TRXX

TRUVAC®

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TRXX

TRUVAC Training Academy

514275A rC

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TRUVAC

TRUVAC TRXX

Operation & Maintenance Manual

Operation & Maintenance Manual
TRXX

Release history

0	Initial release (DE - 02-17-2022)
1	Post initial review release (DE - 04-01-2022)
2	Updated water pump controls (DE - 04-20-2022)
3	Updated images and options (DE - 10-12-2022)
4	Updated options pages (DE - 12-15-2022)
5	Updated unloader valve operation/adjustment (DE - 1-17-2024)
6	Added Dumping Best Practices, Longterm Storage, and Belt/Sheave Aligment (9-16-2024)

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

509036A

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.**

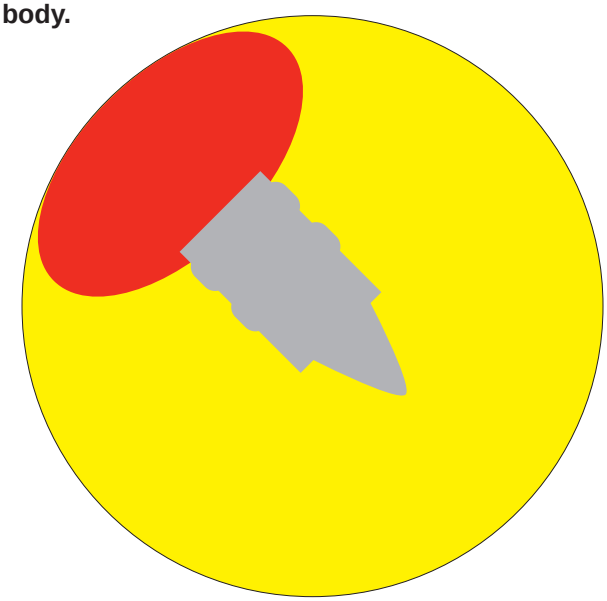
SAFETY INSTRUCTIONS

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 trailer when raising or lowering the body.



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.**

⚠ 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.

FSESG Environmental Solutions Group

Scan the QR Code with your mobile device or visit:

http://www.fsesgsafety.com

for the latest FSESG product and application safety information.

507048 r0

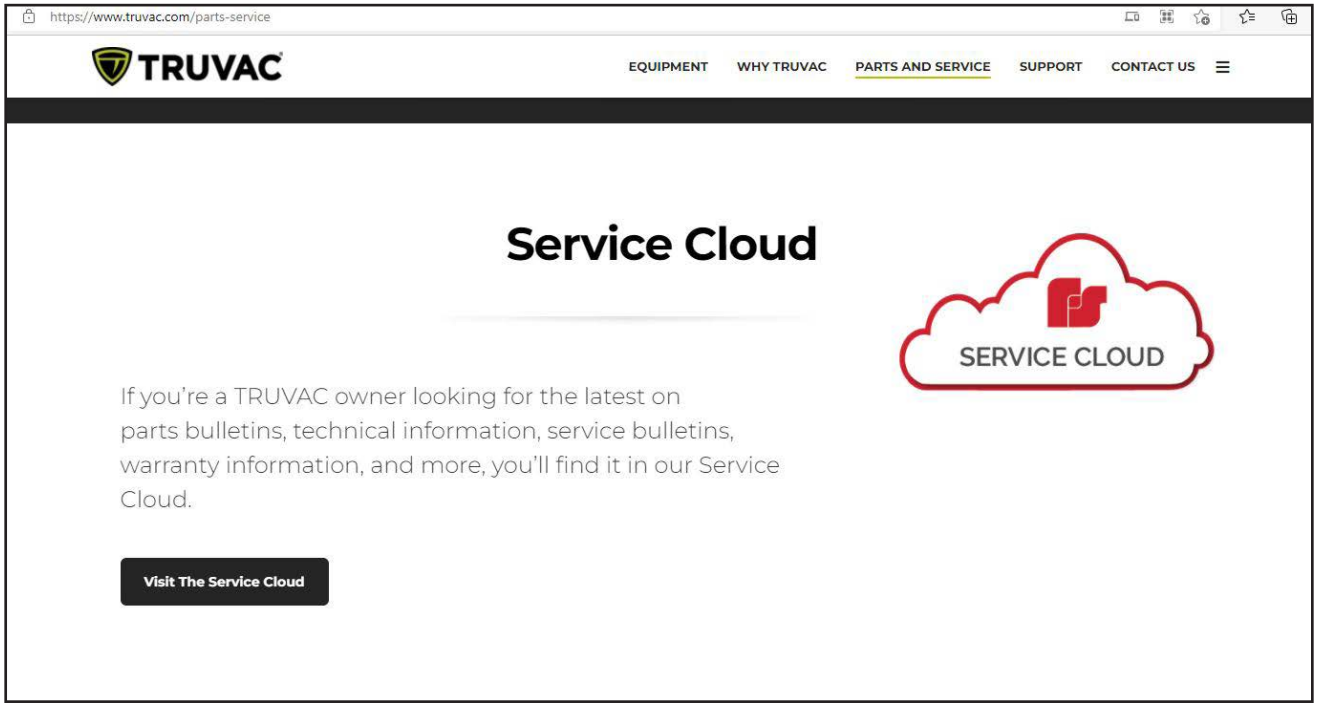
TRUVAC Manual

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 at: **TRUVAC.com** → **Parts and Service** → scroll down to **Service Cloud**

Replacement operation manuals require the unit serial number.

Order part No.: 512459A-30



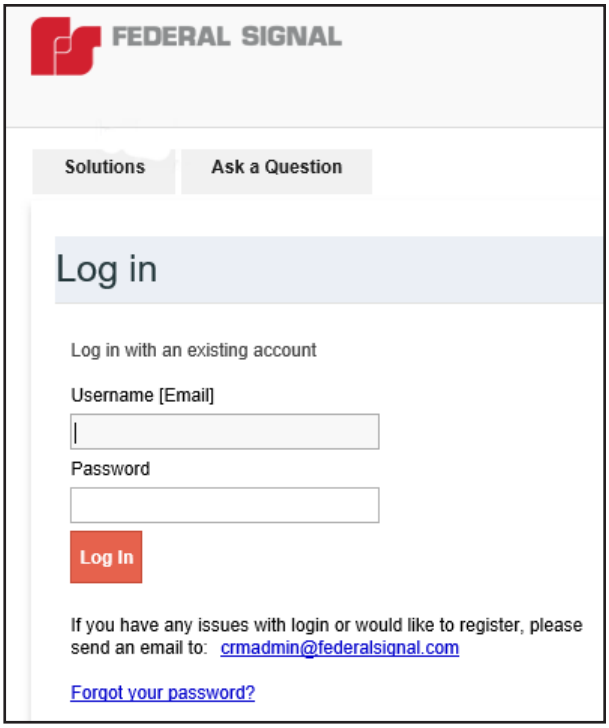
Units with High Pressure Handgun Options

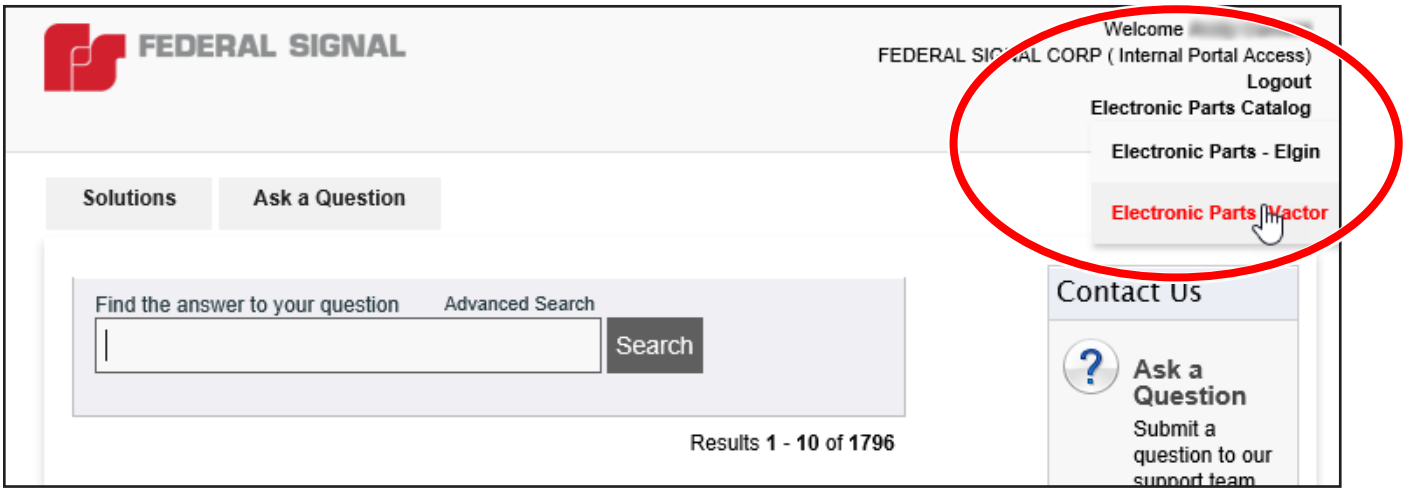
Note: Preferred browsers are Microsoft Edge or Google Chrome. Other browsers may not work correctly.

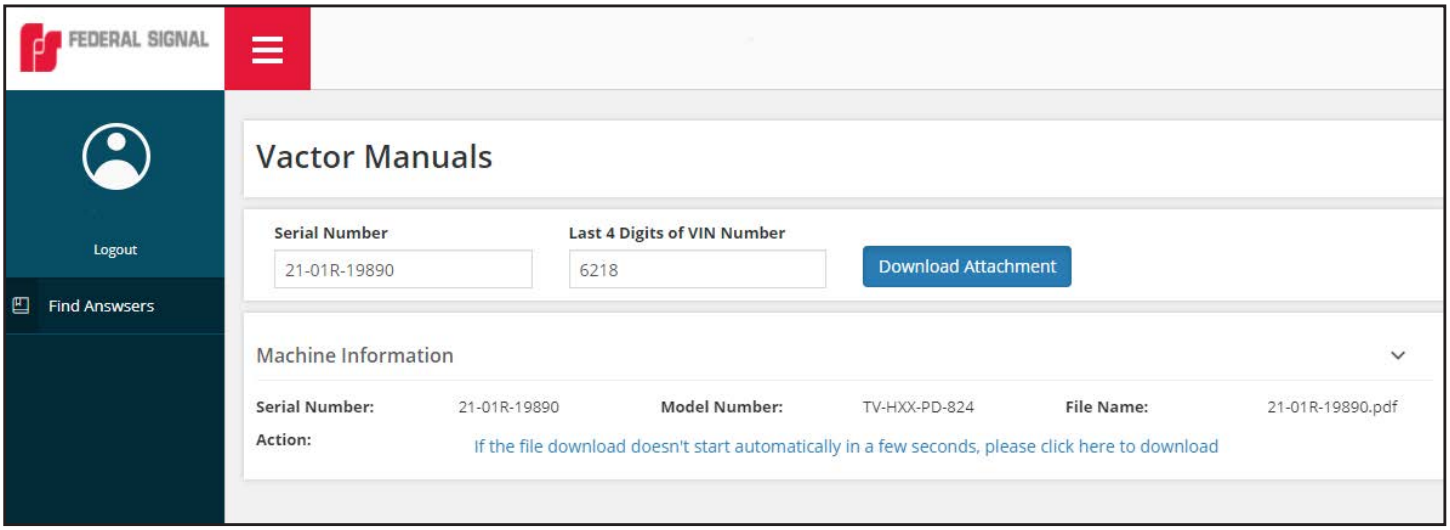
Selecting the Service Cloud will take you to the login page. Registration is required.

