. Loosen the nut at the clevis. Rotate rod +/- in full turns only so that rod flat is aligned with the locking block. Tighten nut at the clevis. Repeat until all locking rods have been adjusted. Close and lock rear to verify proper operation. Locks should be fully engaged into the locking blocks.



Door lock setting procedure:

Note: A person at the rear of the unit watching the locks and one at the controls makes this task easier and provides immediate warning in case the locks are not set properly.

Note: Washers are utilized to set proper rod/block engagement clearance. Seal adjustments are performed utilizing rod adjustments.

1. Engage hydraulics as described previously in the manual.
2. At the debris body directional valve for the debris body door select open and hold there until door is fully open and you hear the oil going across the relief in the directional valve.
3. Move directional valve handle to the lock position.
4. Door locks will begin to move immediately after selecting lock.
5. Stop locks before they begin to enter the



blocks.

6. Verify that there is a 1/8" gap between rods and blocks.
 - a. If the gap is less than 1/8" you can add washers to reach the required gap.
 - b. If the gap is more than 1/8" you will need to remove washers.
7. The rods should all be extending and entering the blocks at the same time. This allows a smooth and even pull of the door seal against the lip.



8. The positioning and adjustment of the locking rods is achieved by loosening the jam nut and turning the rod either in or out of the turn buckle. You must guarantee that the beveled side of the rod is aligned to slide into the block.
9. Once the gap and alignment have been verified and set finish by locking the door.
10. Once the door is fully locked tighten up the rod jam nuts against the turnbuckle.

Regularly clean the door, especially the door seal, and lubricate the hinges. The door seal should be cleaned each time the debris body is dumped.

The rear door seal provides an airtight seal for the debris body. It is important to keep the seal clean and in good condition. Inspect the seal after each dump and replace if damaged or worn. The seal can be replaced on the vehicle or the door may be removed and placed on supports with the seal channel facing up.

Changing the Door Seal

Materials needed:

- Replacement seal
- 3M Industrial Adhesive P/N 4799 (2 tubes 1002)
- Cyanoacrylate adhesive (super glue)
- Duckbill vise grip pliers
- Hacksaw
- Mallet

Seal Replaced with Door Removed

If removing the door for installation of the seal off the vehicle, use an overhead crane support and lift to remove the door. Place it on supports with the seal channel facing up.



Use an overhead crane support and lift to secure the door before disassembling the door hinges. Use the crane to remove the door and position it for seal replacement. Never work underneath the door without proper support or safety props.

Seal Replaced with Door on Unit

When installing the seal with the door on the vehicle, do the following:

- Use the instructions posted in the cab to engage the hydraulic pump.
- Raise the debris body. Install the debris tank and rear door safety prop.
- Shut down the engine and remove the ignition key.
- Post a notice on the steering wheel that maintenance is being performed.

⚠ WARNING

Crushing hazard.
Serious injury or death can result from falling debris body.
Never go under a raised debris body without the safety prop(s) in place. Debris body must be clean and empty for service work.
On firm level ground raise the body above the height of the props. Tilt the prop(s) in place. Lower debris body until it just rests on the prop(s). Use all props.
Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.
Refer to manual for details.

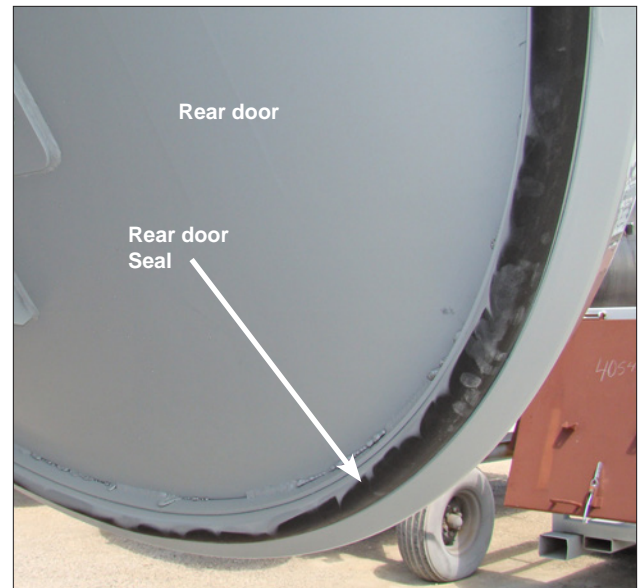
⚠ WARNING

Crushing hazard.
Serious injury or death can result from falling rear door. Never go under the rear door when open.
Use door prop(s) or safety pin(s) to secure door before entering body, working under or around the door.
Open the rear door to just clear the prop(s) and lower door until it just rests on the prop(s). On units that use a safety pin(s) open the door until the pin holes are aligned and insert pin. Use all props or pins.
Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.

⚠ WARNING

Electrocution hazard.
Serious injury or death can result from electrocution.
Check for overhead wires and obstructions before raising debris body, opening rear door or raising optional equipment. Never leave debris body, rear door or optional equipment raised or partly raised while vehicle is unattended. Never move vehicle with debris body, rear door or optional equipment raised.
Be aware of the vehicle's surroundings before operating any of the hydraulic functions to prevent death, injury or equipment damage.

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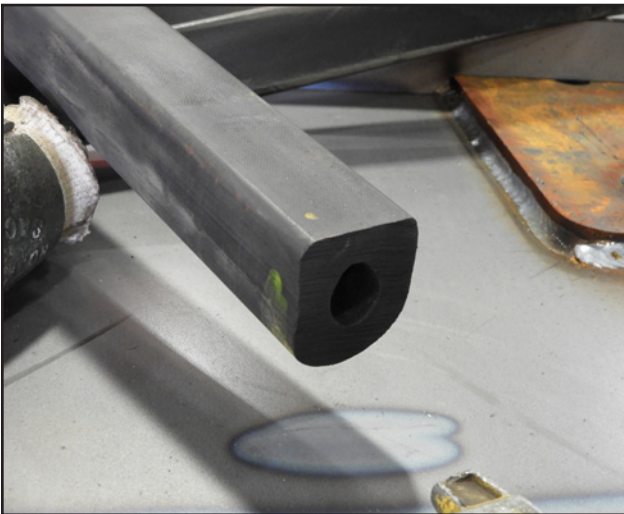


Procedure When Replacing the Door Seal

1. Completely remove the seal and clean the seal channel of all glue and dirt.
2. Apply a generous amount of adhesive to all sides of the seal channel.



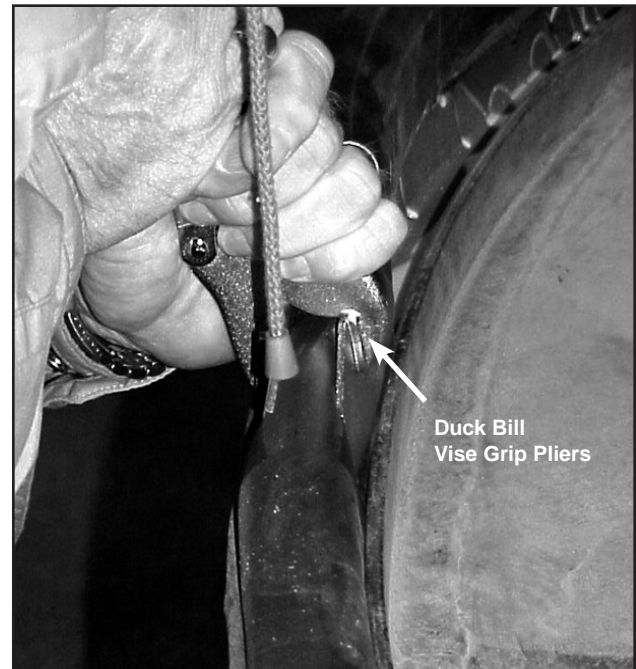
3. Make sure the end of the seal is cut squarely for a proper seal at the end of the procedure. A hacksaw works well.



4. Starting at the top of the door, place the flat surface of the new seal into the seal channel.



5. If installing the seal with the door on the vehicle, do the following:
 - Squeeze the seal with the duckbill pliers while feeding the seal into the channel.

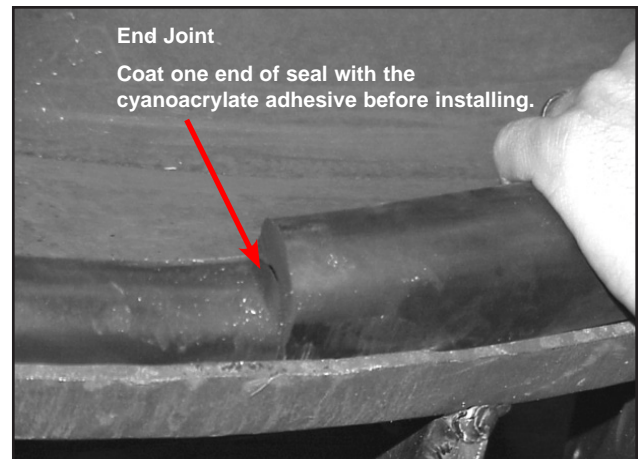




6. If installing the seal with the door removed do the following:
 - Using a mallet, pull on the seal while pounding the seal into the channel.



7. Use the hacksaw to cut off excess seal to form a flush, airtight mating surface between seal ends. Coat one end of seal with the cyanoacrylate adhesive before installing.
8. If installing the seal with the door off of the vehicle, use an overhead crane support and lift to install the door on the debris body.



Starting in late 2009 the standard rear door safety prop configuration has a break-away feature. The center bolt will shear off with a loud popping sound in the event an operator inadvertently tries to power the door closed with the prop(s) in place. This reduces the risk of damaging the rear door.

If the bolt is sheared, tap the arm back in place, remove the damaged bolt and replace with Vactor part number 16342D-30, 43762-30, and two of 16365B-30. Reinstall all washers as shown.

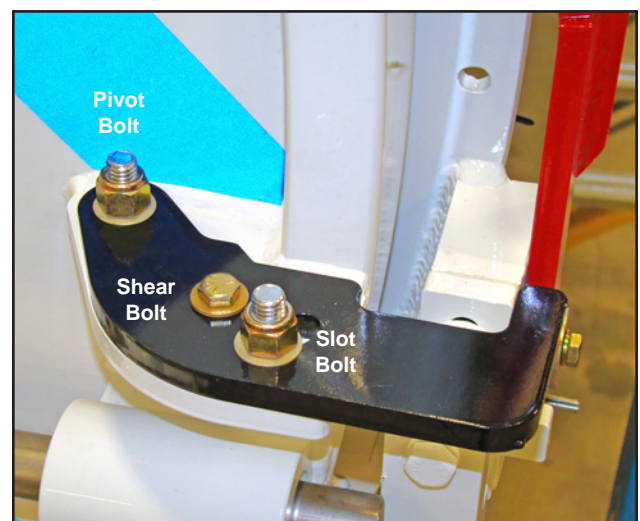
Remove the pivot and slot bolts and replace if damaged with standard grade 5 bolts. Reinstall all washers as shown.

The pivot bolt and slot bolt are installed with belleville washers. Tighten the fibre locknuts down until the belleville washer just becomes flat and no more. Do not overtighten.

NOTICE

Rear Door Can Be Damaged

To avoid twisting damage to rear door always use the rear door prop(s). Lower rear door until it just touches both prop(s). Never power door down onto prop(s).



A variety of air and hydraulic actuated butterfly style valves from a number of different manufacturers are used. A butterfly valve, shown at right, rotates a disc in the material flow to open and closed positions (shown in closed position). The valves are normally actuated by switches or automatically by the system controls. During servicing or use an inadvertent actuation could result in an injury from the moving parts. The valves can still remain active when not installed unless the air or hydraulic lines are disconnected and all safety precautions followed.

Do not allow tools, arm, hands etc. in the butterfly areas as serious injury may occur. Shut down all systems and de-energize or disconnect the air or hydraulic system to the valve before servicing.

Improperly adjusted valves can cause actuator damage or disc bolt fatigue and failure. *Valve should open and close smoothly.*

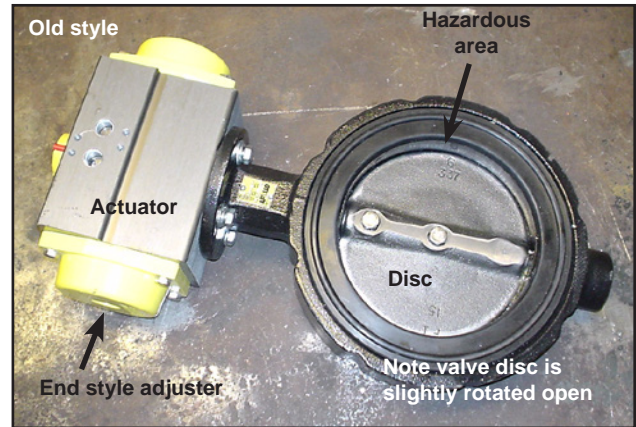
Butterfly pneumatic actuators are designed to allow adjustment without the removal of the actuator end caps. Typically there is a jam nut located on each end of the actuator in the center of the end cap. Newer style butterfly valves have the adjuster bolt on the side of the actuator. One adjuster controls the closed position and the other the open position.

With the valve in the CLOSED position:

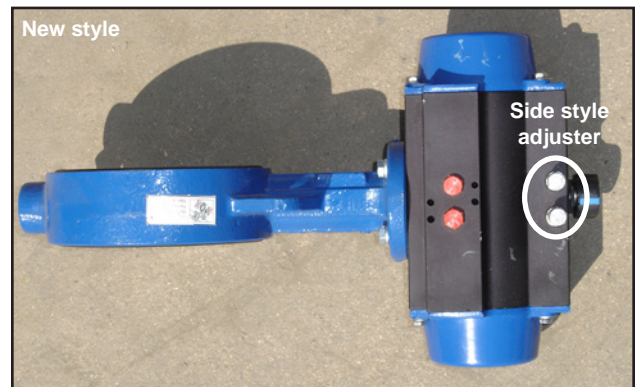
1. Determine which adjuster screw is for the closed position. It will be the one that moves the disc.
2. Adjust the screw all the way in (for side adjusters - out for end cap adjusters). This should give you about 5 deg. adjustment.
3. The disc should start to unseat in this position and still provide shut-off.
4. Tighten the jam nut and check your system to see if the valve is providing shut-off.
5. If the valve is not providing shut-off loosen the jam nut and readjust to where the disc just seals.
6. Observe the valve operating:

CLOSED Valve angle seat should be between 3 and 5 degrees.

Valve should open and close smoothly.



Butterfly Valve



The air operated vacuum relief valve is used to relieve the system if the vacuum hose, debris body or inlet filter become plugged or restricted. These valves are on all blower units. The valves are normally operated from the master control panel, pendant or optional wireless remote. Proper operation should be verified daily by verifying under vacuum. Actual location size and configuration of the valve varies by the model and options. Typical location is in the inlet piping of the blower.

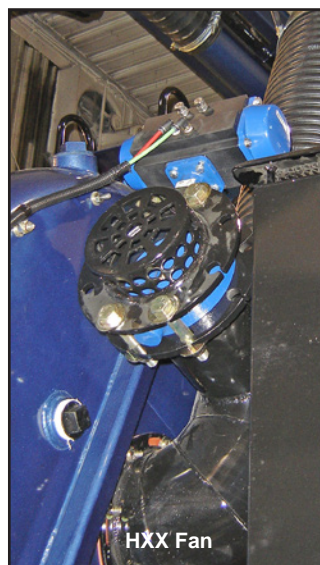
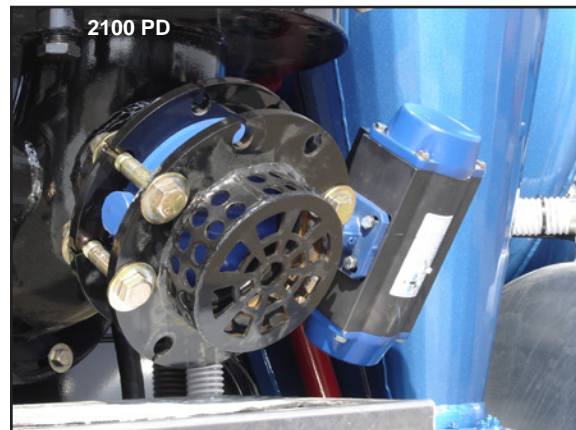
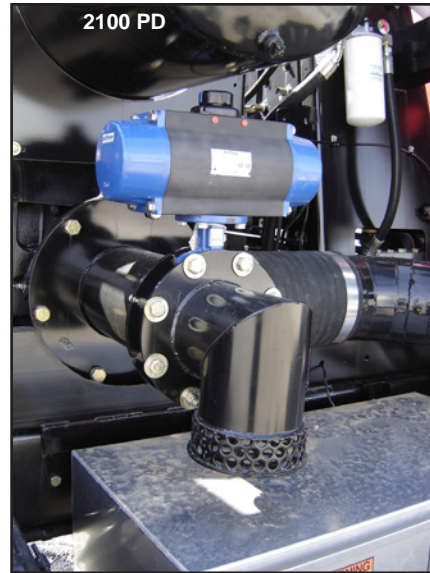
Vacuum relief valves require regular inspection and periodic cleaning. Develop a regular program of visual inspection, looking for clogged drains and discharge pipe, dirt buildup in and around the valve seat, and broken or missing parts. Keep the valve and the area around the valve clean and free of any foreign material or substance.

⚠ Use proper hearing protection when in the vicinity of this device which emits a loud, sharp sound. Follow safety precautions to prevent injury from high velocity flow of materials.

Note: Keep foreign material from entering the valve. Do not paint, oil, or otherwise cover any interior or working parts of any safety valve; safety valves do not require any lubrication or protective coating to work properly.

Note: Test all vacuum relief valves to ensure proper valve operation. See the section "Vacuum Relief Valves" in the Operations section.

The vacuum relief valve is actuated by a switch located on the main control panel or a switch located on the pendant control. The switch controls an air valve which sends air pressure to the valve either opening or closing, whichever is needed. The vacuum relief valve needs to be open for normal vacuuming using the boom and debris hose. When the vacuum relief valve is closed, air flow is blocked to the boom and debris hose.



Whether it is manually or automatically operated, a switch energizes an electric over air solenoid valve. This allows pressurized air to fill a chamber on the actuator for the butterfly valve which opens or closes depending on whether the 'on' or the 'off' solenoid is actuated.

As with any other electrical system in Vactor products, the master switch in the main control panel has to be in the ON position. If the valve fails to function, the problem could lie in the electrical or the pneumatic system. It is in very rare cases that there is a mechanical reason for the failure of the valve. To trouble-shoot, first ascertain whether the problem is mechanical, electrical or pneumatic. To do this, start the engine, build up air pressure to the maximum and follow the procedure to obtain power to the control panel and turn on the master switch. Trace back the two air lines at the valve actuator to the double air solenoid. This may be located very close to the valve itself or may be somewhere at the underbelly of the debris body. Remove one air line at a time on the "out" side of the solenoid. If there is pressure at one of the ports, the problem is not pneumatic.

Now, operate the switch. If the air pressure switches to the other port, there is no electrical malfunction either. Now that the problem has been categorized, we can proceed to rectify the defect.

Pneumatic

If there is no air pressure at the "out" side of the air solenoid, remove the incoming air line to the solenoid. Does that have air pressure? If yes, you have a faulty solenoid. Open, clean and reassemble or replace the solenoid assembly. If there is no pressure in the incoming line, trace the incoming line to its origin, checking for kinks or blockages. Pull out the air line coming out of the air dryer/tank at the air protection valve. Check for air in the reservoir. Check if air protection valve functions properly, if not, replace.



Electrical

Is the master switch in the control panel turned on? Check for loose connections at the mating plugs. Open the control panel door and check for blown fuses, loose connections or damaged wiring. Repair as required. Unplug the wiring harness at the solenoid and check for voltage at the harness connectors with the switches in both, the open and closed positions. If no power, go back to the pendant switch and open it. Check incoming voltage to the switch, corroded, worn or otherwise damaged contacts or loose or damaged wiring. Repair as required.

If there is voltage at the wiring harness connectors at the solenoid valve, press the solenoid override rubber buttons, one on each of the solenoid assembly. If that operates the valve, the solenoids are faulty. Replace the faulty solenoids).

Mechanical

If air is being supplied to the valve actuators and the valve still does not work, the valve could be binding. Remove the strainer basket and try to free the valve by squirting some penetrating oil at the shaft bushings. Remove the air lines going to the actuators and lubricate the ports with air tool oil or penetrating oil. It may be that the screws of the valve to shaft or the actuator coupling have come loose or the shaft is broken. Rectify as necessary.

All units use compressed air to operate various valves and cylinders. The air is normally supplied by the chassis air system. Depending on options, unit or chassis configuration there will normally be one or more air tanks, filters or dryers located on the unit in varying locations.

Maintenance

If equipped all air tank filters should be checked daily and cleaned if necessary. If upon a visual inspection, the filter is dirty or clogged, it should be replaced.

Note: the chassis air tank should be drained daily and the unit air filter checked and cleaned if necessary every 48 hours. Cold or very humid weather may require more frequent draining of the chassis air tanks.

When air is compressed the water vapor in the air is put into the vehicle's air system. The liquid accumulates and affects system performance by washing away lubricants, accelerating corrosion and blocking air system components by freezing. High humidity, high air consumption and cold temperatures increase the water vapor collected in the air system. Two common methods are used to address this issue are automatic drains and desiccant-type air dryers. Manual drains may also be found.

Note: Alcohol injection systems are sometimes used by others. They are very specialized and should not be used as the alcohol can damage seals and plastic parts in an air system.

Freezing conditions can create situations where the frozen water can slow down or stop the proper operation of the various components in an air system. This can include chassis brakes, air valves and air cylinders that operate safety systems such as vacuum reliefs. When operating under these conditions proper operation of the air systems should be routinely verified. The frequency will vary with the conditions.

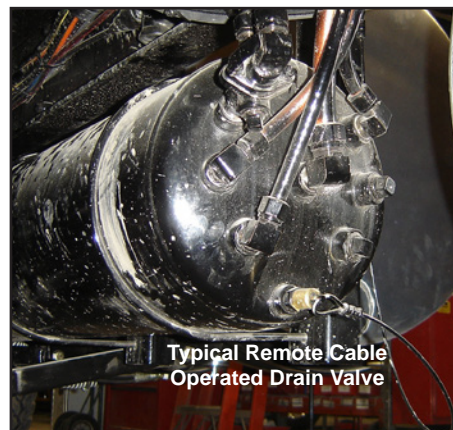
When the conditions exist for air system water problems Vactor Manufacturing and most chassis manufacturers recommend draining all system air reservoirs every 2-3 hours of operation.

Desiccant-type air dryers require routine replacement of the desiccant element. Refer to the chassis service manual.

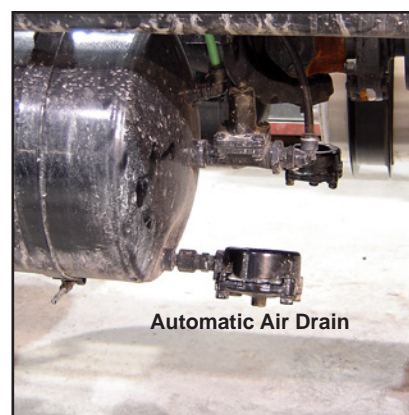
Consult the Vactor Manufacturing Service Group for recommendations and systems suited to your applications.



Typical Manual Air Valve

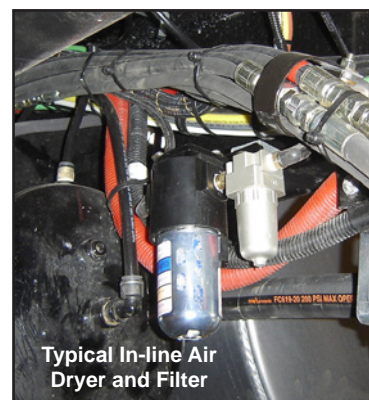


Typical Remote Cable Operated Drain Valve



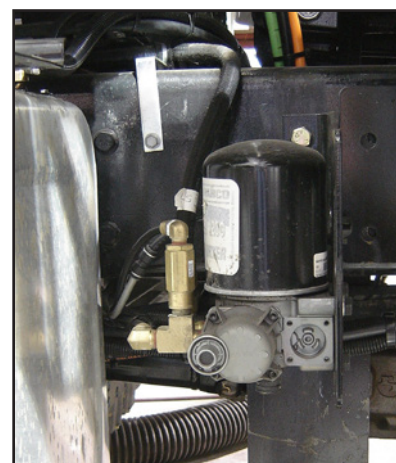
Automatic Air Drain

In-line dryers and filters are normally used on units with blowers and transfer cases for the air shift.



Typical In-line Air Dryer and Filter

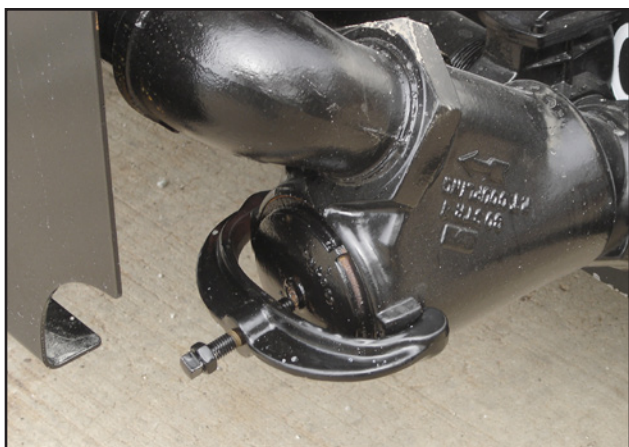
Typical desiccant style air dryer with replaceable filter element.



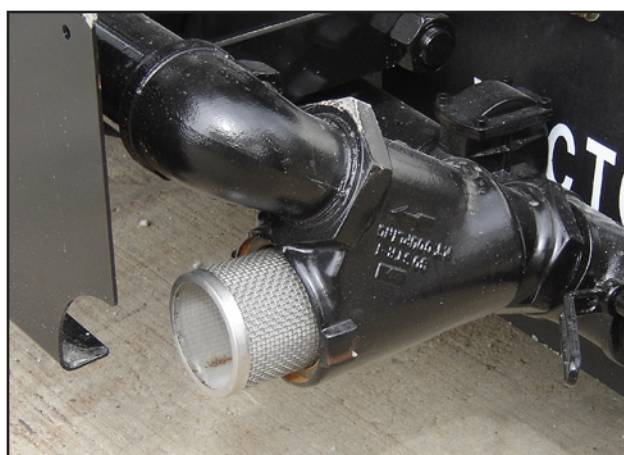
The Y strainer water filter is an important part of the maintenance program to protect the water pump from damage. The Y strainer comes in different sizes. Y strainers are normally either 2" or 3" and may be an option depending on where it is located. Each filter is inspected the same way and needs to be inspected daily or more often if poor quality water is being used. All versions work the same. Smaller Y strainers may be made from composite materials.



3" Y-strainer on water pump - Assembled



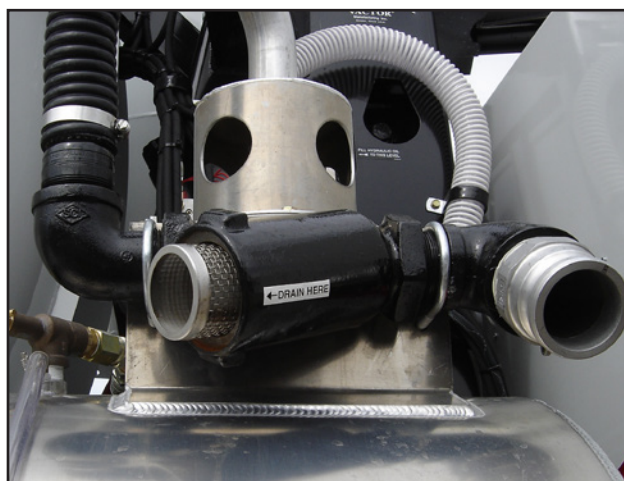
3" Y-strainer on water pump - Disassembled



2" Y-strainer at water fill - Assembled



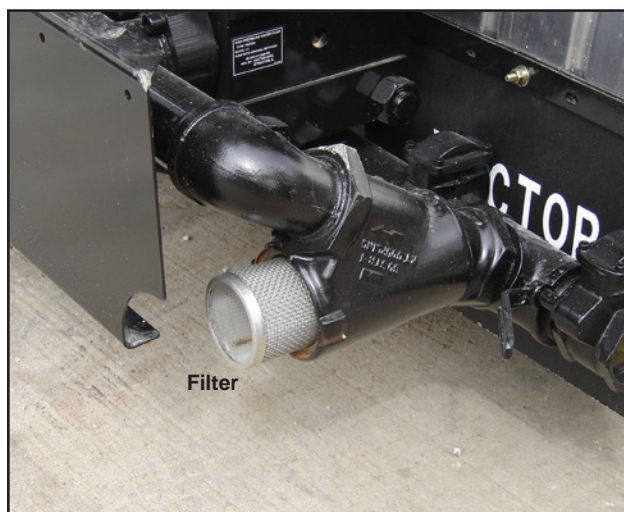
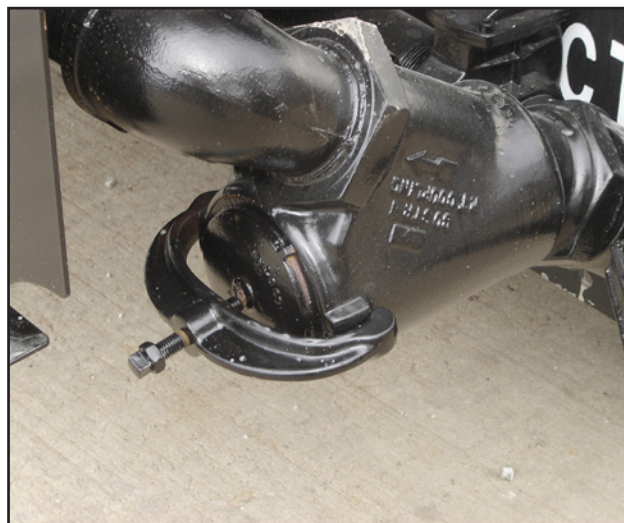
2" Y-strainer at water fill - Disassembled



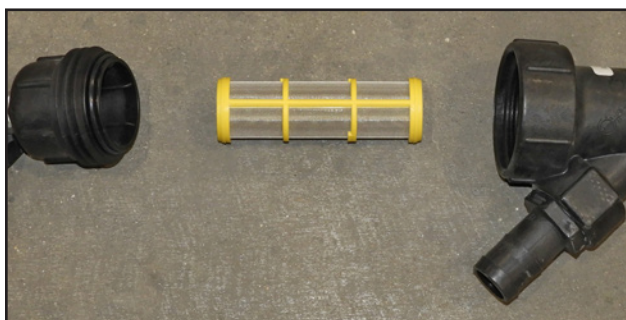
Remove the cap and the retainer from the filter housing. Then remove the filter. Inspect the filter for any damage. Replace any damaged filter. Inspect the inside of the filter for any dirt, stones, grime, etc. Be sure to clean any filter screen before reinstalling the filter. NEVER reinstall a dirty or damaged filter.

Always inspect the filter cap prior to installation. There are two gaskets on the filter cap. Both gaskets **must** be intact and in place before installing the filter cap. The outer gasket seals the cap to the housing. Water will leak out if this gasket is not in place.

The second gasket seals the cover to the filter screen. If this gasket is missing, debris can bypass the filter screen and get into the water tank and eventually into the water pump causing damage to the pump. Both gaskets must be intact and in place. Replace any damaged or missing gasket.



Typical composite Y Strainer. Cap unscrews to remove filter.



Machines can often sit at a work site for months while work creeps along. For long term storage beyond one year consult Vactor-Guzzler Service. Refer to the unit's manual for specific details. Storage protection plans should look like the following for a northern, dry climate:

Rotation - Rotate all compressors, pumps, fans and blowers every two weeks.

Visual Inspection - When rotating exposed machined surfaces, check shafts and couplings to see that a protective coating has been applied and has not been removed. Reapply if needed.