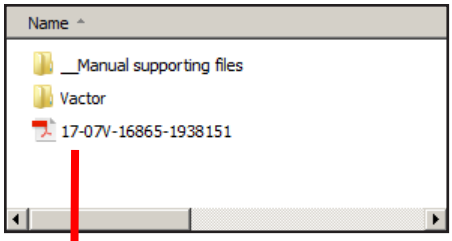
Once in you will find parts manuals for over 7000 Vactor products. Each manual contains relevant drawings and parts lists for the assemblies that make up the machine as a whole. The purpose of the EPC is to provide you with the parts information that is relevant to your machine.

If you have any issues with obtaining a Vactor 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.

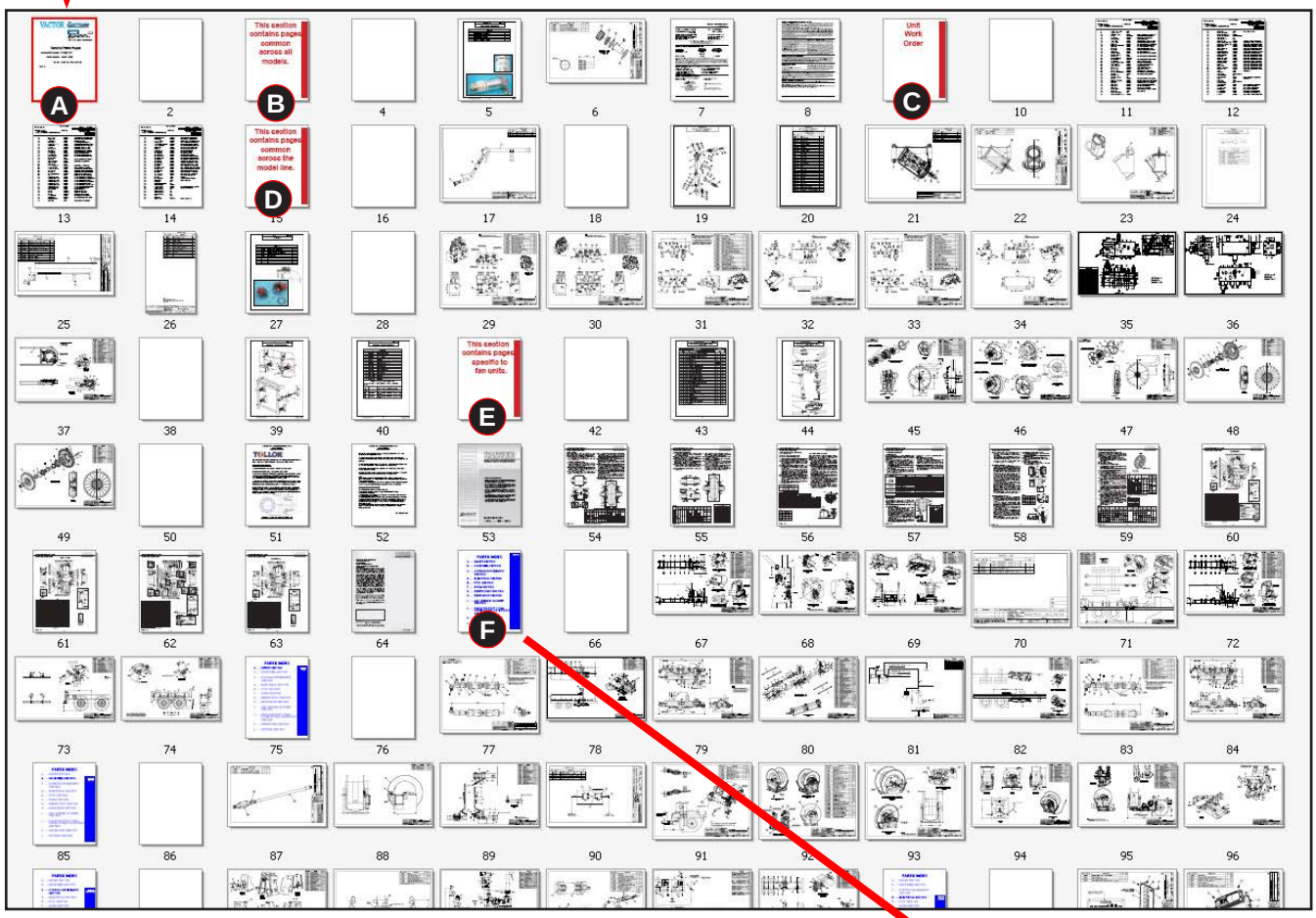
B. Parts common to all models.

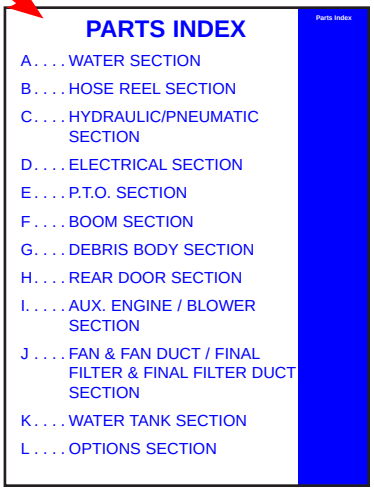
C. Build ticket - included with units built after February 2011.

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

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!

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 it's 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.

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.

Environmental Solutions Group

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.

Vactor (ESG) Technical Service Hotline

24 Hour

Vactor 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, Vactor, 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 Vactor 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 Vactor 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!

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

Driver Side View

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 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.

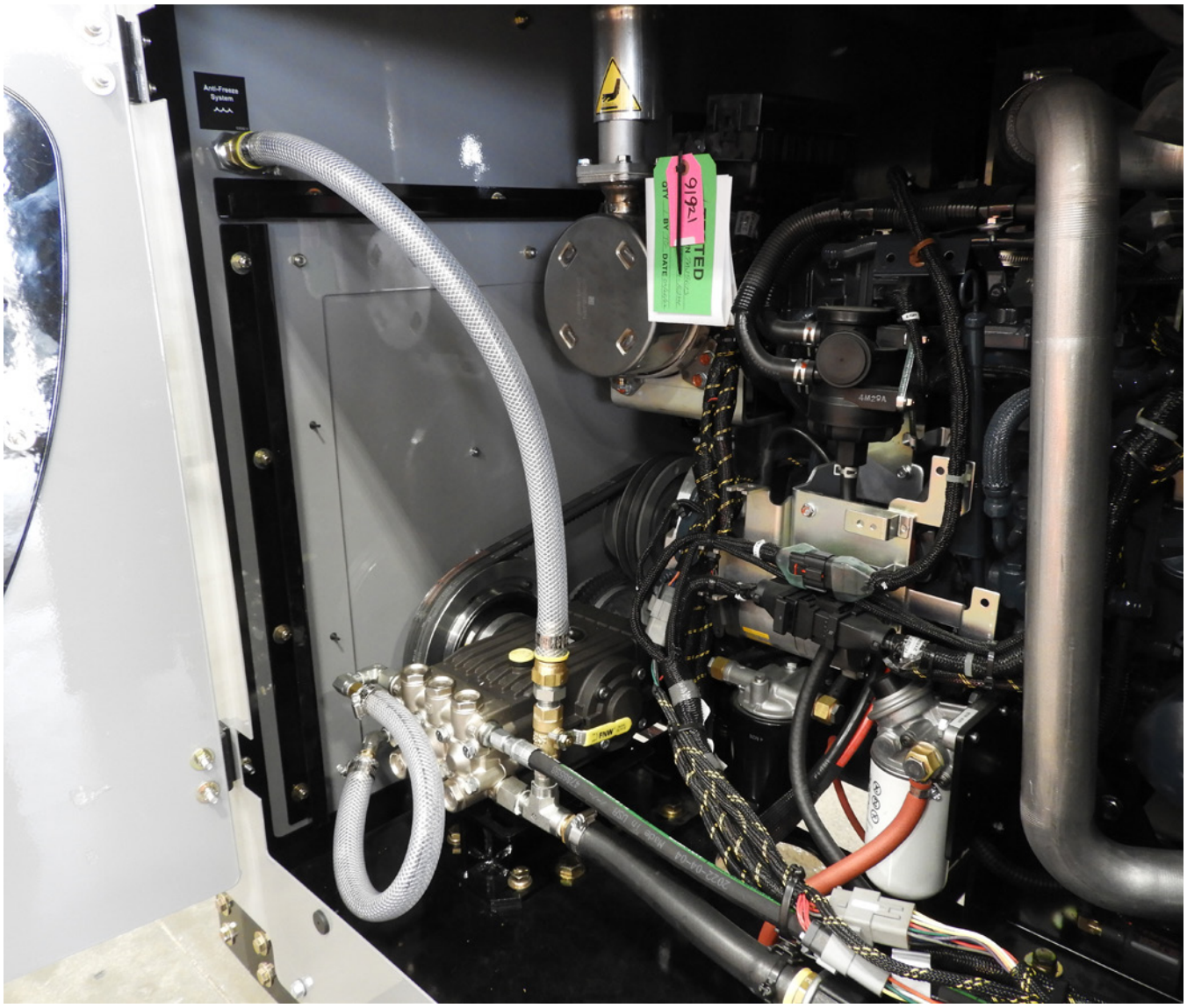
Vacuum excavation also is the preferred approach in confined locations that simply don't accommodate even the most compact standard mechanical excavators.

Passenger Side View

The operational systems on the Truvac TRXX are dependent upon the options and capacities of the machine as ordered. The machine 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 machine.

Prior to operation, perform daily maintenance on the unit according to the **Daily Maintenance Check List** in the Maintenance Section of this manual.

The TRXX units are powered by a Kubota diesel engine. There are currently two offerings: a 49HP and 64HP models.



Hydro-excavation uses high-pressure water to loosen soils, and the residual slurry spoils are easily extracted into the debris body. Using water is the most productive process, especially in rocky soils. It outperforms air-excavation 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 then compressed air systems.

Hydro-excavation advantages:

- In frozen ground or harder materials, water can be heated with optional 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.

The operational systems on the Truvac are dependent upon the options and capacities of the machine as ordered. The machine is custom designed to provide a combination of compressed air or 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. 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.

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. 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. Position unit where optimum air speed can be achieved for the job at hand. 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.

You have two things that you can control; water volume and water pressure.

Blower speed controls the volume of air and the speed of the air through the pipe and into the debris body. When “Dig Mode” is engaged, the blower on the TRXX is designed to automatically run at full RPM.

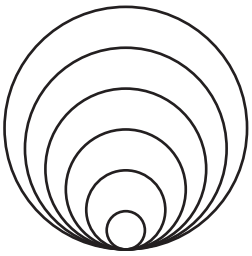
If the ground is very hard or frozen, you will not able to move the same volume of material in these conditions. How far away from the unit is the job site? Material moving through a hose or pipe has a friction factor. This value is directly related to the amount of length of hose/pipe that the material travels through. It can more appropriately be defined as *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 a six (6) inch nozzle is closed down.

Hose Restriction			
Hose Dia. Inches	Hose Area square/inches	Orifice Area	Orifice Area
6	28.3	100.0%	
5	19.6	69.4%	
4	12.6	44.4%	100.0%
3	7.1	25.0%	56.3%
2	3.1	11.1%	25.0%
1	0.8	2.8%	6.3%



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

Vacuum System

Vacuum System Components: Suction hose, boom, debris body, float ball vacuum shut off, vacuum relief, blower, silencer.

Water System

Water is held in the water tanks and 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 tanks, Y-strainer/ filter, water pump, unloader valve, hose reel/ handgun.

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 prefilter, cyclone filter (optional), filter element, microstrainer (PD only), silencer (PD only)

Hydraulic System

The hydraulic system powers functions including the debris body lift/lower, boom functions, and rear door operations. The system runs at the following pressures:

1GPM @ Idle

4GPM @ Full

Operations Overview

In order to safely and effectively operate the TRXX unit, multiple people should be on hand. 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 different water pressures 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 an optional cyclone chamber. 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, then through the blower and on 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 through the rear loading port or optional boom hose.
2. The bulk of the material falls out of the airstream and it falls to the floor of the debris body. In the body, the air travel is slowed as it goes through it to the other end and leaves the debris body.
3. The air flows into the secondary prefilter or optional cyclone chamber.
4. In the cyclone 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 cyclone filter and enters the final filter 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 silencer on the passenger side of the unit.

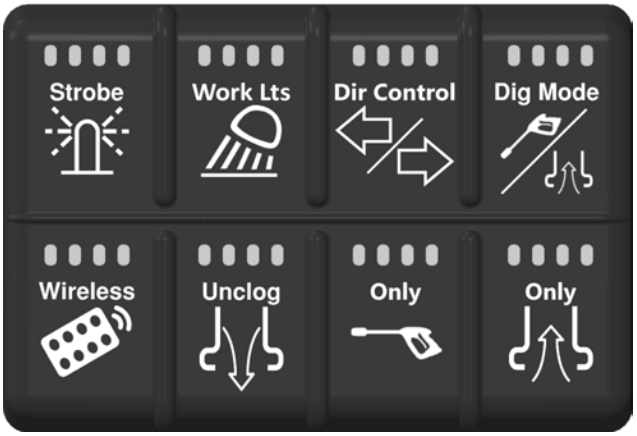
Note: Controls explained on next page.

Wireless remote has approximately 40 hours of battery life between charges.

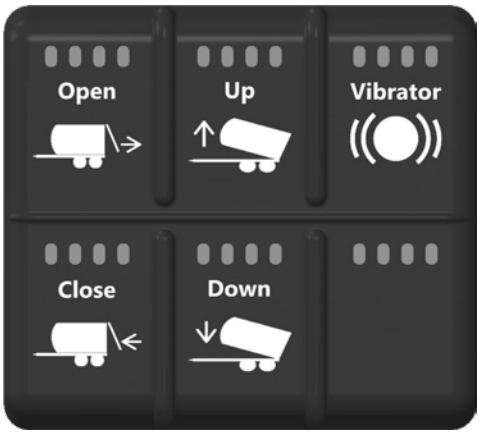
SAFETY INSTRUCTIONS

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.

Note: switches vary with options



1	**Debris Body Vacuum Pressure**
2	**Water Pressure**
3	**Water Pressure Adjustment/Unloader**
4	**Keyed Ignition**
5	**Engine Vitals Gauge**
6	**Operations Keypad**
7	**Dump Controls Keypad**
8	**Emergency Stop (E-Stop)**



Notes:

1. Dig Mode uses the electric 4-way valve to shift into vacuum mode.

2. 4-way valve has Neutral, Vacuum, and Unclog modes.

3. Handgun Only button activates water only.

4. Blower is direct drive from the engine so there is no mode to turn on blower.

5. Unclog button needs to be held for 13 seconds in order for 4-way valve to perform full cycle.

6. When E-stop is pressed, the engine will throttle down, 4-way valve will move to the neutral position, and vacuum will cease.

7. There is a low water shut-off and indicator on the display. With the water pump button held, the pump will operate. However in order to reset, the system must shut down and filled before restarting.

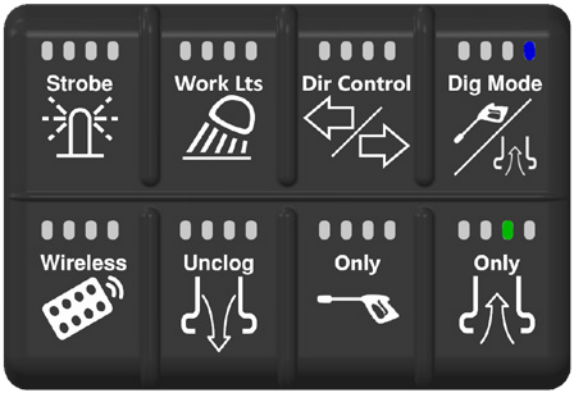
Priority of functions

The established priority between the two possible control systems are:

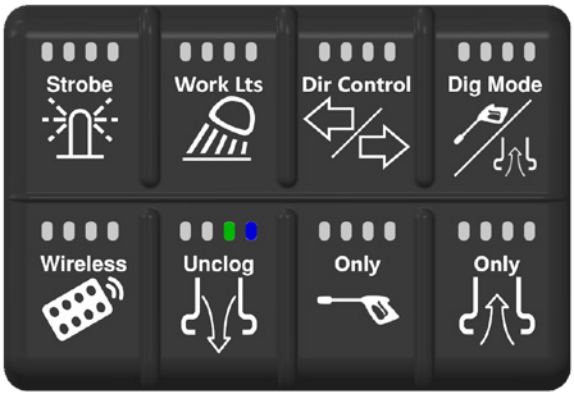
1. Wireless remote
2. Panel switches

Note: Any switch function not available on the active controls will function on the other controls in the established priority. When in wireless mode, the body functions are inactive.

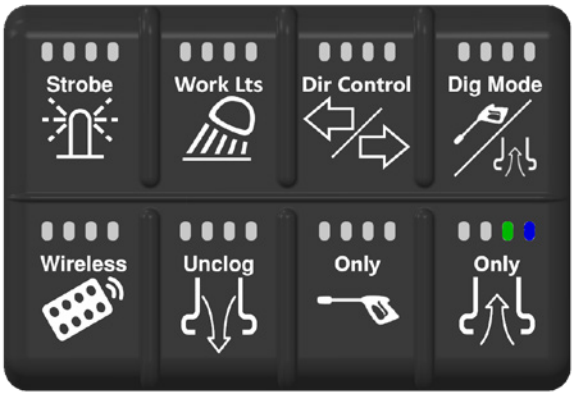
Dig Mode with Green Position Indicator: Dig mode pressed, vacuum indicator lights green when 4-way valve is in vacuum position. (Blue light indicates “Water ON”)



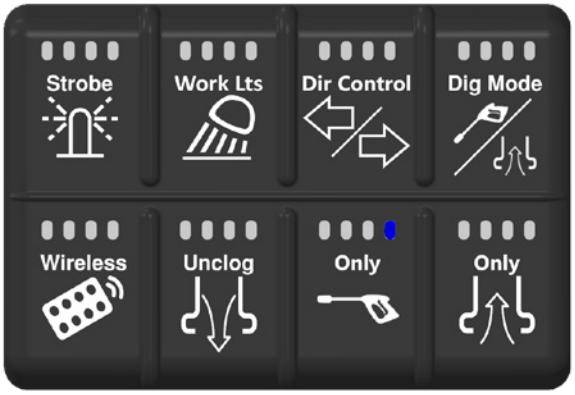
Unclog: Unclog held, indicator lights green when 4-way valve is in the “Unclog” position.



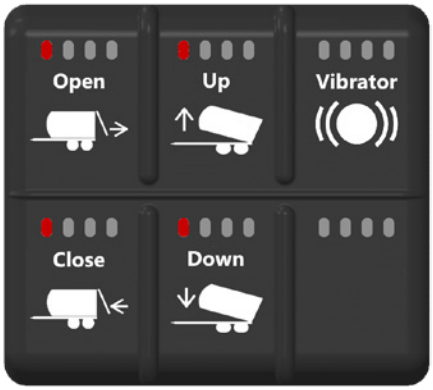
Vacuum Only: 4-way valve engaged; no water.



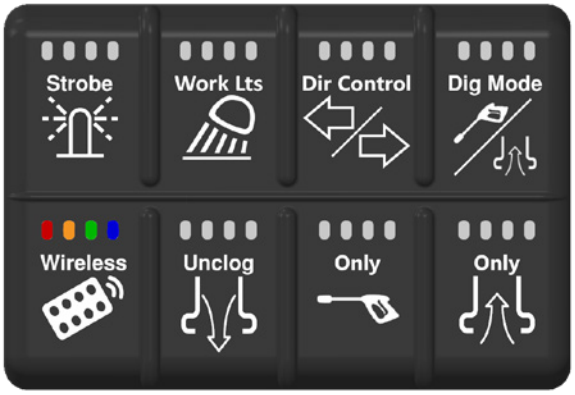
Water Only Mode: No vacuum operation; handgun water only. The button has 4 presses: Water 1, 2, 3, and off. Settings are indicated by amber, green, and blue lights. When water is low, the pump shuts off automatically and the button becomes a momentary. Button must be held for water pump to function.