Miscellaneous - Lubricate miscellaneous equipment as applicable per normal maintenance schedule.

Drains - Leave all drain plugs out to prevent the buildup of moisture.

Other Considerations

In a warm, high-precipitation climate it is wise to look for alternate solutions to the problem of field storage during construction and prior to start-up.

For engines refer to the manufacturer's manual for procedures.

Vacuum System

Any time the unit will sit after use, the blower should be run 3-5 minutes with the vacuum relief open to dry out the vacuum system.

If the unit is not in operation, or will be parked for an extended period of time, the rear door can be opened slightly to drain and vent the debris body. This allows airflow into the body which reduces rusting and allows the rear door seal to relax, preventing it from training to a flat state. To ensure no entry to the debris body, or operation of the unit while the door is open, the door must only be cracked enough to relax the seal and a lockout/tagout procedure must be performed.

Air Systems

Drain all moisture traps and tanks. Replace all filters and all desiccant.

Freezing Weather

Any time the unit will sit after use during freezing weather the blower should be run 3-5 minutes with the vacuum relief open to dry out the vacuum system.

Oil & Grease

The unit should be on level ground and off. Before

storage all oil should be changed and filled to the center of the sight glass(s) or fill mark. **DO NOT OVERFILL.** When the blower will not be used for any time beyond a few days there is risk the close fitting surfaces inside the blower will rust and increase blower lobe wear on startup. Refer to the blower manufacturer's manual for details on long term storage. Grease the unit per the manual's schedule.

Sound Suppression Systems

Leave the drain plugs out when not in use to prevent rain water from building up in the silencers. Verify the rain cap works correctly to assure rain and water cannot enter.

Water Systems

Drain and purge all the water components. When completed open all ball valves, put Y-strainers, cap, clamp and drain plugs in a tool box if the unit will sit overnight or longer. This will allow any residual water to drain.

- Verify that water flows when valves or plugs are opened. Insure that ice has not plugged drain lines, valves or drain plugs.
- Leave all drain plugs open to keep residual tank water from the tanks from migrating to the system during transport.
- Leave all valves open, Y-strainers out and drain plugs out when the unit will sit overnight or longer. This will allow residual water to drain.
- If the unit cannot be properly drained, move the unit to a warm area and allow the water system to warm completely to drain.
- Never operate water pump(s) if system is frozen.

Putting the unit back in service

- Close the rear door if left open.
- Verify all fluids are at correct levels.
- Install all drain plugs and Y-strainers and close all drain valves.
- Operate engine(s) at low RPM's until warm.
- Engage and cycle all functions to verify operation.

NOTICE

Consult OEM chassis and engine operation and maintenance manuals for complete details on operation.

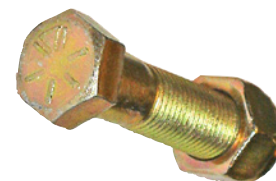


Driveline components installed by Vactor all require these bolt, nut and torque specifications.

Chassis manufacturers may use other bolt, nut and torque configurations in the chassis drivelines. Some transfer cases are installed by the chassis manufacturer. Follow chassis manufacturer specifications for bolt, nut and torque when provided.

Vactor standard practice is to replace any yoke strap that is removed with a new strap and bolts. All Vactor installed driveline bolts are marked with **TORQUE SEAL** (508727-30) to verify the bolts were properly torqued and to detect vibration loosening.

Use only recommended and approved components and torque specified here or by the chassis manufacturer for service work. Alterations, substitutions, or use of additional components must have Vactor engineering approval.



Series	Strap & Bolt Kit P/N	Bolt Torque (Ft-Lbs)
1710	48332D-30	115-135
1760	48332D-30	115-135
1810	48332D-30	115-135
SPL250	48332F-30	115-135

Note: Use Loctite 242 or equivalent on all bolt threads. If the seal on the bolts is broken at any point reapply the thread locker.

Driveline Bolt and Torque Specifications					
Driveline Series	Diameter, Thread, Length	Grade	Vactor Bolt	Vactor Nylock Nut	Torque (Ft-Lbs) ±5% Lubed w/Loctite 242 or Equiv.
1280-1310	3/8"-24 X 1"	8	1210648-30	43042A-30	35
1610	3/8"-24 X 1-3/16"	8	1210008-30	43042A-30	35
1710	3/8"-24 X 1-1/4"	8	16337N-30	43042A-30	35
1610*	3/8"-24 X 1-9/16"	8	48400B-30	43042A-30	35
1710*	3/8"-24 X 1-11/16"	8	1210701-30	43042A-30	35
1350/1410	7/16"-20 x 1-3/16"	8	1210650-30	49751-30	60
1760	7/16"-20 x 1-3/4"	8	47635C-30	49751-30	60
1810	7/16"-20 x 1-3/8"	8	1210010-30	49751-30	60
1350/1410*	7/16"-20 x 1-5/8"	8	1210913-30	49751-30	60
1810*	7/16"-20 x 1-3/4"	8	47635C-30	49751-30	60
SPL140	3/8"-24 x 1-11/16"	8	1210701-30	43042A-30	35
SPL170	7/16"-20 x 1-3/4"	8	47635C-30	49751-30	60
SPL250	7/16"-20 x 1-3/4"	8	47635C-30	49751-30	60

* Tru Stop Brake Applications

PURPOSE: THE PURPOSE OF THIS STANDARD IS TO PROVIDE A RECOMMENDED TORQUE FOR THREADED FASTENERS SUCH AS BOLTS, NUTS, CAP SCREWS, USED IN STEEL AND CAST IRON PARTS.

APPLICATION: THIS STANDARD IS INTENDED FOR FASTENERS OF GASKETED OR NON-GASKETED JOINTS, WITH OR WITHOUT STEEL WASHERS, AND WITH COARSE OR FINE THREADS. ALL SPECIAL CONDITIONS WHICH WILL SERIOUSLY AFFECT THE RELATIONSHIP BETWEEN TORQUE AND TENSION OF THE FASTENER, SUCH AS SPECIAL SURFACE FINISHES, LEAD WASHERS, AND FASTENERS SCREWED INTO MATERIAL OTHER THAN STEEL OR CAST IRON, WILL REQUIRE SEPARATE TORQUE VALUES TO BE INCLUDED IN THE APPLICABLE SPECIFICATION. THIS SPECIFICATION DOES NOT APPLY TO TORQUING OF HYDRAULIC CONNECTIONS.

MEAN OR BASIC RECOMMENDED TIGHTENING TORQUE FOR INCH FASTENER REQUIRING $\pm 20\%$ ACCURACY*. TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS.

NOM. DIA. INCH	TORQUE IN POUND FOOT (LB-FT)	
	GRADE 5	GRADE 8
1/4 - .250	9	12
5/16 - .312	18	25
3/8 - .375	30	45
7/16 - .438	50	70
1/2 - .500	75	110
9/16 - .562	110	155
5/8 - .625	155	215
3/4 - .750	270	385
7/8 - .875	435	620
1 - 1.000	660	930

NOM. DIA. INCH	TORQUE IN NEWTON METER (Nm)	
	GRADE 5	GRADE 8
1/4 - .250	12.2	16.3
5/16 - .312	24.4	33.9
3/8 - .375	40.7	61.0
7/16 - .438	68	95
1/2 - .500	101	149
9/16 - .562	150	210
5/8 - .625	210	290
3/4 - .750	365	520
7/8 - .875	590	840
1 - 1.000	895	1260

BOLT HEAD MARKING



GRADE 5



GRADE 8

*WRENCH TYPES WITH $\pm 20\%$ ACCURACY:

TORQUE CONTROLLED IMPACTS WITH TORSION BARS
HAND TORQUE WRENCHES
NUTRUNNERS - STALL AND SHUTOFF
NUTRUNNERS - ELECTRONIC SHUTOFF
AIR CYLINDER - STALL TYPE

NOTE: THIS DOES NOT INCLUDE AIR AND ELECTRIC IMPACT WRENCHES WHICH TYPICALLY ARE $\pm 50\%$ ACCURATE.

NOTE: NYLON LOCKING NUTS WILL BE TORQUED TO GRADE 5 STANDARDS

PURPOSE: THE PURPOSE OF THIS STANDARD IS TO PROVIDE A RECOMMENDED TORQUE FOR THREADED FASTENERS SUCH AS BOLTS, NUTS, CAP SCREWS, USED IN STEEL AND CAST IRON PARTS.

APPLICATION: THIS STANDARD IS INTENDED FOR FASTENERS OF GASKETED OR NON-GASKETED JOINTS, WITH OR WITHOUT STEEL WASHERS, AND WITH COARSE OR FINE THREADS. ALL SPECIAL CONDITIONS WHICH WILL SERIOUSLY AFFECT THE RELATIONSHIP BETWEEN TORQUE AND TENSION OF THE FASTENER, SUCH AS SPECIAL SURFACE FINISHES, LEAD WASHERS, AND FASTENERS SCREWED INTO MATERIAL OTHER THAN STEEL OR CAST IRON, WILL REQUIRE SEPARATE TORQUE VALUES TO BE INCLUDED IN THE APPLICABLE SPECIFICATION. THIS SPECIFICATION DOES NOT APPLY TO TORQUING OF HYDRAULIC CONNECTIONS.

MEAN OR BASIC RECOMMENDED TIGHTENING TORQUE FOR METRIC FASTENER REQUIRING $\pm 20\%$ ACCURACY*. TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS.

SIZE	TORQUE IN POUND FOOT (LB-FT)		
	GRADE 8.8	GRADE 10.9	GRADE 12.9
M3	0.4	1.3	1.5
M4	2.2	3.3	3.7
M5	4.5	6.5	7.5
M6	7.5	11.0	13.0
M8	18	30	33
M10	35	50	63
M12	65	95	110
M14	105	150	177
M16	160	235	277
M20	320	460	542
M24	550	790	937

SIZE	TORQUE IN NEWTON METER (Nm)		
	GRADE 8.8	GRADE 10.9	GRADE 12.9
M3	0.5	1.8	2.0
M4	3.0	4.5	5.0
M5	6	9	10
M6	10	15	18
M8	25	35	45
M10	50	70	85
M12	90	125	150
M14	140	200	240
M16	225	310	375
M20	435	610	735
M24	750	1050	1270

BOLT HEAD MARKING



*WRENCH TYPES WITH $\pm 20\%$ ACCURACY:

TORQUE CONTROLLED IMPACTS WITH TORSION BARS
HAND TORQUE WRENCHES
NUTRUNNERS - STALL AND SHUTOFF
NUTRUNNERS - ELECTRONIC SHUTOFF
AIR CYLINDER - STALL TYPE

NOTE: THIS DOES NOT INCLUDE AIR AND ELECTRIC IMPACT WRENCHES WHICH TYPICALLY ARE $\pm 50\%$ ACCURATE.

NOTE: NYLON LOCKING NUTS WILL BE TORQUED TO GRADE 8.8 STANDARDS

Troubleshooting

Trouble	Probable Cause	Remedy
Air volume (suction) at hose pickup point drops.	Plugged hose, elbow, horizontal connection hose.	Material has plugged tubing at some point. Most likely blockage is at the truck elbow or the horizontal hose connection location. Remove hose and inspect for blockage. Use the vacuum enhancer if equipped.
	Hose has flattened or collapsed.	Check hose for flattening or collapse. Blockage will be immediately ahead of such an area.
	Leaking seals.	Check rear door, cyclone and microstrainer housing for proper sealing. Clean and/or repair, as required.
	Blower is faulty (blower lobe wear or timing problems).	Normal vacuum is inadequate; the blower is not functioning properly. Refer to the Blower manual for repair information or contact factor service for repair assistance.
	Debris body is full.	Empty debris body at the dump site.
	Microstrainer is plugged.	Remove and clean microstrainer.
	Inner liner of hose has collapsed.	Remove and discard hose. Replace with a new hose section.
	Inlet seal is damaged or missing.	Repair or replace the faulty inlet seal.
	Plugged hose from heavy material being vacuumed.	Mix air and heavy material evenly to avoid sluggish in-hose transport.
	Frozen water and debris in hose	Spray warm water into boom or bring unit inside to warm up.
	Float ball screens plugged	Clean ball seals and screens
Hoses soften or melt.	Material is too hot for plastic hoses.	Switch to rubber hose or steel pipe.
		Reduce feed rate so that material is cooled as it flows through the hose.

NOTICE

Machine can be damaged

The boom operator must maintain a clear view of the boom during all movements to avoid striking the parts of the unit and surrounding structures.

NOTICE

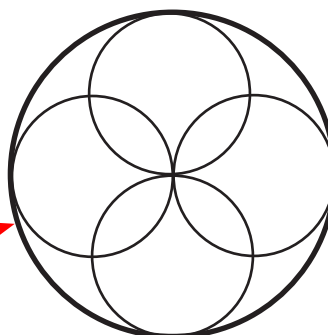
Machine Can Be Damaged

If ice builds up in the boom, shut down the vacuum system. Use hot water to heat the boom tubes or move the vehicle to a warm place. Slowly retract the boom when the tubes have warmed up. Do not retract the boom with ice build up in the vacuum tube. Damage to the boom and/or seal can occur. If hot water is available, start the vacuum system and spray hot water into the vacuum tube/nozzle. As the ice breaks away it will be carried to the debris body.

Trouble	Probable Cause	Remedy
Air volume (suction) at hose pickup point drops.	Worn hose or pipe.	Repair or replace. Keep bends and turns to a minimum.
	Damp material clogging hose or pipe.	Material must be very wet to be effectively vacuumed.
	Hose has split or come apart at a joint.	Replace damaged hose section.
Air volume (suction) at hose pickup point drops and/or hose shortens suddenly (the anaconda effect).	Hose blockage.	Examine hose for blockage; clear blockage, repair, or replace hose.
Lump material enters hose but does not flow to debris body	Material too heavy or lumpy.	Material too heavy to be conveyed on existing air volume or the lumps are too large for hose diameter in use. Use larger hose if possible.
Low air volume (suction) in multiple hose hookups.	Blockage at porthole connection or "Y" adapters.	Generally, the hose diameter should be larger than the maximum lump size handled. For heavy materials, the larger hose diameters provide more efficient pneumatic conveying and also can handle higher blower speeds for additional carrier air volume.
		Find and remove blockage.

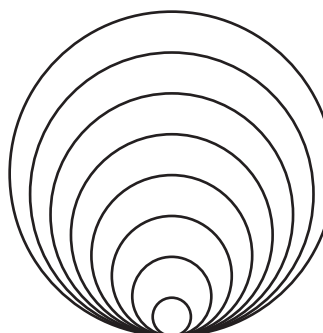
Multiple Hose Runs

Multiple lines should all be the same length.
Three 2" hoses = 4" hose run
Nine 2" hoses = 6" hose run
Four 3" hoses equals 6" hose run
Two 4" hoses equals 6" hose run
Sixteen 2" hoses = 8" hose run
Seven 3" hoses = 8" hose run
Four 4" hoses equals 8" hose run



Hose Restriction

Hose Dia. Inches	Hose Area square/inches	Orifice Area	Orifice Area	Orifice Area
8	50.3	100.0%		
7	38.5	76.6%		
6	28.3	56.3%	100.0%	
5	19.6	39.1%	69.4%	
4	12.6	25.0%	44.4%	100.0%
3	7.1	14.1%	25.0%	56.3%
2	3.1	6.3%	11.1%	25.0%
1	0.8	1.6%	2.8%	6.3%



What should I look for when there is little or no suction at the end of the vacuum hose.

There are several reasons that could singly or in combination cause loss of suction at the end of a vacuum hose. By following these logical steps you can identify and easily rectify the problem by the process of elimination.

- Are all vacuum enable valves closed?

If not, close them, never tape any relief, pressure or safety valves shut. To do so will jeopardize safety and serious bodily harm or even death might occur. Faulty valves need to be repaired, not bypassed or forcibly shut.

- Did you reduce the size of the hose/tube or tube somewhere down the run?

Reduction of the hose/tube size midway down the run can cause material to build up in the hose/tube around the area where the hose/tube size changes. As the hose/tube size changes, the speed of air flowing through the hose/tube drops and some material falls off the airstream and begins to collect in that area. Over a short period, the accumulation grows into an obstruction which clogs the hose, resulting in loss of suction at the hose/tube inlet. The idea is to keep a constant air velocity from the point of material pick up to the entrance to the debris body. A velocity just high enough to transport the material to the body.

What Do I do to remedy the situation?

Uncouple the hose/tube at the point of the size change and operate the blower. If the clog is not very bad, it will clear itself otherwise manual cleaning of the hose/tube or removal of the clogged section of the hose/tube may be required. To avoid the situation, if a smaller hose/tube is all that will work, run that size hose/tube right from the truck but remember a 50% diameter reduction reduces the effective area to 1/4th the original size. Therefore the job will take much longer and also blower cooling will be reduced. To get the job done more efficiently always use the recommended hose/tube size.

- Is the debris body full?

In a liquid filled debris body, the float ball will get sucked closed resulting in a drop of suction at the hose/tube inlet.

In case of solids, an over full body, debris might partially block the passageway, translating to a loss of suction at the hose/tube end. If continued, debris will get carried over to the cyclone (if equipped) chamber, choking the filter. Any blockage of the air

path or a considerable reduction of airflow will not supply enough cooling to the blower and it will over heat. The blower is a positive displacement pump and has to have a certain amount of air flowing through it to work efficiently. It is similar to failure of the water pump in an engine cooling system, if cooler water is not allowed to flow through the engine block, it will overheat rapidly and damage.

How to correct

Stop vacuuming, empty the debris body and clean it thoroughly.

- Leaky gaskets, damaged or blocked hoses, damaged debris body. Leaky or damaged gaskets will cause air to be sucked in through the leaky area which will translate into loss of suction at the hose/tube inlet. Same will be the result of a leaky hose/tube or connections.

Repair or replace the damaged hose. Replace a leaky gasket as soon as possible and repair any other sources of leaks.

Regulating the vacuuming speed. It is a misconception that higher the blower RPM the faster the job will be completed, especially where light weight material is vacuumed.

Note: The vacuum system is not suitable for vacuuming dry material. The material must be wet. When needed an optional water ring can be used to cool and wet the incoming material.

A faster blower speed generates a high velocity airflow and increases the production of flying dust. As it is, light weight dust is difficult to separate from the airstream and a high velocity airstream makes it even harder. As a result, with higher RPM than required, more dust carries over into the cyclone chamber and the microstrainer housing. All the dust that enters the housing tries to pass through the filter, exposing it to faster choking. This ingress can be reduced by reducing the operating blower speed. As a rule of thumb, keep the blower speed just high enough to easily convey the debris to the debris body and no faster. This will depend on the type of material handled and the distance through which it has to travel to the body. Start with a low RPM and if it does not do the job, increase it gradually until material starts flowing easily into the suction hose. A lower RPM will reduce the carryover into the cyclone and microstrainer housing.

- Is the silencer blocked?

Any dust that is small enough to pass through the system also passes through the blower and through

the silencer. Although most of this is emitted in the atmosphere, some of the minute particles cling to the insides of the silencer. Over a period of time, the silencer will get choked. This will not allow all the air from the blower to readily exhaust out of the blower, effectively creating a back pressure in the blower. This reduces its efficiency as it has to use some of its power to overcome this back-pressure, resulting in loss of airflow through it.

The remedy is to clean or replace the silencer.

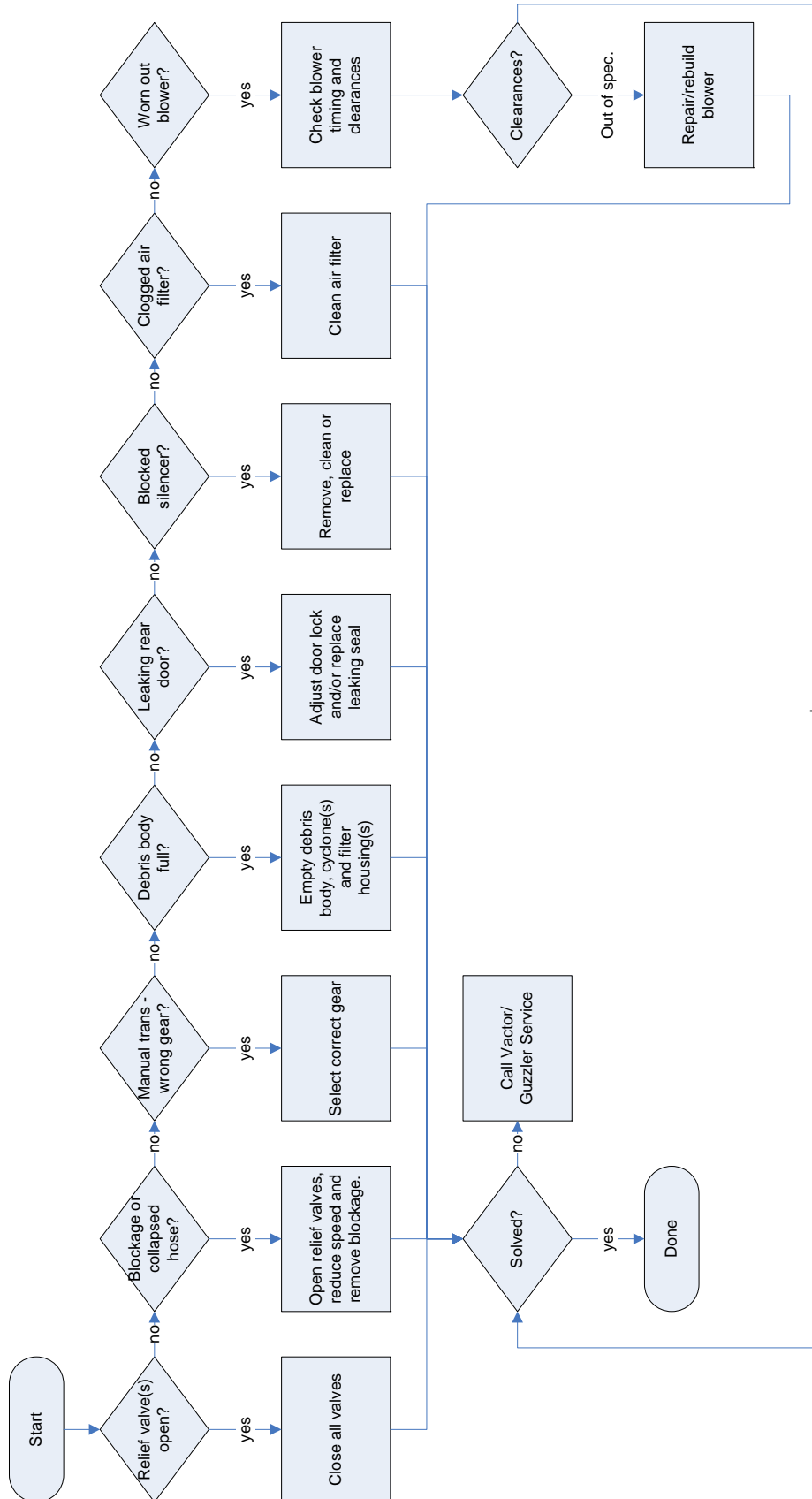
- Is the blower worn out?

Any dust particle that passes through the system, however small it may be, at the high speed it is traveling sand blasts the internals of the blower and eventually wear it out. The tolerances between the moving and stationary parts in a blower are very minute and they get even smaller as the metals expand when the blower achieves its working temperature. This helps in creating a seal to trap air and pump it out. As the blower wears, the clearances get larger and the sealing gets weaker, the pumping performance reduces, creating less and less airflow. Eventually it needs to be taken out of service and rebuilt.

The blower's condition can be checked by the following method:

1. Find and repair all vacuum system leaks. This includes all door seals, debris body inlet seal, etc.
2. Cap the boom hose end to close it off.
3. Set the vacuum to disable.
4. Start the engine, engage the blower.
5. Increase the blower speed to about 1500rpm.
6. Set the vacuum to enable.
7. Note the rise in the vacuum gauge reading.
8. Observe the blower as vacuum builds and the automatic vacuum relief valves (Kunkle valves) open up at the specified vacuum for the blower, or in case of a high vacuum blower, the gauge climbs up without an appreciable loss in blower speed.

The blower should raise the vacuum to at least 75% of the blower's rated vacuum or the automatic vacuum relief valves should open. If the blower achieves the required vacuum, the blower is in good shape. Refer to competent repair facilities (factory service can assist), or refer to blower manufacturer's maintenance manual. If it fails to achieve the rated vacuum, the blower may need attention. If the engine bogs down and begins to stall, the engine is not building enough power to run the blower to full load. It could also translate to a choked silencer and excessive back pressure.



Trouble	Probable Cause	Remedy
Excessive carry-over into cyclones.	Debris	Overfilled debris body.
	Float ball problem	Float ball not sealing in debris body. Clean float ball and seal.
	Excessive blower RPM	Lower blower RPM for lighter materials.
	Dry material	Water rings are available to wet and cool material.

APXX

REAR DOOR

OPERATION TROUBLESHOOTING

Trouble	Probable Cause	Remedy
Rear door will not operate.	Hydraulic pump is not engaged.	Engage hydraulic pump.
	Leaks and blockages.	Check hydraulic oil level in sight gauge. Ensure main supply valve is open.
		Check hydraulic pump and hoses for leaks.
		Check hydraulic system for dirt or blockage.
		Check hydraulic return oil spin-on filter.
		Check suction line strainer.
	Electrical	Check for power at fuse.
Rear door leaks on way to dump site.	Leaking rear door seals.	Seal is not holding. After dumping, clean off seal and inspect gasket for cuts.
		Replace door seal.
		Adjust door locks

APXX

BLOWER

OPERATION TROUBLESHOOTING

Trouble	Probable Cause	Remedy
Noisy.	Low oil.	Check sight gauge and add oil.
	Bearings bad.	Disassemble and replace.
	Timing out	Place transfer case in neutral and with engine OFF manually rotate the blower. If interference is felt call service.
	Low RPM	Operate blower at 900rpm or blower
Runs hot.	Too much or too little oil.	Check sight gauge and service as needed.
	Operating at too low RPM or too high vacuum.	Never operate below 1,200 RPM or above the blowers rated vacuum level.
	Submerged or blocked vacuum hose/tube limiting air flow	Clear hose/tube and verify air flow
Locked up.	Material or rust build up in blower.	Disassemble and clean. Inspect filtration system
	Ice in blower (Never operate)	Bring inside and warm up.
Bearing cover paint discolored.	Too much or too little oil.	Check sight gauge and service as needed.
	Bearings bad.	Disassemble and replace.
	Submerged or blocked vacuum hose/tube limiting air flow	Clear hose/tube and verify air flow
Low vacuum at pick up nozzle.	Hose/tube plugged.	Disengage and clean or replace.
	Hose/tube damaged.	Repair or replace.
	Hose/tube leaks (can be heard).	Replace.
	Final filter screen plugged.	Disassemble and clean or replace.
	Relief valve plugged or stuck open.	Clean or replace.
	Blower worn.	Repair or replace.
	Microstrainer plugged	Remove and clean
	Doors not sealed.	Secure locks, check for debris; replace seals if worn.
	Clamps on joints not sealed	Check for proper attachment.
No vacuum	Doors not sealed.	Secure locks, check for debris; replace seals if worn.
	Clamps on joints not sealed	Check for proper attachment.
	Blockage in pipe / tube.	Clean or check to see if inner liner has collapsed and replace.
	Debris body full.	Dump.
	Suction nozzle immersed	Operate properly by raising and lowering nozzle in material.
	Microstrainer plugged	Clean microstrainer

Trouble	Probable Cause	Remedy
Protective strainer plugged (float ball cages)	Screen assemblies plugged	Dump debris, open body, lower safety props, clean screens.
	Float balls stuck.	Remove and flush with water or air.
No air flow.	Engine speed too low.	Verify engine operation
	Wrong direction of rotation.	Compare actual rotation with vacuum pump illustration and arrow on blower. Compare driver if wrong.
	Obstruction in piping.	Check piping, screen, valves, silencer, to assure an open flow path.
Low capacity.	Engine speed too low.	Verify engine operation
	Excessive discharge pressure.	Check inlet vacuum and discharge pressure, and compare these figures with specified operating conditions on order.
	Obstruction in piping.	Check piping, screen, valves, silencer, to assure an open flow path.
	Excessive slip.	Check inside of casing for worn or eroded surfaces causing excessive clearances.
	Hose leaks.	Check hose for tears or splits.
	Connection leaks.	Check connections for air leaks.
	Rear door leak.	Check for leaking seal at rear door.
	Expansion joint leak.	Check for air leaks at rubber seal connection at the make/break.
	Blower lobe wear or timing problem.	Refer to competent repair facilities (factory service can assist), or refer to blower manufacturer's maintenance manual.
	Vacuum relief valves	Check for leaks and proper operation.

NOTICE

Machine Can Be Damaged

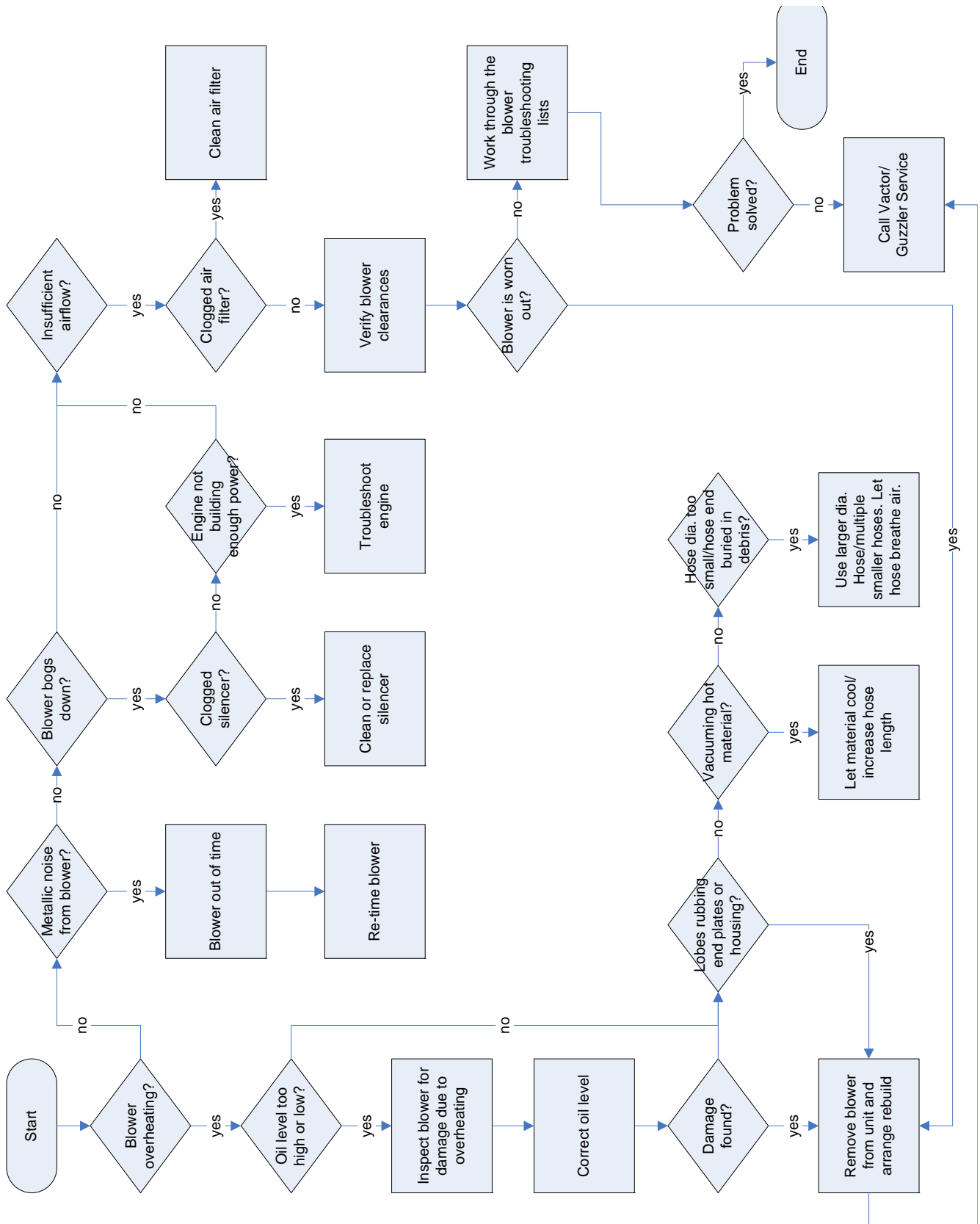
To avoid damage to the blower/fan and drive train immediately shut down the unit when any vibrations or material discharge at the exhaust is noticed. Immediately stop operations and correct problem.