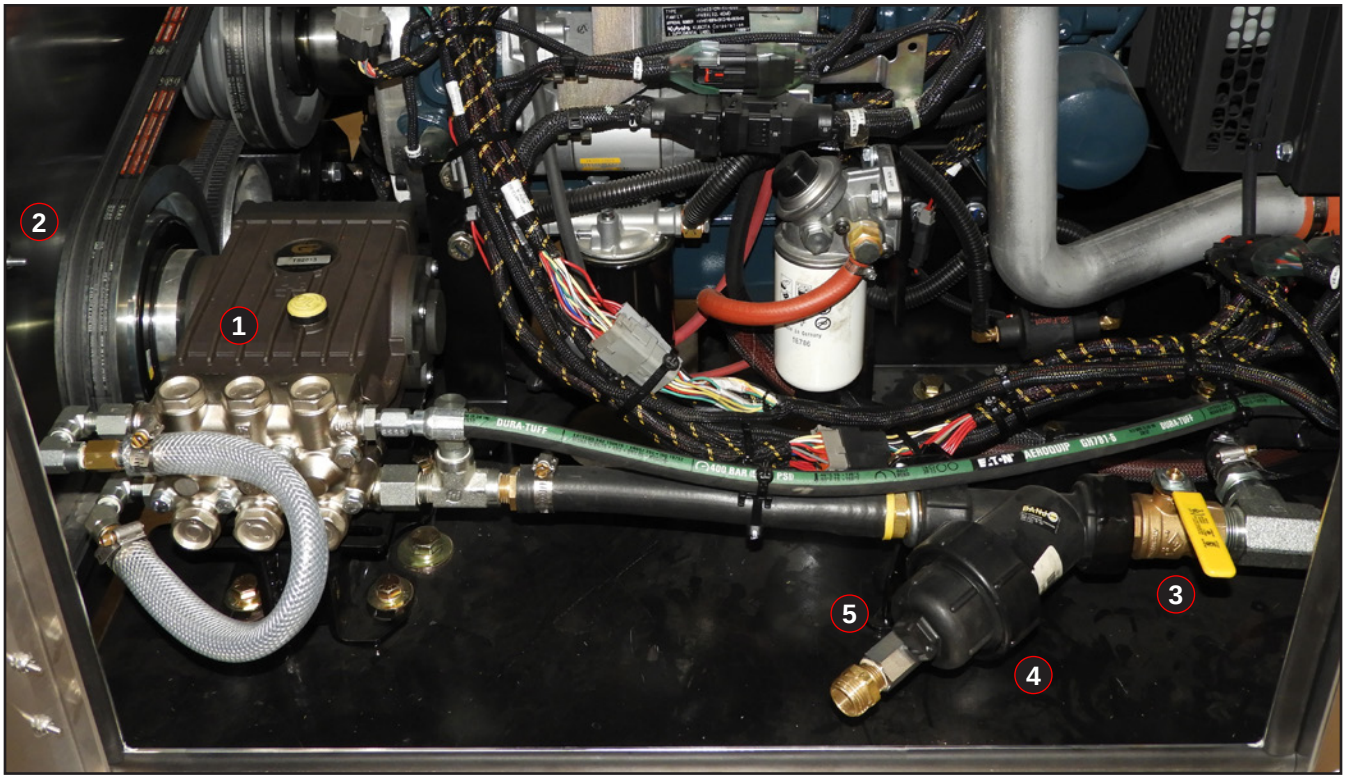


HAWE Valve No Contact: Debris body indicators flash red when the system loses contact with hydraulic valves (diagnostic tool).



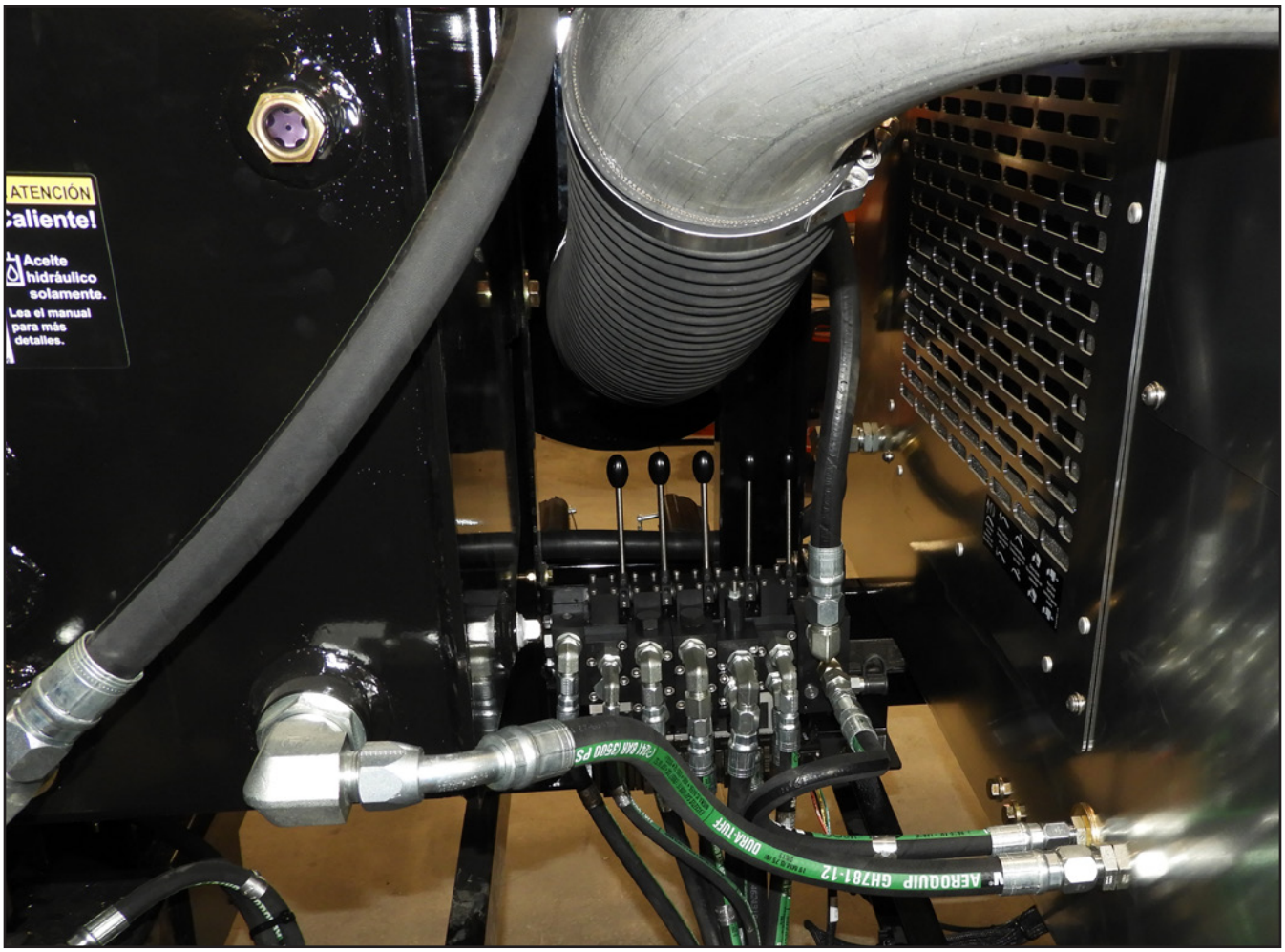
Return from wireless E-stop: When in wireless mode and the E-stop on the remote is pressed, trailer latches E-stop until wireless button is pressed again. Wireless indicators flash in sequence.

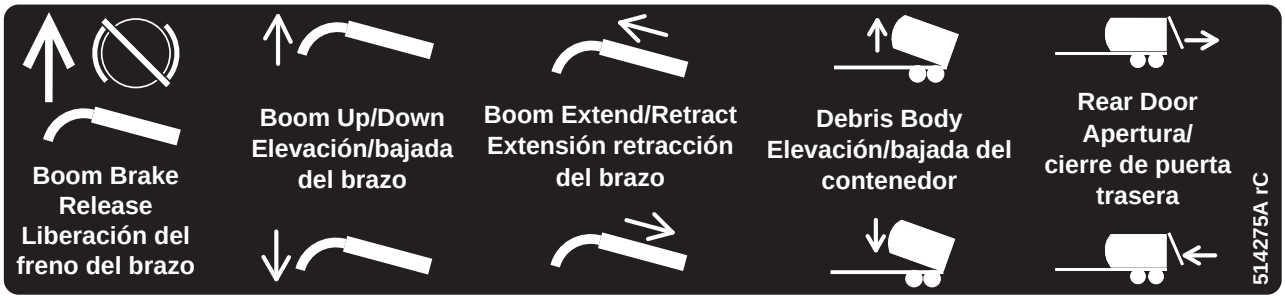




1	Water pump
2	Direct belt drive with clutch
3	Water supply shut-off valve
4	Y-Strainer/Filter
5	Pump supply drain valve

1. Water pump goes live via the “Dig Mode” or “Handgun Only” buttons. When the trigger on the handgun, or dead man switch is depressed, an electrical signal is sent to the drive clutch via a pressure switch on the unloader, which then engages the pump.
2. Water pump disengages when the trigger on the handgun or the dead man switch is released, sending a pressure signal to the unloader which disengages the pump.





Access to the hydraulic control valve can be had from the passenger side, behind the engine cabinet. This valve allows for manual operation of all hydraulic functions related to the boom and debris body in case of electronic control box malfunction.

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 TRXX model. Dump angle is 50 degrees.

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 float-ball vacuum shut-off valve to the optional cyclonic housing.

Float Ball

Float ball protects the vents. They consist of a stainless steel ball suspended from the top of the debris body. 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 ball 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 when the debris body is “full.”