Trouble	Probable Cause	Remedy
Dust plume through blower (silencer) exhaust.	Dry material	Water rings are available to wet and cool material.
	Excessive blower speed for job requirement creates dust carry-over through the microstrainer.	Reduce engine speed to optimize vacuum operations.
	Over loaded cyclone section resulting in excessive carry over. Microstrainer overloaded.	Dump the vacuum system and thoroughly inspect for material buildup. Clean vacuum system, as required.
	Overloaded microstrainer.	Open the microstrainer door and clean out the housing area. NOTE: This section should be cleaned every time that the vacuum system is dumped.
	Faulty or improperly installed microstrainer.	Open the microstrainer access door, remove the microstrainer and inspect for dust buildup. If a general buildup or leak is evident, replace the microstrainer. Material behind the microstrainer is an indication of a leaking or damaged microstrainer.
A plume appears for several minutes after microstrainer change over.	Dust from previous vacuuming activities is being blown into the atmosphere.	Clean equipment between microstrainer service intervals.
Excessive power (chassis)	Speed too high.	Never operate above rated RPM of blower.
	Pressure too high.	See item "Low capacity."
	Impellers rubbing.	Inspect outside of cylinder and head plates for high temperature areas, then check for impeller contacts at these points. Correct blower mounting, drive alignment.
	Vacuum too high	Never exceed blower system rating. Repair or replace the vacuum relief (Kunkle) valve.
Overheating of bearings or gears.	Inadequate lubrication	Restore correct oil levels in main oil sumps.
	Excessive lubrication	Check oil level. If incorrect, drain and refill with clean oil of recommended grade.
	Excessive pressure	See item "Low capacity."
	Not enough air flow	Do not submerge the end of the hose or vacuum tube. There must be adequate airflow to cool the blower.

NOTICE**Machine Can Be Damaged**

To avoid damage to the blower/fan and drive train immediately shut down the unit when any vibrations or material discharge at the exhaust is noticed. Immediately stop operations and correct problem.

Trouble	Probable Cause	Remedy
Vibration	Driver of blower loose.	Tighten mounting bolts securely.
	Driveline bearings	Check and replace as needed both UPPER and LOWER driveline bearings.
	Misalignment.	See item "Overheating of bearings or gears."
	Impellers rubbing.	See item "Excessive power."
	Worn bearings/gears.	Check gear backlash and condition of bearings. Refer to blower manual for specifications. Replace gears and bearings.
	Unbalanced or rubbing.	Scale or process material may build up on casing and impellers, or inside impellers. Remove buildup to restore original clearances and impeller balance.
Engine overheats and blower gets hot to the touch.	Hose sized incorrectly.	Allow more air to flow into vacuum hoses.
High blower temperatures, high vacuum, low air flow.	Hoses are plugged.	Allow more air to flow into vacuum hoses.
High blower temperatures, high material temperatures.	Insufficient air flow in vacuum hose.	Allow more air to enter the vacuum hose. If possible, cool the hot material with water.
High blower temperature with normal air flow.	Improper amount, type, or weight of oil in blower.	Drain blower lubricant and refill with proper type and weight of oil. Refer to the OEM manual for further information.
Noisy blower.	Silencer or muffler defects.	Check for holes and/or leaks.
		Replace silencer if sound deadening material has hardened or has disintegrated.
Engine loads up and relief valve pops open.	Debris body is full.	System is overloaded. Shutdown and dump. Debris body is full and float has closed off air passage. After dumping, clean rear door seal and inspect gasket for cuts. Check and clean float balls.



APXX

TRANSFER CASE

TROUBLESHOOTING

Trouble	Probable Cause	Remedy
Transfer case runs hot.	Too much or too little oil in the transfer case.	Drain and refill the transfer case with the proper type and amount of oil.
Transfer case is noisy.	Vehicle has been idling with blower engaged.	Never allow vehicle to idle with blower engaged. Note: The blower should not be operated at idle rpm's. Maintain at least 875rpm to reduce wear on the transfer case. The system does this automatically on auto transmissions.
Transfer case is hard to engage. (MANUAL transmission)	Transfer case gears are not meshing properly.	Feather the clutch pedal to allow the transmission to roll. This will allow the transfer case gears to mesh.
Transfer case does not operate blower when engaged. No power is available at the remote control panel. (MANUAL transmission)	Faulty transmission shift prior to engaging the transfer case.	Return transfer case shift knob to ROAD MODE and restart the gear shifting process until the amber TRANSMISSION CAUTION light extinguishes. Then place the transfer case shift lever in the BLOWER MODE.
Transfer case does not engage.	Proper transfer case engagement procedure not followed.	Procedures are normally decalled on the driver side visor.
Blower does not engage.	Low air pressure.	Check compressor air pressure gauge. There must be a minimum air pressure of 80 PSI for the air shifter to operate.
	Air leak at air shifter.	Tighten or replace leaking air shifter components.
	Transfer case nose cone not shifting.	Refer to the transfer case manual for repair instructions.
	Proper engagement procedure not followed.	Attempt engagement procedure.

APXX

BOOM - GENERAL USE

TROUBLESHOOTING

Trouble	Probable Cause	Remedy
Debris leaks from the seal between the inner and outer boom tube when unit is shut down.	Operator is shutting the vacuum system down with debris in tube. Debris runs between tubes and leaks out the seal.	Prior to shutdown of the vacuum system, raise the boom and allow the vacuum system to clear the tube of any debris.
Debris leaks from the seal between the inner and outer boom tube while vacuuming (telescoping boom, if equipped)	Excessive build up of debris between the inner and outer boom tubes.	Engage the vacuum system. Extend and retract the boom. At the same time, use a pressure washer to wash the seal area. If this does not stop the leak, disassemble the boom and clean the area between the inner and outer boom tube. Prior to shutdown of the vacuum system, raise the boom and allow the vacuum system to clear the tube of any debris.
Bottom of inner tube has holes in it causing leaks.	Excessive build up of material between the inner and outer boom tubes causing tube to rust and corrode as well as physical wear of the tube.	Replace the inner tube. Prior to shutdown of the vacuum system, raise the boom and allow the vacuum system to clear the tube of any debris.
Debris hose and / or tube wear out quickly.	Material being vacuumed is highly abrasive.	Add water to the material being vacuumed. Reduce the engine rpm. Reducing the air flow and / or adding more water reduces the abrasion factor of the material.
Debris leaks at boom turret.	Abrasive action of debris has worn through elbow.	Replace turret.

APXX

BOOM - GENERAL USE

TROUBLESHOOTING

Trouble	Probable Cause	Remedy
Debris leaks from the seal between the inner and outer boom tube when unit is shut down.	Operator is shutting the vacuum system down with debris in tube. Debris runs between tubes and leaks out the seal.	Prior to shutdown of the vacuum system, raise the boom and allow the vacuum system to clear the tube of any debris.
Debris leaks from the seal between the inner and outer boom tube while vacuuming.	Excessive build up of debris between the inner and outer boom tubes.	Engage the vacuum system. Extend and retract the boom. At the same time, use the handgun to wash the seal area. If this does not stop the leak, disassemble the boom and clean the area between the inner and outer boom tube. Prior to shutdown of the vacuum system, raise the boom and allow the vacuum system to clear the tube of any debris.
Bottom of inner tube has holes in it causing leaks.	Excessive build up of material between the inner and outer boom tubes causing tube to rust and corrode as well as physical wear of the tube.	Replace the inner tube. Prior to shutdown of the vacuum system, raise the boom and allow the vacuum system to clear the tube of any debris.
Debris hose and / or tube wear out quickly.	Material being vacuumed is highly abrasive.	Add more water to the material being vacuumed. Increase flow from handgun/ water wand. Reduce the engine rpm. Reducing the air flow and / or adding more water reduces the abrasion factor of the material.
Debris leaks at boom turret elbow.	Abrasive action of debris has worn through elbow.	Replace elbow

The water system is the component that allows the hydro-excavation feature to function. This system includes the following items:

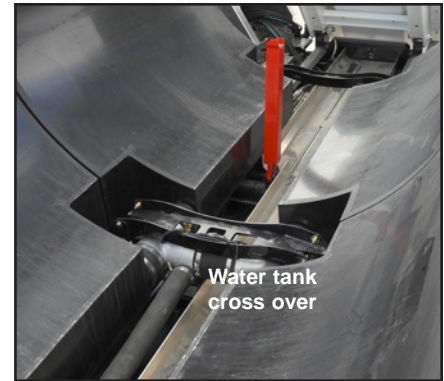
- Water tank
- Water pump
- Air purge
- Water heater (optional)
- Recirculator (optional)

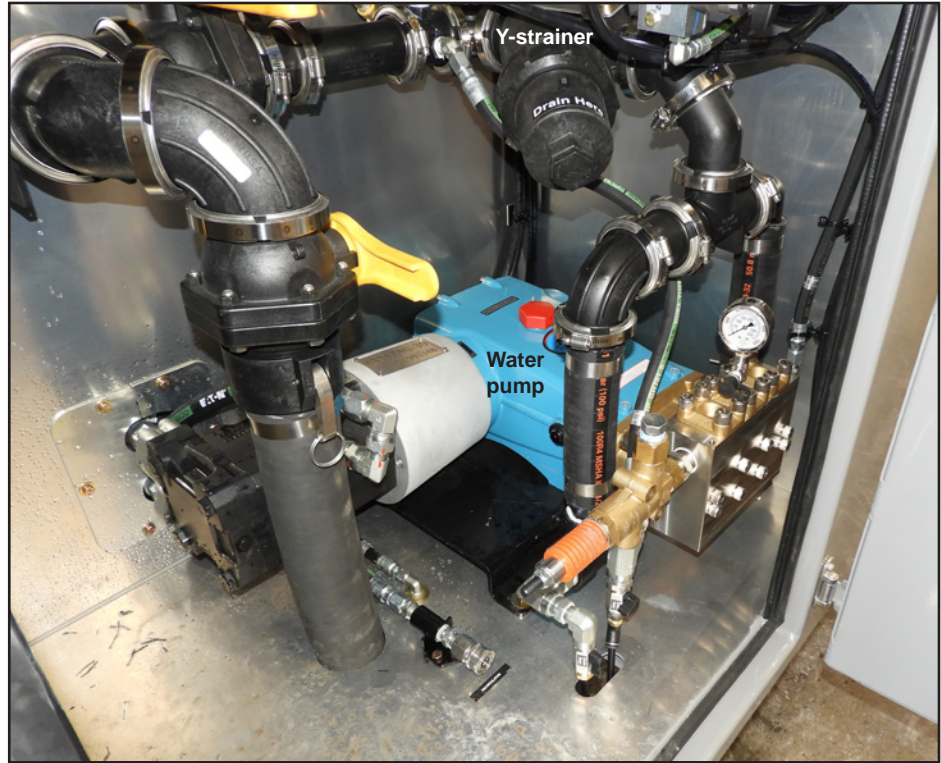
Watertank

The water tanks are located along both sides of the debris body. The tank capacity is up to about 1300 gallons depending on model. The tank is normally filled through a Camloc fitting at piping to an air gap install with a hydrant hose and Y-strainer in-line.

Tank drain lever gate valve controlled by a handle just above the water pump.

The water tank is equipped with a pressure sensor in the cross over pipe to indicate approximate water level on the display on the master control panel.





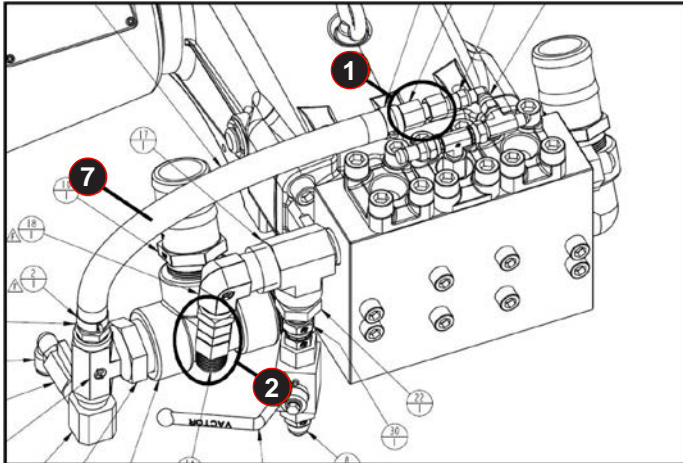
The water pump is rated at 20 gpm. However, the nozzle size at the end of the handgun will determine how much flow you actually have.

Once water leaves the tank through the shut-off valve, it travels to the water pump via hose.

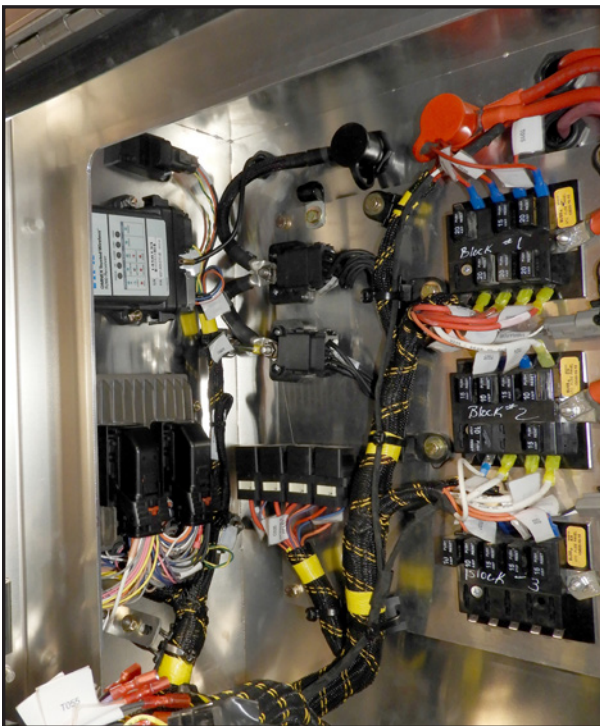
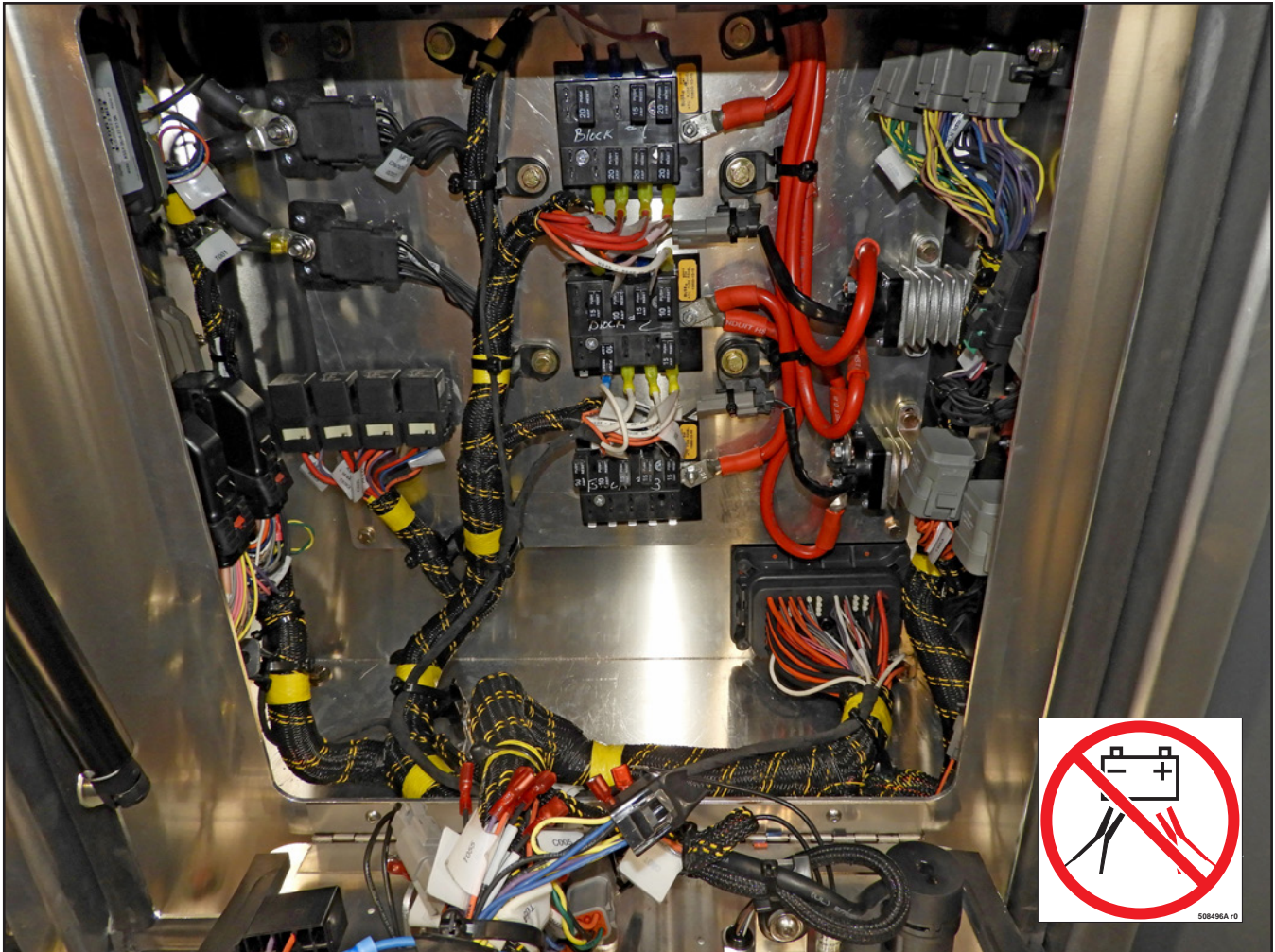
A y-strainer is located inside the pump cabinet. Water flows through the strainer and is guided to the pump. The strainer must be kept clean.

Five common questions to ask if the water pump is not making pressure or making low pressure.

1. Is the pump turned on correctly?
 - a. Chassis ignition power to on.
 - b. PTO engaged
 - c. Water pump switch to on and recirculator switch off.
 - d. If the above conditions are met and the pump still does not work, there is an electrical or a hydraulic issue.
2. **Is there a nozzle installed?**
 - a. Make sure that you have a nozzle installed on the end of the handgun or the digging wand
 - b. Make sure the nozzle is clean of foreign debris which could create spikes allowing the unloader to cycle sporadically
 - c. Make sure you have the correct nozzle size for the required flow
 - i. Nozzle too big-flow but low pressure
 - ii. Nozzle too small-creates excessive pressure can stall pump
3. **Is the multiflow switch fully increased?**
 - a. If noticing a low flow coming out of the end of the handgun/or dig pipe check that the multiflow switch is able to be increased
 - b. If no response, check for power
4. **Is there adequate inlet conditions?**
 - a. Identify the water level in the tank
 - b. Check that the outlet valve from tank is open
 - c. If still low flow/pressure
 - i. Close outlet valve
 - ii. Remove screen from y-strainer and inspect
 1. If dirty clean with compressed air (flush w/water in field)
 2. Reinstall
 - iii. Open the outlet valve on the water tank
 - iv. Check for increased pressure/flow



- 1 Close the shut off valve that feeds the water pump.
- 2 Remove the (7) hose that is attached to the (1) pop off valve.
- 3 The (3) adjustment screw is internal on this pop-off valve. Using an allen wrench, turn the adjusting screw all the way in. Once the screw is all the way turned in, then back the screw out three full turns. (This will be the starting setting for (1) pop off valve)
- 4 Reattach the (7) hose that was connected to the (1) pop off valve.
- 5 The adjustment for the (2) pop off valve can be done using a wrench. The (6) locking nut must be backed off then adjust the pressure by turning the (4) adjusting bar clockwise until the spring is completely compressed, this is the highest pressure. (This will be the starting setting for (2) pop off valve)
- 6 Attach A ball valve to the outlet of the water pump, be sure that it is in the open position.
- 7 Open the water valve that feeds the water pump.
- 8 Run the truck in dig right mode set to 3000psi. Be sure that the engine is set to the max operating speed and that pressure is being displayed on the screen.
- 9 Slowly close the ball valve until 3000psi is displayed on the gauge and screen.
- 10 Once 3000psi is maintained then quickly close the ball valve, at this point the system pressure should spike and the (1) pop off valve should relieve the excess pressure. The valve should then close and the displayed pressure should be less than 3000 psi. If the (1) pop off valve continues to relieve then it is set too low, increase the setting 1/2 turn and run step 10 again. If the (1) pop off valve does not relieve then the pressure is set to high, decrease the setting 1/2 turn and run step 10 again.
- 11 Once step 10 is complete then the (1) pop off valve is set.
- 12 To set the (2) pop off valve. Set dig right to 3000 psi and crack the ball valve until 3000psi is maintained on the gauge and screen. Slowly back the (4) pop-off adjusting bar until a small amount of water is dripping. Immediately adjust in 1/2 turn at a time until the dripping stops. Slide the (5) o-ring up to the (4) adjusting bar and then hand-thread the (6) lock nut up to (5) o-ring and (4) adjusting bar so the (5) o-ring is fully compressed.



No power

Before attempting to check for power failure at the control panel, check all connections for tightness at the battery. This includes all auxiliary wires connected to the battery terminals.

Verify that there is power to the relay and that the relay is functioning. Replace relay as required.

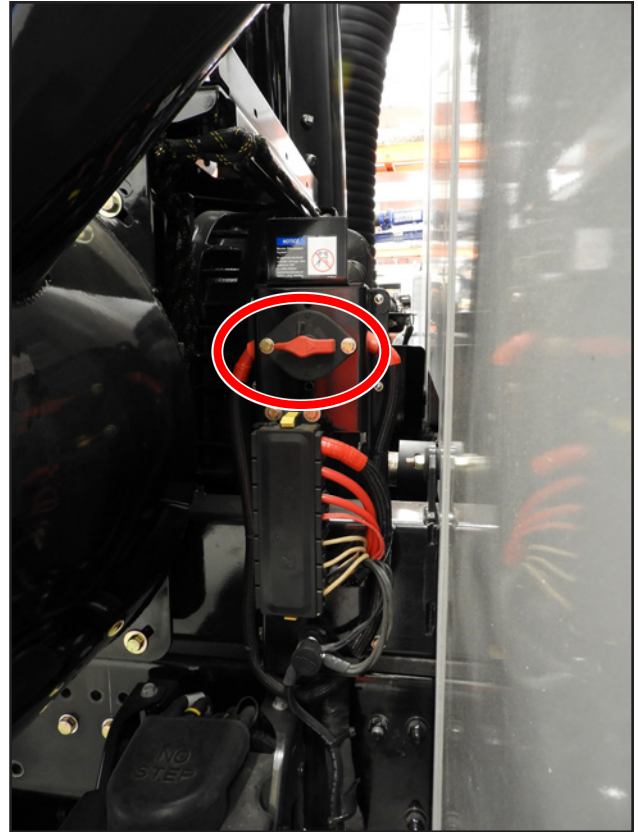
NOTICE


Electrical Systems Can Be Damaged

Never use a test light when troubleshooting. Only use digital multimeter on all circuits. Test lights and older analog meters can damage the electronic systems.

The master disconnect switch is normally located on the driver side behind the cab. Switching to off separates the chassis electrical systems from the TRUVAC systems for service.

Below the switch is the main power fuse box. Circuits are normally labeled under the cover. Refer to the unit specific schematics for details.



NOTICE	
Master Disconnect Switch To prevent electrical systems damage, turn switch to OFF position before servicing chassis or before jump starting.	
514576 rA	

Refer to the unit specific schematics for details.
Breaker location and functions vary with options.

Top breaker block

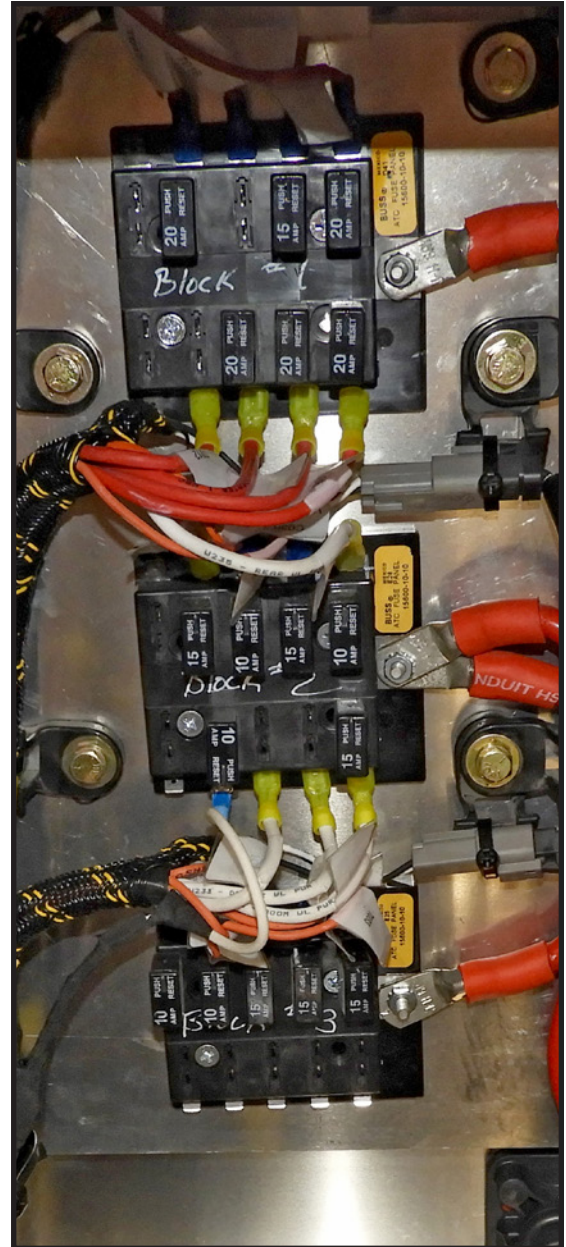
Battery hot power

Middle breaker block

Switched Power

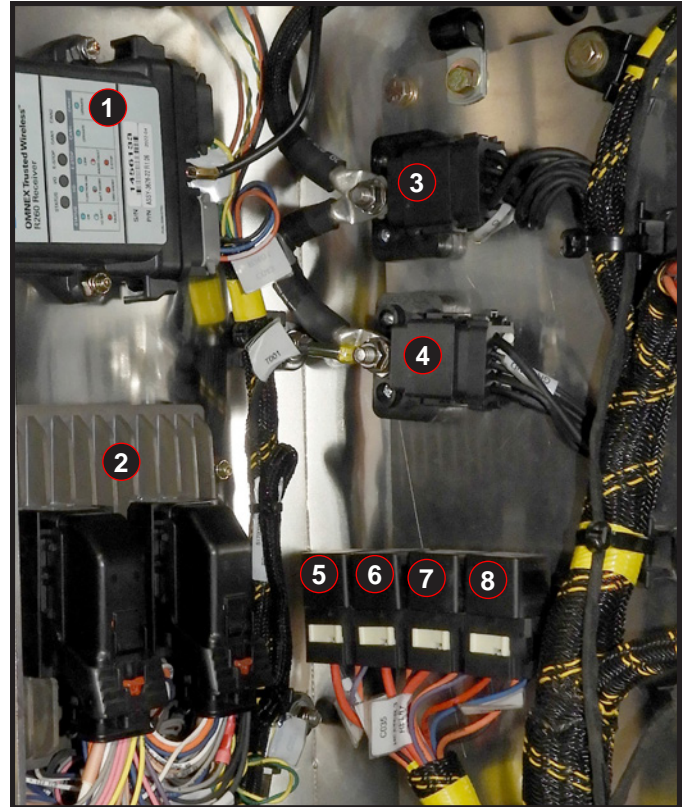
Lower breaker block

Switched Power

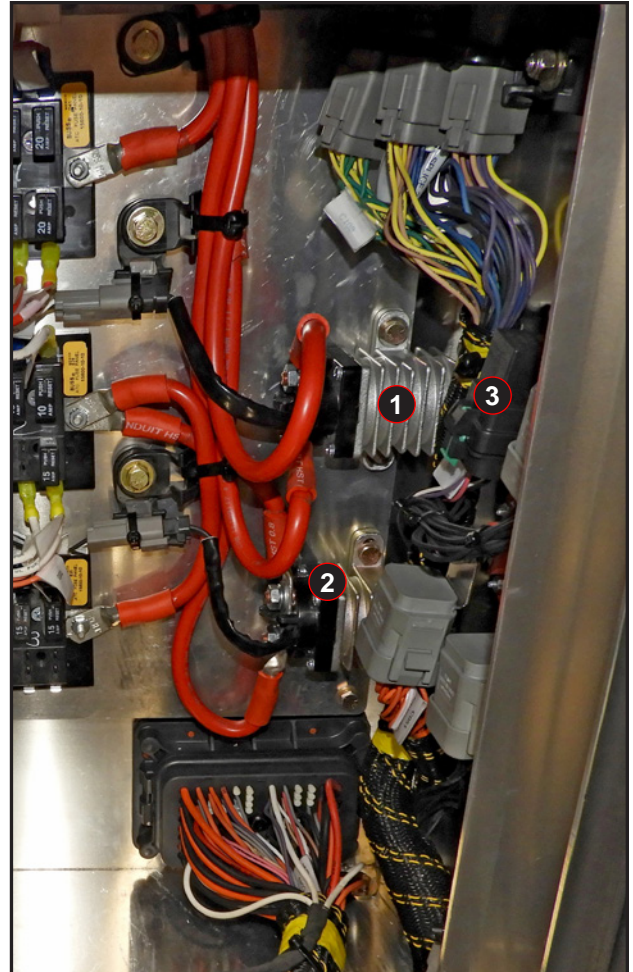


Refer to the unit specific schematics for details.
Relay location and functions vary with options.

- 1 Wireless controller
- 2 MC-43 master controller
- 3 Ground splice pack
- 4 Ground splice pack
- 5 Strobe - verify with wire tag
- 6 Cabinet heater 1 - verify with wire tag
- 7 Cabinet heater 2 - verify with wire tag
- 8 Cabinet heater 3 - verify with wire tag



- 1 Vibrator
- 2 Master power
- 3 E-Stop



APXX-C E-Stop Light blink codes

(Slow:Fast flash)

- 1:1 Water Pressure Sensor Fault
- 1:2 Hyd Temp Sensor Fault
- 1:3 Blower Temp Sensor Fault
- 1:4 Body Level Sensor Fault
- 1:5 Final Filter Vacuum Sensor Fault
- 2:1 Air Comp Temp Sensor Fault
- 2:2 Air Comp Pressure Sensor
- 2:3 Aux Pressure Sensor Fault
- 2:4 Hydrostat Pressure Sensor Fault
- 2:5 Water Tank Temp Sensor Fault
- 3:1 Water Level Sensor Fault
- 3:2 Estop Coil Sensor Fault
- 3:3 DigFast Sensor Fault
- 3:4 Load Sense Pressure Fault
- 3:5 Outside FF Vacuum Sensor Fault
- 4:1 Cat Pump Speed Sensor Fault
- 4:2 Blower Speed Sensor Fault
- 4:3
- 4:4
- 4:5

Air Comp Light

(Slow:Fast flash)

- 1:1 Comp won't start due to pressure
- 1:2 Comp Overtemp Shutdown
- 1:3 Comp Pressure Shutdown
- 1:4
- 1:5

Trouble	Probable Cause	Remedy
Noisy hydraulic pump.	Insufficient flow of hydraulic fluid.	An insufficient oil flow to the hydraulic pump will cause what is called "Starving the Pump". First check the reservoir. NOTE: Insufficient oil supply in the reservoir with lift cylinders in extreme raised position will cause the pump to deliver charges of air instead of oil into hydraulic unit.
Slow lift (body, rear door.)	Extreme temperature.	In cold weather, oil becomes thick. This can cause hoist cylinder to be slow in raising a load. Pump efficiency is retarded by the oil being unable to flow readily enough to supply the pump in extreme hot or cold temperatures.
Insufficient lifting of debris body.	Hydraulic leakage.	Check for leaks in hydraulic lines.
	Bad check valve.	Check for leakage in hoist cylinder packing.
Hoist cylinder will not operate in up or down position.	Improperly functioning check valve.	The pilot in the check valve holds hydraulic fluid to operate cylinder. If this does not happen, replace check valve when body is in fully lowered position.
Body is up and will not come down	Center of gravity of body and debris misaligned.	Never attempt any repair. Consult factory.
	Bad check valve.	The debris body MUST be held securely by means of the safety stand. If it will not, place blocking between body and chassis or other means before removing and replacing new check valve.