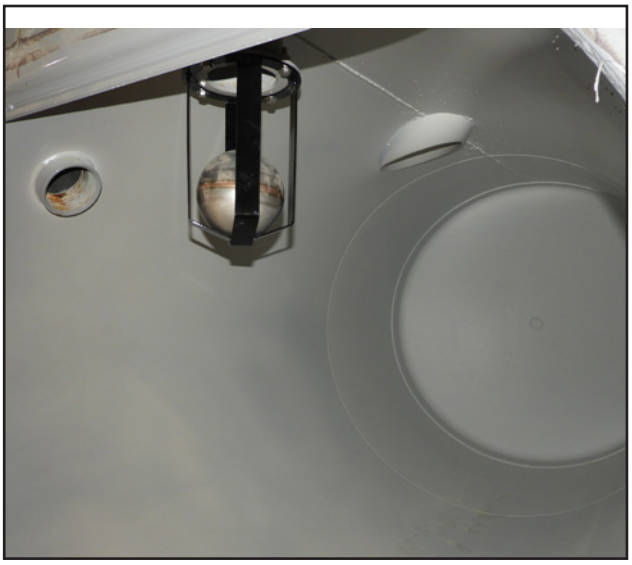
Clean the float ball and cage with the handgun **EVERY TIME** the debris body is dumped. It is important to keep these clean because debris clogged in the screen will result in a loss of airflow and productivity.

Checking the Debris Level

View the level of solid debris using the inspection port.

It is good practice to keep track of how much material is vacuumed to avoid overfilling the debris body and causing potential damage to vacuum system.

The debris body is equipped with a float ball shut-off. If the body fills with water the float ball blocks the air inlet to stop suction and prevent flooding the blower. This reduces the risk of liquid entering and damaging the blower system.



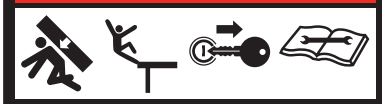
Extra vacuum tubing is needed in certain operations.

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

Storing the Vacuum Pipes

When storing the pipes in the rack, place the most used pipe in the outer position. This will aid in retrieving the pipes in the order needed. Secure the pipes to the rack.

DANGER



Crushing Falling Hazards

Can cause severe injury or death.

Before servicing, shut down unit, remove the ignition key, lock out electrical switches and hydraulic valves before working on unit.

Never ride on the trailer.

CAUTION

Noise can cause permanent hearing loss.

- Always wear approved hearing protection when operating equipment.

Wear protective equipment including footwear and gloves when using or servicing this machine.

Read SAFETY section for details.

Electrical system can be damaged.

- Do not weld on unit.
- Disconnect all chassis and unit ECU's and batteries before welding on unit.
- Electrical systems may be damaged by welding.
- Read Service manuals for details.

WARNING

Cancer and Reproductive Harm

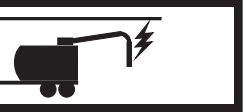
Required for compliance with California Prop 65.
Refer to: www.P65Warnings.ca.gov

WARNING

Explosion and fire hazards

To avoid severe injury or death never use an air mover to move hydrocarbon or other materials with a flashpoint below 140° (F). Vacuuming, or pump or pressurized off-loading is not permitted unless the flashpoint of the material is 140° (F) or higher.

Static electricity build up can result in electrical shocks, fire and/or an explosion when vacuuming dry and/or combustible materials. A static electricity charge may build up as material moves through the vacuum system. Grounding and/or bonding the unit may be required. Follow site procedures for static electricity.



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.

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Note: never use the boom as a crane to lift loads, as it could bend the frame or strain and weaken the hinge points. The boom is only rated to handle the vacuum hoses, tubes and debris during normal operation.

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.

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.

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.

SAFETY INSTRUCTIONS

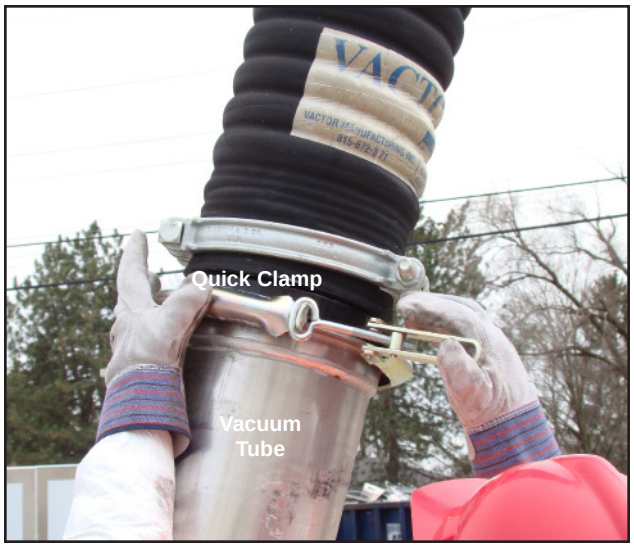
Unit operator must hold the pendant/remote during vacuum operations and stay within line of sight of the hose end operation. In an emergency, use the E-stop or pendant/remote to disable the vacuum. Maintain clear access to all E-stops and place an operator near one.

The boom is used to lift and position the vacuum tube. A hydraulic cylinder lifts the boom. The boom manually rotates out away from the debris body.

The boom UP/DOWN and the IN/OUT are controlled using either the control keypad or wireless remote.

The vacuum tube is maneuvered and controlled using the wireless remote or control keypad. The vacuum must be off when attaching or removing vacuum tubes.

1. Release the boom brake with the wireless remote by pressing and holding the boom brake button. Releasing the button will activate the brake. If not equipped with a hydraulic boom, manually lift the boom tube from the stowed position. Otherwise, use the hydraulics of the boom to position hose.
2. Swing the boom to the desired dig location and release the boom brake button to reactivate boom brake.



The rear door is hydraulically opened and closed using the control panel keypad on the passenger side. When opening, the door locks release allowing the rear door to then hydraulically open. Similarly, when closing, the door is hydraulically lowered into position tight against the debris body and the locks lock the door.

Decant drain

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 unit.

Decanting should be done at job site for several reasons. Excessive weight can:

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

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

The decant port if equipped with a valve allows liquid to be drained from the debris body. First position the unit over a manhole or near the catch basin. Turn off the vacuum to allow the liquids to flow out. 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.

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 shutting off the decanting process.

The TRXX boom can be configured in several different ways. One option is no boom which utilizes and hose and plate mount that come directly out of the debris body inlet. Another is a manual operated boom which is operated by workers utilizing no hydraulics. The third option is a hydraulically controlled boom.

Deploying the Boom

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.

The manual boom rotates freely with no hydraulics but is equipped with a rotation brake controlled from the wireless remote.

Storing the Boom

The boom must be lowered and parked in the boom cradle for transport. Swing it into position and allow it to seat in the boom cradle. Lower the boom, until it firmly rests in the cradle. Place the boom hose in the racks.

The movement of air by the blower picks up debris and water from the work site and moves the material through a vacuum tube into the debris body. A positive displacement (PD) blower is used to produce the movement of air needed to transport debris from the job site into the debris body. Due to the change in air volume in the debris body, the debris and water are deposited into the body, while air is drawn through ports in the body to the blower where it is exhausted.

Blower

The blower is the heart of the vacuum system. Large volumes of air are displaced from the intake side to the discharge side. This creates air flow and allows material to be conveyed through the vacuum hose.

The vacuum pump is driven by the chassis engine. Its fuel-efficient, positive-displacement design enables the unit to vacuum solids from beneath water surfaces and to convey material for distances more than 600 feet. Airflow created by the vacuum pump is controlled by the engine speed. Maximum vacuum is limited by the relief valves and airflow. The level of vacuum can be monitored on the vacuum gauge.

Blower Operation

The operator should monitor the exhaust of the blower consistently. If there is a visible discharge, the operator should take immediate steps to correct the problem. NO DISCHARGE IS ACCEPTABLE. The material is probably too dry and will have to be “wetted” with the handgun prior to entering the end of the vacuum hose.

Freezing Weather

Any time the blower/unit will sit after use during freezing weather the blower should be run 3-5 minutes with the 4-way valve 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.

NOTICE

Blower Can Be Damaged

To avoid damaging the blower:

- **When engaging or disengaging the blower, make sure the blower has stopped turning completely before attempting to shift in or out of gear.**
- **Never attempt to disengage blower while it is still turning.**
- **Never operate blower at less than 1,000 RPM or more than its rated RPM. Never operate blower when vacuum exceeds its allowable rating.**

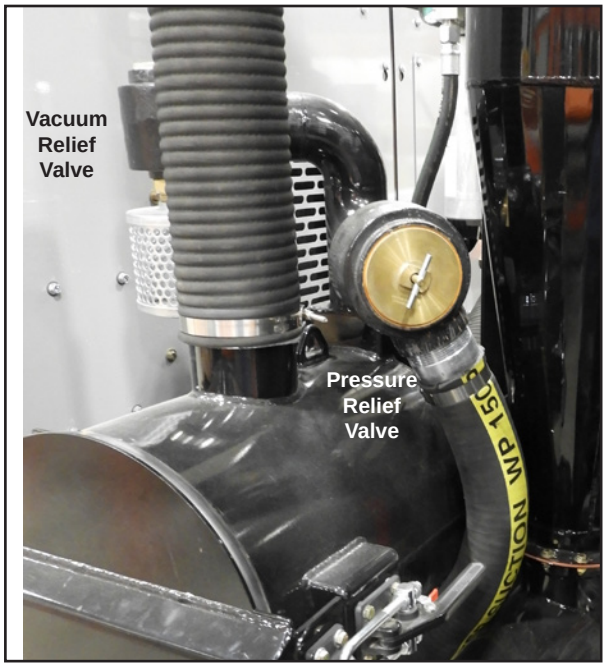
The vacuum system is equipped with a vacuum relief valve to relieve vacuum if the air intake system or nozzle become plugged or restricted beyond its capacity.

Note: Make sure 4-way valve is not in vacuum/dig mode when connecting nozzle or extension pipes to the boom with the blower running.

A switch on the control panel or wireless control controls the 4-way valve. The valve should be in the neutral position when starting operations or when connecting any debris tube or hose to the boom system. The switch should be in the enabled position when using the vacuum system for pickup. A manual override crank is located on the back of the cabinet in case valve electronics malfunction.

An automatic pressure relief valve is a separate relief valve designed to relieve pressure so as to prevent damage to the blower.

Note: This valve comes factory set to 5 psi; DO NOT ADJUST.