WARNING

Crushing hazard

NEVER go under a raised loaded debris body. To avoid injury or death:

- Empty debris body before service work.
- Always use the body prop when the debris body is raised for service.
- **NEVER** disconnect check valve with the debris body in raised position. Debris body will fall.



- **NEVER** remove the bleeder screw (if equipped) from cylinder with pressure on the cylinder. Debris body will fall. Only loosen bleeder screw to bleed air from cylinder.
- **NEVER** loosen or disconnect any hydraulic components while the hydraulic pump is running.

Hoist

The hoist includes the hydraulic pump, hoist control valve and debris body / boom lift cylinders.

Noisy hydraulic pump.

Note: Insufficient oil supply in the reservoir will “starve the pump” and cause it to deliver charges of air instead of oil when hoist is in the extreme raised position.

The primary causes of pump noise are a lack of hydraulic oil known as cavitation or operating in extremely cold temperatures. Check the hydraulic oil level daily before operating. In extremely cold weather, allow the unit to warm up completely and slowly operate the hydraulic controls until the hydraulic oil has warmed. See the Maintenance Section for information on hydraulic oil level and specifications.

1. Check hydraulic oil reservoir level and service as needed.

Note: Raising the hoist at a higher speed than necessary may also “starve the pump,” which will reduce hoisting speed and result in damage to the unit.

2. Keep the truck engine speed at a moderate level when using the hydraulic controls.

Extreme temperatures effects pump efficiency.

1. During cold weather, the oil may become thick and cause the hoist to be slow in raising. Thick oil will also retard the descent. Pump efficiency is reduced because the oil is unable to flow readily enough to supply the pump. This is another case of “starving the pump.”
2. Be sure to have the right viscosity oil for your operating conditions. (See suggested oils in the Maintenance section.)

DANGER

Entanglement Hazard

Contacting moving parts with clothes or body can cause injury or death:



- Never go underneath the vehicle with the engine running.
- Never work near a rotating drive shaft.
- Never attempt to engage or disengage the pump or other driven equipment from underneath the vehicle with the engine running.
- Never attempt to engage or disengage any driven equipment from any position that could result in getting entangled in the drive shaft or moving parts.
- Never attempt to work on any installed driven equipment with the engine running.
- Remove the ignition keys and post a lockout/tagout sign on the chassis steering wheel and engine control panels as required.

WARNING

Crushing hazard

NEVER go under a raised loaded debris body. To avoid injury or death:



- Empty debris body before service work.
- Always use the body prop when the debris body is raised for service.
- **NEVER** disconnect check valve with the debris body in raised position. Debris body will fall.
- **NEVER** remove the bleeder screw (if equipped) from cylinder with pressure on the cylinder. Debris body will fall. Only loosen bleeder screw to bleed air from cylinder.
- **NEVER** loosen or disconnect any hydraulic components while the hydraulic pump is running.

Lift cylinder creeping down or drifting.

The terms "creeping down" and "drifting" refer to the hydraulic cylinder dropping slowly during operation. The primary cause of this is a loss of hydraulic pressure, either internally or due to leaks in the system.

1. Visually check for oil leaks at the following points:
 - Cylinder sleeve packing
 - Hoses and connections
 - Tubing and connections
 - Pipe fittings
 - Pump mounting base

Note: A small particle of dirt between the ball and seat of check valves and control spools can result in pressure loss and damage to internal parts. See the Maintenance Section for information on hydraulic system service.

2. Examine for debris in the check valves by operating the hoist several times to dislodge and pass the debris to the filter.

Drifting can also be caused by hydraulic oil bypassing internally and causing a lack of pressure at the cylinder. Wear and damage can cause bypassing around cylinder packing, control valve seals / spools and actuating solenoid. If drifting continues after checking for leaks and debris in the system, check the system for bypassing.

Poor hoist performance.

Air in the lift cylinder can cause many problems including:

- Failure to lift
- Jerky hoist operation
- Lift cylinder won't raise to full extension
- Lift cylinder drops several inches when lowered

Note: Bleeding air from the lift cylinder can result in a discharge of hydraulic oil from the cylinder. Make sure the vehicle is in an appropriate area for cleanup. Make sure surrounding personnel are aware of the procedure.

Check the hydraulic reservoir oil level daily before use. If air enters the hydraulic system, add oil to the reservoir if needed and operate the hoist several times. If necessary, raise the lift cylinder a few inches and loosen the manual bleeder valve on top of the debris body lift cylinder. This will allow air to escape. When the air is displaced, close the bleeder and lower the cylinder. Check the hydraulic reservoir level.

Other Notes

A small particle of dirt between the ball and seat of check valves and control spools can result in pressure loss and damage to internal parts. See the Maintenance Section for information on hydraulic system service.

Insufficient oil supply in the reservoir will "starve the pump" and cause it to deliver charges of air instead of oil when hoist is in the extreme raised position.

Noisy hydraulic pump.

Insufficient oil supply in the reservoir will “starve the pump” and cause it to deliver charges of air instead of oil when hoist is in the extreme raised position.

The primary causes of pump noise are a lack of hydraulic oil known as “starving the pump,” or operating in extremely cold temperatures. Check the hydraulic oil level daily before operating. In extremely cold weather, allow the unit to warm up completely and slowly operate the hydraulic controls until the hydraulic oil has warmed. See the Maintenance Section for information on hydraulic oil level and specifications.

1. Check hydraulic oil reservoir level and service as needed.
2. Keep the truck engine speed at a moderate level when using the hydraulic controls.

Lift cylinder creeping down or drifting.

The terms “creeping down” and “drifting” refer to the hydraulic cylinder dropping slowly during operation. The primary cause of this is a loss of hydraulic pressure, either internally or due to leaks in the system.

Visually check for oil leaks at the following points:

- Cylinder sleeve packing
- Hoses and connections
- Tubing and connections
- Pipe fittings
- Pump mounting base

Note: A small particle of dirt between the ball and seat of check valves and control spools can result in pressure loss and damage to internal parts. See the Maintenance Section for information on hydraulic system service.

Drifting can also be caused by hydraulic oil bypassing internally and causing a lack of pressure at the cylinder. Wear and damage can cause bypassing around cylinder packing, control valve seals / spools and actuating solenoid. If drifting continues after checking for leaks and debris in the system, check the system for bypassing.

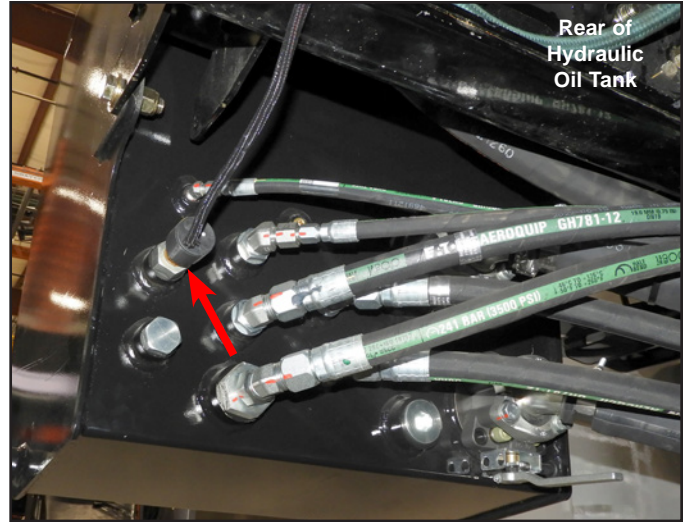
! WARNING**Crushing hazard**

NEVER go under a raised loaded debris body. To avoid injury or death:

- Empty debris body before service work.
- Always use the body prop when the debris body is raised for service.
- **NEVER** disconnect check valve with the debris body in raised position. Debris body will fall.
- **NEVER** remove the bleeder screw (if equipped) from cylinder with pressure on the cylinder. Debris body will fall. Only loosen bleeder screw to bleed air from cylinder.
- **NEVER** loosen or disconnect any hydraulic components while the hydraulic pump is running.



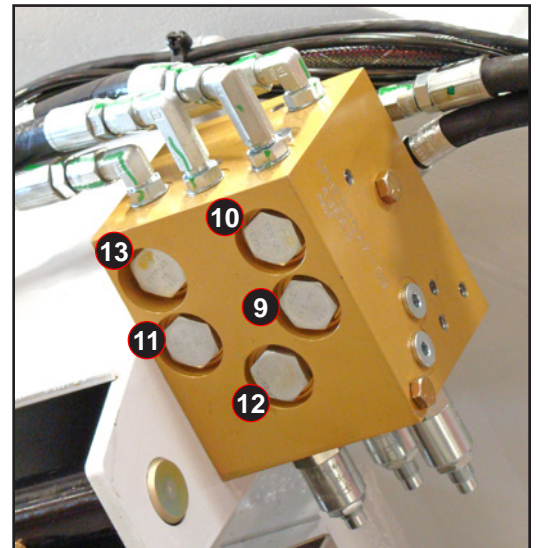
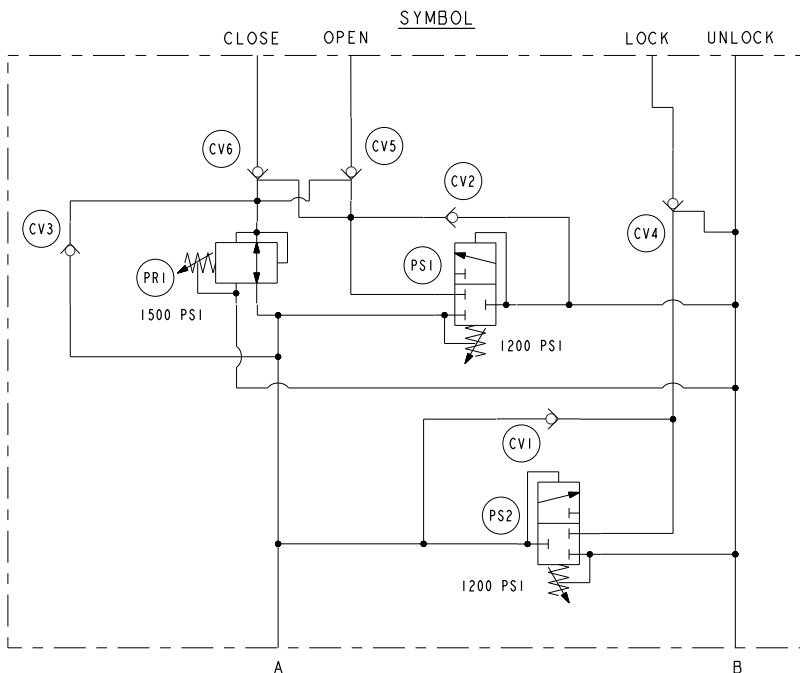
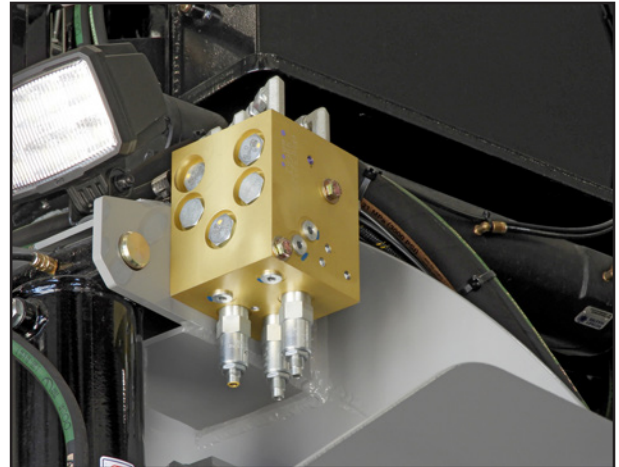
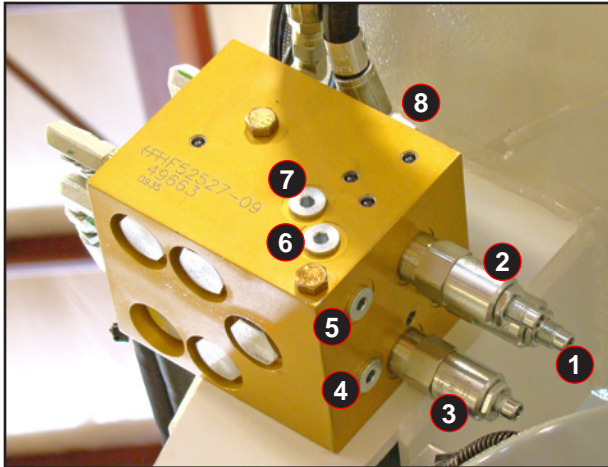
Switch activates the hydraulic cooling fans at about 120° (F).



APXX

HYDRAULIC SYSTEMS ID - 49663 - REAR DOOR MANIFOLD

OPERATION

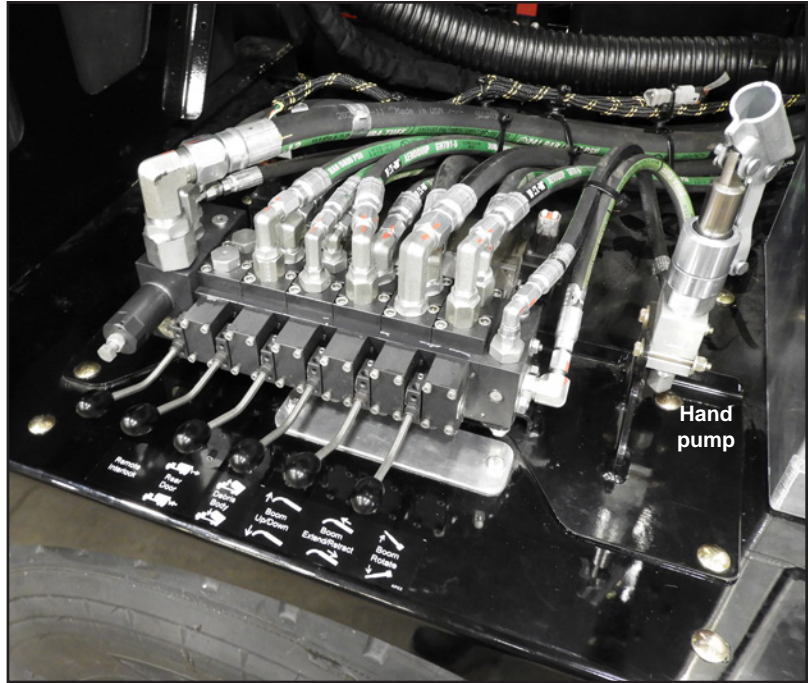


Function		Setting
1	Sequence valve - close/lock	1200psi
2	Sequence valve - unlock/open	1200psi
3	Pressure reducer valve - limit rear door closing force	1500psi
4	Hole plug	NA
5	Hole plug	NA
6	Hole plug	NA
7	Hole plug	NA
8	Check valve - proper sequencing of open/close	NA
9	Check valve - proper sequencing of lock/unlock	NA
10	Check valve - holds door locks when hydraulic power is removed	NA
11	Check valve - proper sequencing of open/close	NA
12	Check valve - holds door open when hydraulic power is removed	NA
13	Check valve - holds door closed when hydraulic power is removed	NA

Manifold block itself is not serviceable.

Manual activation with the chassis engine off

Activate the blocking valve (raise) and the function you need while using the hand pump.





General Services Pump: debris body, rear door, hoist, boom, and options: vacuum enhancer, optional tool package, sludge pump and hydraulic vibrator.

Water Systems Pump: water pump

PTO A drives the pump for all of the hydraulics on most unit configurations. The cab switch signals the controller to activate the PTO if all interlocks are good. The air solenoid (manual transmissions) that operates the PTO is separate from the PTO and is normally mounted nearby between the chassis frame rails. Refer to the PTO manufacturer's manual for additional details.



DANGER

Entanglement Hazard

Contacting moving parts with clothes or body can cause injury or death:

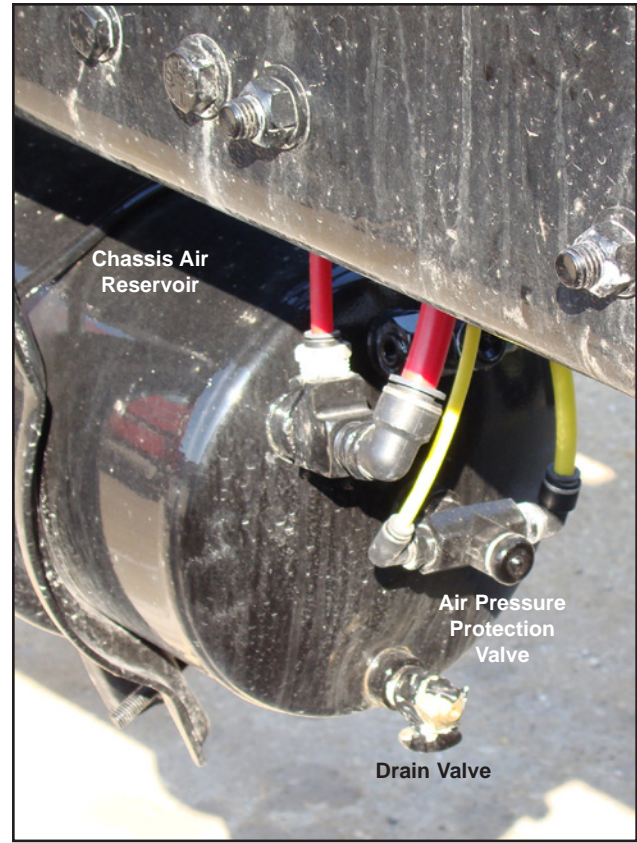


- **Never go underneath the vehicle with the engine running.**
- **Never work near a rotating drive shaft.**
- **Never attempt to engage or disengage the pump or other driven equipment from underneath the vehicle with the engine running.**
- **Never attempt to engage or disengage any driven equipment from any position that could result in getting entangled in the drive shaft or moving parts.**
- **Never attempt to work on any installed driven equipment with the engine running.**
- **Remove the ignition keys and post a lockout/tagout sign on the chassis steering wheel and engine control panels as required.**




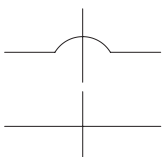




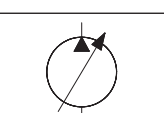
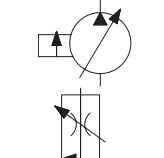



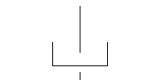


All pneumatic controls added to the chassis by Vactor are fed from the chassis air reservoir through an air pressure protection valve. This valve acts like an electrical fuse by not allowing the reservoir air pressure to drop below about 70psi. When air pressure drops to about 75psi the valve closes and shuts off the Vactor systems. Normal chassis operating air pressure is about 120psi. By limiting the available air pressure to a minimum of 75psi the chassis will still have functional brakes and other needed systems.



The valve typically fails due to debris in the air system and corrosion. The valve may work intermittently or fail either open or closed. If the valve fails open, an air leak may deplete the chassis air system if there is a significant system failure on the Vactor side. If the valve fails closed no air will be supplied to the Vactor systems. Either can be verified by putting an air gauge in the system. The valve is not user serviceable and must be replaced.



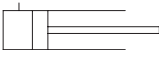
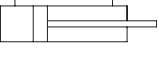

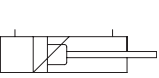
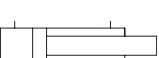
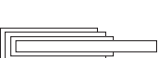
Note: There are a variety of these valves in service. Some are supplied by the chassis manufacturers. Appearance will vary.















REFERENCE - HYDRAULIC SYMBOLS


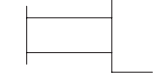




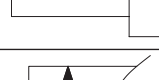
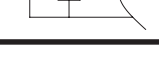
Lines	
	Line, Working (Main)
	Line, Pilot or Drain
	Flow Direction Hydraulic Pneumatic
	Lines Crossing
	Lines Joining
	Lines With Fixed Restriction
	Line, Flexible
	Station, Testing, Measurement or Power Take-Off
	Variable Component (run arrow through symbol at 45°)
	Pressure Compensated Units (Arrow parallel to short side of symbol)
	Temperature Cause or Effect
Reservoir	
	Vented
	Pressurized
Line, To Reservoir	
	Above Fluid Level
	Below Fluid Level
	Vented Manifold

Hydraulic Pumps	
	Fixed Displacement
	Variable Displacement



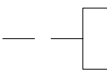

Motors and Cylinders	
Hydraulic	
	Fixed Displacement
	Variable Displacement
	Cylinder, Single-Acting
Cylinder, Double-Acting	
	Single End Rod
	Double End Rod
	Adjustable Cushion Advance Only
	Differential Piston
	Telescopic

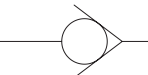




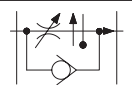


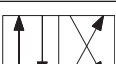
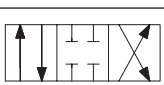
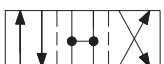
Miscellaneous Units	
	Electric Motor
	Accumulator, Spring Loaded
	Accumulator, Gas Charged
	Heater

Miscellaneous Units	
	Cooler
	Temperature Controller
	Filter, Strainer
	Pressure Switch
	Pressure Indicator
	Temperature Indicator
	Component Enclosure
	Direction of Shaft Rotation (assume arrow on near side of shaft)

Methods of Operation	
	Spring
	Manual
	Push Button
	Push-Pull Lever
	Pedal or Treadle
	Mechanical
	Detent
	Pressure Compensated

REFERENCE - HYDRAULIC SYMBOLS

Methods of Operation	
	Solenoid, Single Winding
	Servo Control
Pilot Pressure	
	Remote Supply
	Internal Supply

Valves	
	Check
	On-Off (manual shut-off)
	Pressure Relief
	Pressure Reducing
	Flow Control, Adjustable - Non-Compensated
	Flow Control, Adjustable (Temperature and pressure compensated)
	Two-Position Two Connection
	Two-Position Three Connection
	Two-Position Four Connection
	Three-Position Four Connection
	Two-Position In Transition

Color Code for Fluid Power Schematic Drawings	
Black	Intensified Pressure
Red	Supply
Intermittent Red	Charging Pressure
Intermittent Red	Reduced Pressure
Intermittent Red	Pilot Pressure
Yellow	Metered Flow
Blue	Exhaust
Green	Intake
Green	Drain
Blank	Inactive

- A WATER SECTION
- B HOSE REEL SECTION
- C HYDRAULIC/PNEUMATIC
SECTION
- D ELECTRICAL SECTION
- E P.T.O. SECTION
- F BOOM SECTION
- G DEBRIS BODY SECTION
- H REAR DOOR SECTION
- I AUX. ENGINE / BLOWER
SECTION
- J FAN & FAN DUCT / FINAL
FILTER & FINAL FILTER DUCT
SECTION
- K WATER TANK SECTION
- L OPTIONS SECTION

Prodigy

SERVICE PARTS

PARTS

Hand gun nozzles - refer to the data chart in the Operation section.

Part Number	Description	Frequency (hours)	PD units	Fan units
46938JF-30	Remtron plastic carry bag	As Needed	•	•
48611-30	Spindle Box Lube, Shell Omala RL 68	500	•	•
48209A-30	Filter Element for 48208A Hydraulic Filter	500		•
42431B-30	Filter Element for 62643B Hydraulic Filter	500		•
42431-30	Filter Element for 62643 Hydraulic Filter	500	•	
48749A-30	Kit, Seal Cat 3560	1500	•	•
48567-30	Kit, Seal Cat 660	1500	•	•
48749B-30	Kit, Valve Cat 3560	2000	•	•
48556-30	Kit, Valve Cat 660 (2 required)	2000	•	•
48565-30	Spider for motor coupling Cat 660	As Needed	•	•
48047MC-30	Spider for motor coupling Cat 3560	As Needed	•	•
46441D-30	Unloader Valve Cat 660 (pump# 48947L / 10gpm)	As Needed	•	•
46441E-30	Relief Valve Cat 660	As Needed	•	•
46441EA-30	Seal Kit, Buna-N for 46441E Relief Valve	As needed	•	•
46441EB-30	Seal Kit, Viton for 46441E Relief Valve	As needed	•	•
46441G-30	Unloader Valve Cat 3560 (pump# 48047N / 20gpm)	As Needed	•	•
46441H-30	Relief Valve Cat 3560	As Needed	•	•
39893-30	Boom Turret Cover Gasket	As Needed	•	•
70404M-30	Debris Hose, Red 8" x 34"	As Needed	•	•
43958A-30	Debris Hose, Red 8" x 136" (Ext.Boom)	As Needed	•	•
46564D-30	Debris Hose, Red 8" x 60" (Tel. Boom)	As Needed	•	•
70404M-30	Debris Hose, Red, Gum Lined 8" x 36"	As Needed	•	•
1140363A-30	Air Filter, Final Filter 19.6OD x 14ID x 28.5 tall (round style for HXX PD)	As Needed	•	
1140363B-30	Air Filter, Final Filter 19.6OD x 14ID x 21.5 tall (round style for Prodigy)	As Needed	•	
1140467D-30	Air Filter, Final Filter 20 x 30 x 3.5 (old square style for HXX PD)	As Needed	•	
35096-30	8" to 6" Reducer Flange	As Needed	•	•
34141-30	6" to 4" Reducer Flange	As Needed	•	•
46471A-30	Quick Clamp 4"	As Needed	•	•
32087-30	Quick Clamp 6"	As Needed	•	•
16584-30	Quick Clamp 8"	As Needed	•	•
51770-30	Band Lock, 8" FLG to 6" MBL	As Needed	•	•
50271-30	Bank Lock, 8" FLG to 6" FMBL	As Needed	•	•
51188-30	Band Lock, 8" FLG to 8" FMBL	As Needed	•	•
1280043-30	Band Lock, 8" FLG to 6" FMBL	As Needed	•	•
42577-30	Band Lock Assembly 4"	As Needed	•	•
42578-30	Band Lock Assembly 6"	As Needed	•	•
42579-30	Band Lock Assembly 8"	As Needed	•	•
42580-30	Band Lock, Female 4"	As Needed	•	•
42581-30	Band Lock, Female 6"	As Needed	•	•
42582-30	Band Lock, Female 8"	As Needed	•	•

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SERVICE PARTS

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Part Number	Description	Frequency (hours)	PD units	Fan units
42583-30	Band Lock, Male 4"	As Needed	•	•
42584-30	Band Lock, Male 6"	As Needed	•	•
42585-30	Band Lock, Male 8"	As Needed	•	•
42589-30	Band Lock, Gasket 4"	As Needed	•	•
42590-30	Band Lock, Gasket 6"	As Needed	•	•
42591-30	Band Lock, Gasket 8"	As Needed	•	•
42586-30	Band Lock, Clamps 4"	As Needed	•	•
42587-30	Band Lock, Clamps 6"	As Needed	•	•
42588-30	Band Lock, Clamps 8"	As Needed	•	•
43322-30	PVC Flex Hose Bulk 4"	As Needed	•	•
43323-30	PVC Flex Hose Bulk 6"	As Needed	•	•
43716-30	PVC Flex Hose Bulk 8"	As Needed	•	•
25637D-30	Aluminum Pipe 8" x 72"	As Needed	•	•
25637E-30	Aluminum Pipe 8" x 90"	As Needed	•	•
25637G-30	Aluminum Pipe 8" x 120"	As Needed	•	•
25262-30	Aluminum Pipe Handle 8"	As Needed	•	•
29314-30	Water Ring 8"	As Needed	•	•
20188M-30	Quick Disconnect (Water) 1/2" Male	As Needed	•	•
20188L-30	Quick Disconnect (Water) 1/2" Female	As Needed	•	•
40589-30	Quick Disconnect 1/2" to 1/2" NPT	As Needed	•	•
27771K-30	Ceramic Lined Elbow 8"	As Needed	•	•
89444-30	Digging Lance Fiberglass	As Needed	•	•
500619A-30	Digging Lance Pipe Assy. 83"	As Needed	•	•
500619B-30	Digging Lance Pipe Assy. 108"	As Needed	•	•
500619C-30	Digging Lance Pipe Assy. 48"	As Needed	•	•
500619E-30	Digging Lance Pipe Assy. 83" w/nozzle	As Needed	•	•
500619F-30	Safety Shutoff Valve Assy.	As Needed	•	•
89714-30	Nozzle Guard Assembly, 3.2 GPM	As Needed	•	•
89714A-30	Nozzle Guard Assembly, 4.8 GPM	As Needed	•	•
89714B-30	Nozzle Guard Assembly, 9.6 GPM	As Needed	•	•
89714C-30	Nozzle Guard Assembly, 16.5 GPM	As Needed	•	•
89714D-30	Nozzle Guard Assembly, 6.4 GPM	As Needed	•	•
86230-30	Nozzle, 3 Insert with out Guard (Inline)	As Needed	•	•
86230D-30	Nozzle, 2 Insert with out Guard	As Needed	•	•
89714A-30	Nozzle, 3 Insert with out Guard	As Needed	•	•
89713-30	Nozzle Tube, Guard (plastic)	As Needed	•	•
47390KJ-30	Heating Coil for 47390K (400K BTU unit)	As Needed	•	•
47390LD-30	Heating Coil for 47390L (940K BTU unit)	As Needed	•	•

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SERVICE PARTS

PARTS

Hand gun nozzles - refer to the data chart in the Operation section.

Part Number	Description	Frequency (hours)	PD units	Fan units
49209-30	Air Spade			
49209-30	AIR EXCAVATION KIT, PREMIUM	As Needed	•	•
49209A-30	AIR-SPADE SERIES 2000 TOOL	As Needed	•	•
49209B-30	AIR-SPADE 3FT EXTENSION POLE	As Needed	•	•
49209C-30	AIR-SPADE 10FT LIGHTWEIGHT HOS	As Needed	•	•
49209D-30	AIR-SPADE 45° ANGLED ADAPTER	As Needed	•	•
49209E-30	AIR-SPADE HANDLE	As Needed	•	•
49209F-30	AIR-SPADE 4FT EXTENSION POLE	As Needed	•	•
49209G-30	AIR-SPADE NOZZLE, 150 CFM	As Needed	•	•
49209H-30	AIR-SPADE NOZZLE, 105 CFM	As Needed	•	•
49209J-30	AIR-SPADE HANDLE REBUILD KIT	As Needed	•	•
49209K-30	DIRT GUARD, AIR SPADE	As Needed	•	•
	3000 Series Air Spade			
49931-30	3000 SERIES AIR SPADE	As Needed	•	•
49931A-30	FLEX LEADER HOSE, 1" X 25FT.	As Needed	•	•
49931B-30	LANCE EXTENSION, 3' LG	As Needed	•	•
49931C-30	NOZZLE, 330 SCFM	As Needed	•	•
503054A-30	AIR EXCAVATION KIT, 330 SCFM	As Needed	•	•
	Fuses (normally located in the battery box)			
507865-30	80A MEGA FUSE	As Needed	•	•
507865A-30	150A MEGA FUSE	As Needed	•	•
507865B-30	350A MEGA FUSE	As Needed	•	•



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