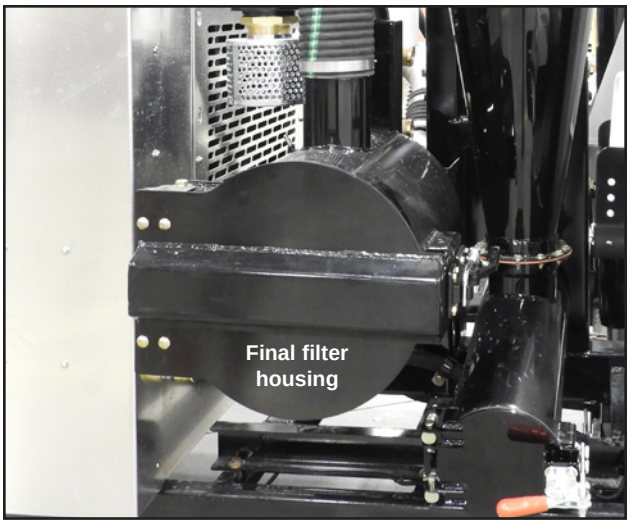


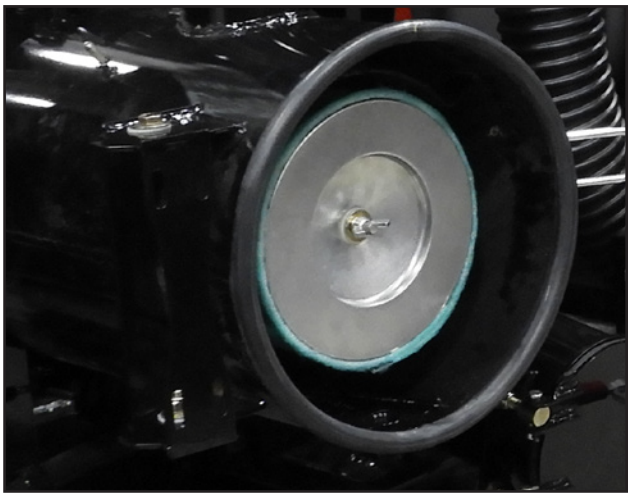
From the debris body, air enters the final filter housing. It's purpose is to prevent any objects or foreign matter which has entered the system from reaching the blower. If it becomes plugged, it will result in a high vacuum and a reduction of air flow. The filter should be replaced if necessary and any foreign matter contained in the housing should be removed.

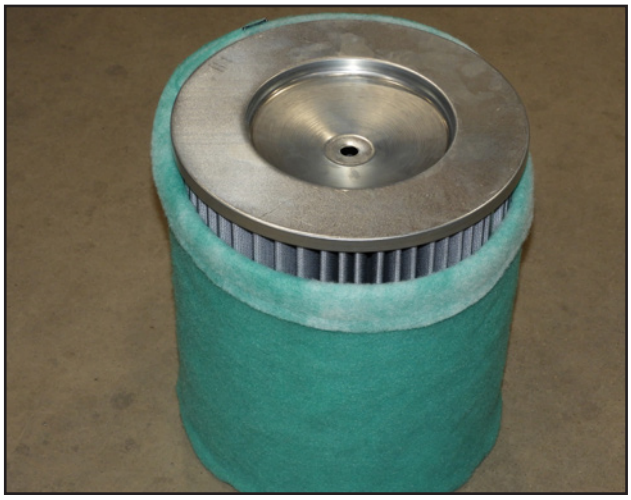
The filter and housing should be checked daily. Follow these steps:

1. Open the lid covering the housing by releasing the latches that hold the lid to the housing. After the lid is unhooked, it can be swung open.
2. Remove the wing nut to remove the filter.
3. Slide the filter out.
4. Inspect the filter and remove any foreign matter or substance and replace if necessary.
5. While the filter is removed, drain any moisture from the housing.
6. After cleaning place the filter back in the housing and replace the plate and nut on the threaded rod. Apply anti-seize compound to the threads for easier disassembly.
7. Close the cover.

Note: The filter can be rinsed clean, but must be allowed to fully dry before reinstalling and using.







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, various hoses with quick disconnect couplers and ball valves. Various size hoses with quick couplers allow for easy connecting and disconnecting of the different systems for draining and storage.

The water tank needs to be filled with clean water before every use. This procedure is the key to extending the life of the pump. Failure to do so may result in pump failure. At the end of each work day, allow the water tank to drain and dry out over night.

The unit can be filled from any fresh water hydrant or hose.

Prior to connecting the fill hose to the water hydrant always flush the hydrant to clear it of contaminants that may enter the vehicle water system.

- Park the trailer centered with the hydrant on the passengers side of the unit. Remove tank fill caps.
- Check and clean y-strainer daily prior to filling tanks. Make sure y-strainer gaskets are in place.
- Remove the cap on the hydrant and flush the hydrant, or water supply, until water runs clear.
- Turn off the hydrant and remove the water fill hose from its compartment and attach it securely to the hydrant, or water source.
- Make sure the water filter screen in the y-strainer is clean and in place. Be sure both gaskets are on the filter housing cap.
- Attach the other end of the water fill hose to the water tank hose connection. A normal hydrant hose or home garden type hose can be used.

Continue to fill the tank, monitoring the progress of the water level. When the tank is near full, slow the water flow from the hydrant to prevent a splash-over. Turn off the hydrant and disconnect the fill hose. Remove excess water from the fill hose; and place it in the holder located near the fill tube.

NOTICE

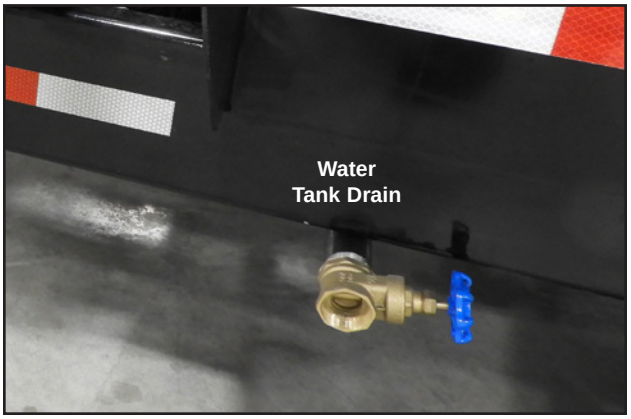
The fill mechanism installed on the Vactor water system has an air gap as required by OSHA to prevent siphoning water out of the tank and back into the fire hydrant and water supply. Never modify or otherwise obstruct this passageway. Obstructions will cause water to be spilled and sprayed onto the operator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

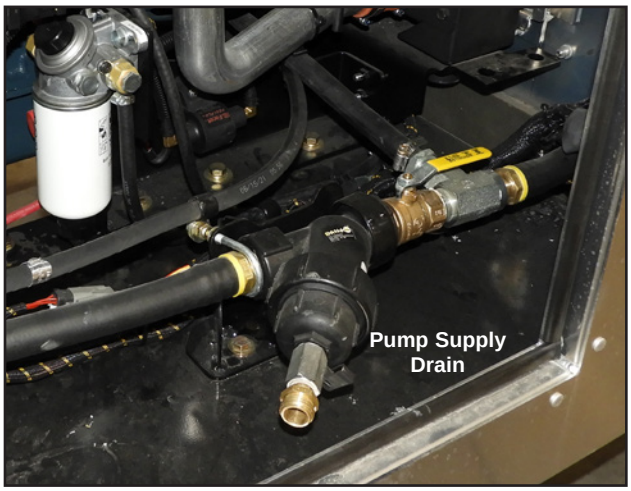
The watertank is equipped with a water drain. Additionally water drains for other system components. A variety of plugs and valves are used. All drains should be opened and flushed weekly. When not in use, typically overnight, the watertank should be drained and empty.

All drains must be left open to avoid freezing during cold weather when unit is not being used.

If equipped, follow process below to operate:

1. Open water tank drains and allow tanks to empty.
2. Open all drain valves on water pump, filter, and lines. Remove the handgun from the quick disconnect on the hose reel.
3. Start Engine.
4. Hold **Water Only** button in the depressed position for 5 seconds to purge remaining water from the lines.





NOTICE

Water System Can Be Damaged By Freezing

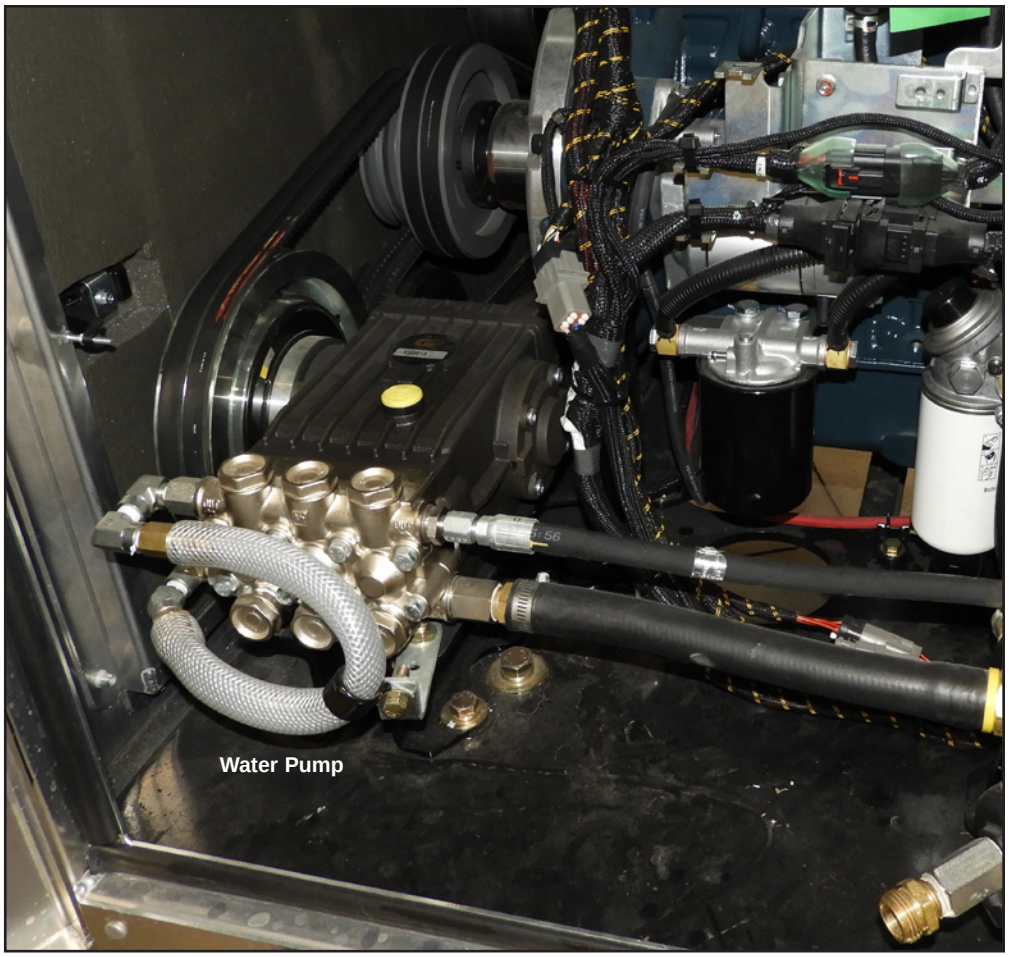
Ice in the water system can severely damage components. To avoid ice damage:

- **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.**

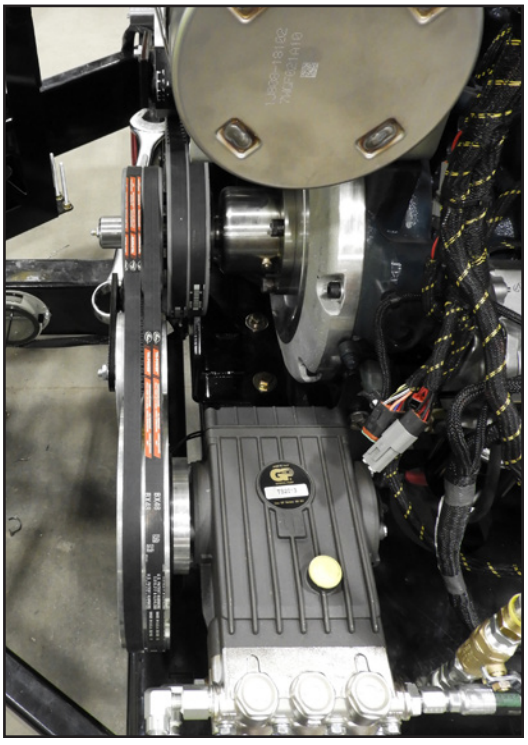
The standard water pump on this unit is capable of producing 5 gallons a minute at 3000 PSI. It is both pressure and flow compensated to ensure the operator maximum performance at a variety of flows or pressures, all through the hand gun.

The water pump is controlled by a clutch via belt drive off of the main engine.

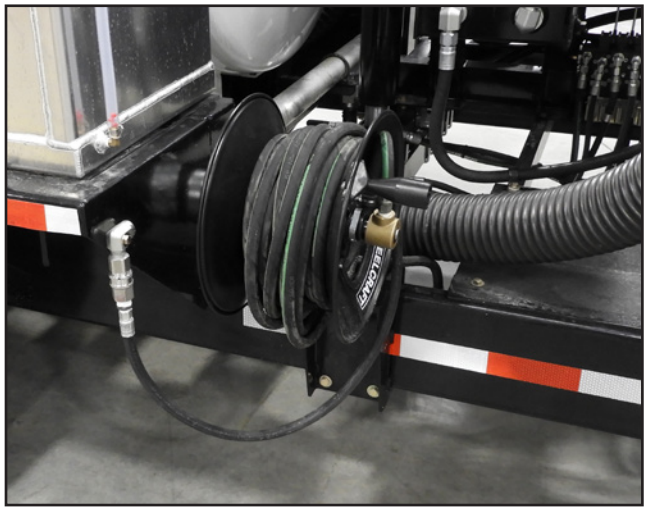
Prior to engaging the water pump, connect the hose reel hose to a water handgun/digging lance.



Water Pump



The water system is used to power a high pressure handgun for digging or washing. Capabilities include variable pressure up to a max of 3000 psi at 5gpm. It is only compatible with a special high pressure handgun/high pressure wand. The selected nozzle size, as well as the pressure set with the unloader valve, are what determines the flow rate.



⚠ 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 HDXpose™ 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.

TRUVAC

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

Nozzle Size	Nozzle Part #	Repair Kit Part #	FLOW RATE CHART (GPM) @ 1000 Psi	@ 1500 Psi	@ 2000 Psi	@ 2500 Psi	@ 3000 Psi
3.0	5086 44-SD	5086 44A-SD	1.5 GPM	1.8 GPM	2.1 GPM	2.4 GPM	2.6 GPM
4.0	5086 45-SD	5086 45A-SD	2.0 GPM	2.4 GPM	2.8 GPM	3.2 GPM	3.5 GPM
5.0	5086 46-SD	5086 46A-SD	2.5 GPM	3.1 GPM	3.5 GPM	4.0 GPM	4.3 GPM
6.0	5086 47-SD	5086 47A-SD	3.0 GPM	3.7 GPM	4.2 GPM	4.7 GPM	5.2 GPM
8.0	5086 48-SD	5086 48A-SD	4.0 GPM	4.9 GPM	5.7 GPM	6.3 GPM	6.9 GPM
10.0	5086 49-SD	5086 49A-SD	5.0 GPM	6.1 GPM	7.1 GPM	7.9 GPM	8.7 GPM
12.0	5086 50-SD	5086 50A-SD	6.0 GPM	7.3 GPM	8.5 GPM	9.5 GPM	10.4 GPM

VACTOR WORK ASSURED

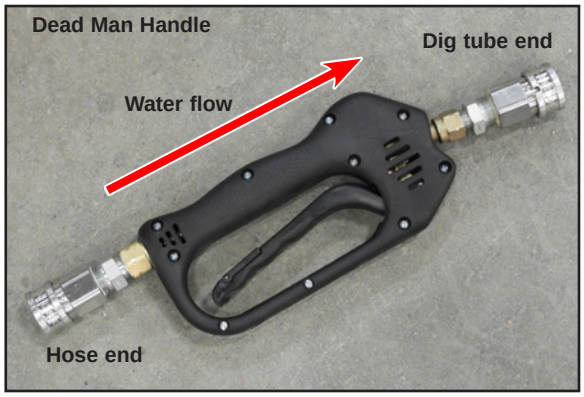
Digging Lance

Options

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.



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.

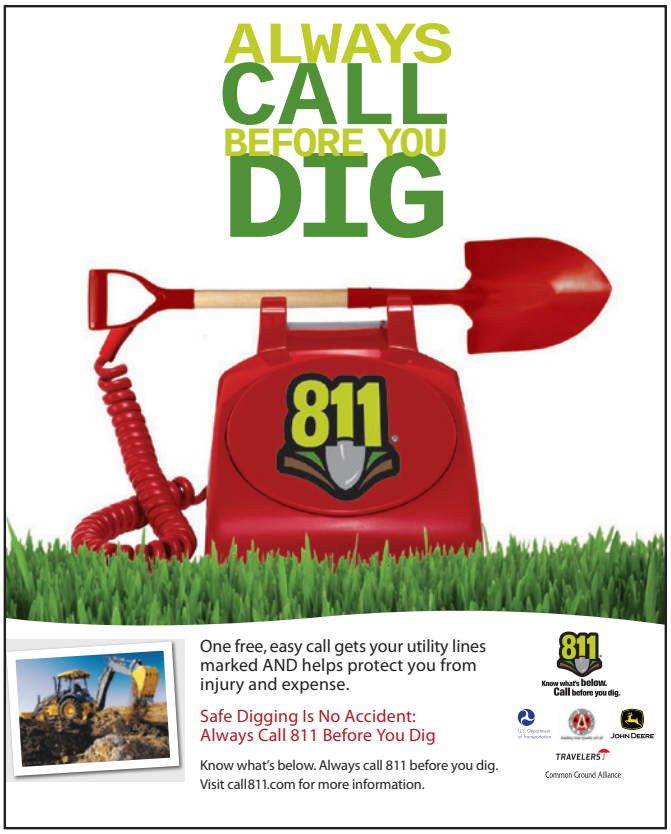
Operators can dig with precision, establishing a less invasive method for slot trenching, pot holing, and pipe location.

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.



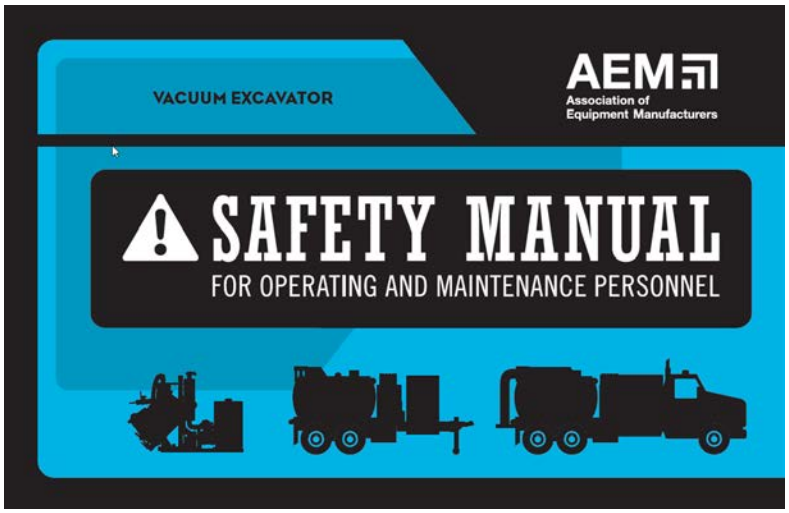
⚠ WARNING

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).

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

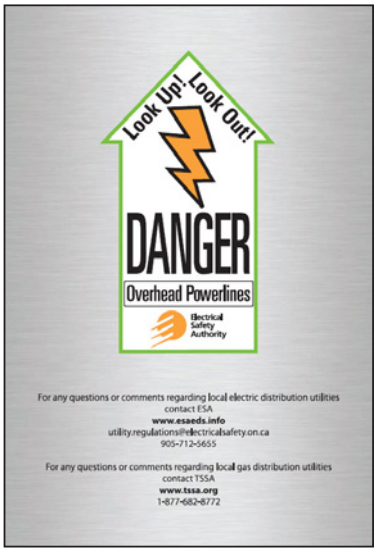
877-788-3883
Fax: 403-788-3723
Email: info@kri-tech.net
website: www.kri-tech.net

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

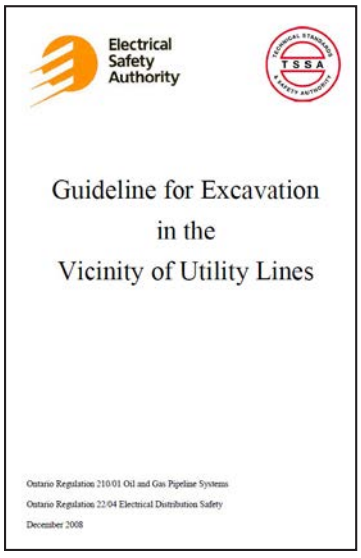
Ontario Regional Common Ground Alliance
195 King Street, Suite 105
St Catharines, Ontario L2R 3J6

866-446-4493
Fax: 866-838-6739
Email: office@orga.com
website: www.orcga.com



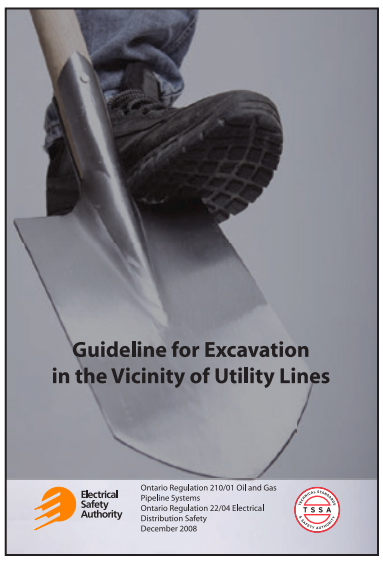
Centre for Health and Safety Innovation
5110 Creekbank Road, Suite 400
Mississauga, ON L4W 0A1

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



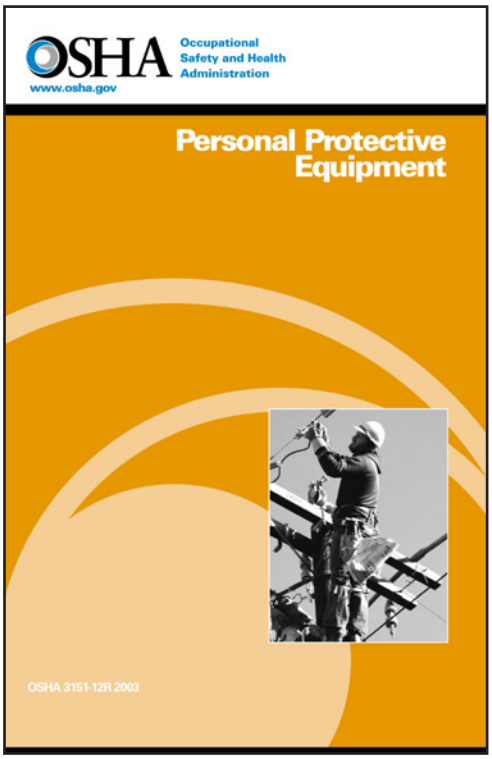
Follow all requirements for PPE when operating and servicing. The Occupational Safety and Health Administration (OSHA) requirements apply to most workers. The following information is from OSHA 3151-12R 2003. The full document can be obtained from www.osha.gov.

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
0 Red	5,000 / 20,000	1,000 / 1,500	10
1 White	10,000 / 40,000	7,500 / 11,250	10
2 Yellow	20,000 / 50,000	17,000 / 25,500	10
3 Green	30,000 / 60,000	26,500 / 39,750	10
4 Orange	40,000 / 70,000	36,000 / 54,000	10

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 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.

811®

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.**

1. Perform a walk-around inspection of the unit making sure it is ready for the job (See Maintenance Section for details). Make sure water tanks are full.
2. With the wheels chocked and the unit in working position, start and idle the engine. They hydraulic pump is direct drive from the engine so that will start circulating oil as soon as the engine is running.
3. Once the engine is up to operating temperature and all supporting equipment is setup for the job, enable Dig Mode. This will activate the 4-way valve/vacuum mode. Dig Mode also makes the water pump go live. Use of the handgun will activate/deactivate the pressure switch on the unloader valve which in turn, engages and disengages the drive clutch on the water pump.

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

DANGER

Rotating Drive Hazard

Contact with drive may cause severe personal injury or death.

Never operate with covers removed. Stay clear when operating.

PERIGO

Peligro de línea de impulsión en rotación

El contacto con la línea de impulsión podría causar graves lesiones personales o la muerte.

Nunca opere con las cubiertas fuera de lugar. Manténgase alejado durante la operación.

514275A rC

Before taking your Truvac TRXX 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 unit before use. A properly conducted pretrip inspection will prevent safety hazards and extend the life of the unit.

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 shroud, make sure all access doors are closed and secured properly.
2. Beginning at the front of the trailer, inspect hitch, wiring/connector, jack for any damage or loose hardware.
3. Moving to the right side of the unit, inspect tires for tread depth, air pressure and securement; loose or missing lug nuts, and hubs for proper amount of lubricant.
4. Battery: check the hold-down, battery cable condition and tightness and the battery should not signs of swelling which could indicate freezing or an overcharging condition.
5. Blower exhaust silencer: check that discharge pipe is tight and that there are no obstructions in it.
6. 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 water pump and ensure all opened drain valves are closed. Ensure all ball valves operate freely and do not leak.
7. Inspect the vacuum nozzle for wear and holes. Inspect the gate valve boom/hose transition.
8. Inspect the water tanks for leaks. Since the water system was drained the previous day the level indicator should be reading empty.
9. Ensure the unit has all the needed tools and wireless remote to operate. Does the wireless remote activate? Are the batteries in an adequate stage of charge? Are there extra clamps for the vacuum hose sections? Do all the buttons on the keypads work?
10. Check all storage inventory.
11. Inspect the boom, boom seals, pivot, and brake.
12. Check the rear lighting: running lights, brake lights, four ways, clearance lights, and license plate light. If equipped with an arrow board, verify that it flashes in both directions. Verify beacon light is operational and visible from the rear of the unit.
13. Rear bumper secure and labeled with conspicuity tape according to your local DOT requirements.
14. 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.
15. 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.
16. Ensure the rear door safety props are in place and functional.
17. Inspect any rear door decants for leaks and function.
18. Inspect the wire harness and hydraulic lines up the side of the body for attachment and condition.
19. Inspect the condition of the debris body as you walk around the unit, note any discrepancies and report to maintenance.
20. Inspect hose connection boots for evidence of leaks, cracks, or other damage.
21. Open any tool box or cabinet and inventory for job site needs. Clamps, auxiliary lighting, hydrant wrenches spare batteries etc.
22. If equipped, inspect and clean the cyclonic cleanout, this door must remain open after dumping and cleaning to allow the cyclones to dry out.
23. Inspect the hydraulic tank. Fill to proper level with the correct fluid. These 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.

24. Inspect the rubber hose coming from the cyclonic filter housing, the clamps are in place and the tube is free of holes.
25. 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.
26. Check the level of the DPF reservoir, if low fill to the appropriate level. The location of the DPF reservoir will vary by engine manufacturer.
27. Fill the unit with diesel fuel daily.
28. Inspect the exhaust system for leaks and the clamps are secure.
29. Inspect all hydraulic component for leaks and ensure they function when the function is activated.

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 any 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 unit. Be aware of underground utilities.

Put the unit 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 trailer 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 unit.

Once you have decided on a parking spot, park the vehicle. Set the parking brake and turn on flashers. Whenever possible, park the unit 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 chock the wheels to prevent the unit from rolling while working or storing.

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

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.

Operations Tips

- Always position the vacuum tube with the rubber end at the loading inlet. The rubber inlet has several important features. The rubber cannot scratch or damage pipe coatings. Air holes near the inlet help maintain airflow should a blockage occur at the inlet. On the inside of the rubber inlet there are several bolts. Do not remove these; they are designed to prevent oversized rocks from entering the pipe.
- Never hold the open end of the hose with your hand while vacuum system is on. Always make sure dig mode is off/4-way valve is in neutral position before attempting to dislodge any obstruction in the vacuum tube.
- 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.

SAFETY INSTRUCTIONS

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

To shut down the system:

- Stop vacuuming.
- Exit Dig Mode to assure 4-way valve is in the neutral position.
- If required, shut down the engine.

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.

- 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.

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.
3. The weather and operating conditions cannot be controlled, but the working distance, water volume and water pressure can be. In colder climates, the wind chill conditions could potentially cause ice build-up in the vacuum tube or boom, which blocks material movement.
4. Proper air speed will vary depending on the material moved. Watch the air exhaust for carry-over material. Any type of carry-over should be avoided.
5. 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.

Setting Up

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 unit 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 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.

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 units move material through air conveyance. They rely on air movement to entrap 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.

Blower Speed

Blower Speed on the TRXX is set to run at full RPM once Dig Mode is activated.

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

Debris Level

During operation, observe the debris body level gauge. The float ball will cease vacuum if level gets too high. Continuously monitor debris body fill level to prevent carryover.

All vacuum units 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

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, if available, 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 4-way valve in neutral 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.

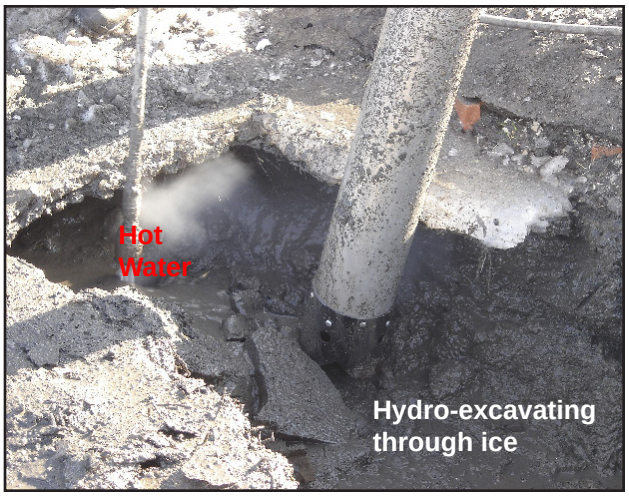
Rocky Ground

Air tends to move around rocks causing them to hang in the air stream. 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 water volume and water pressure can be.
4. Be cautious in cold weather applications as wind chill conditions can occur due to air velocity. The wind chill conditions cause ice build-up in the vacuum tube or boom, which blocks material movement.
5. Monitor blower exhaust for carry-over material. Any type of carry-over should be avoided.
6. 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.

The weather and operating conditions cannot be controlled, but working distance, water volume and water pressure can be.

Material

Working distance/hose length may need to be adjusted depending on the type of material being worked to assure optimal flow.

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.

Distance

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.

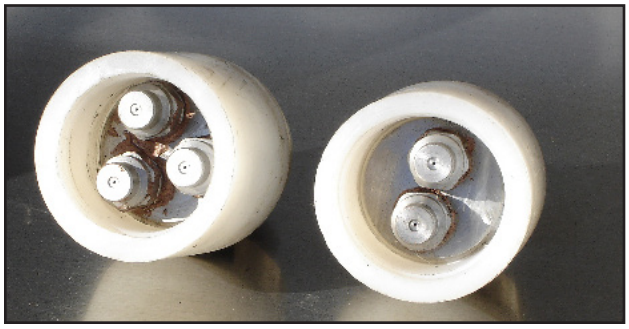
Water Pressure

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.

The unit is not equipped with an inspection port so it is important to 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 and shut down the unit.
3. Disconnect water wand or high pressure hand gun and store them in their respectful places on the tongue of the trailer.
4. Hold onto water line and let it rewind slowly onto hose reel.
5. Disconnect digging tubes and store them.
6. Remove any safety equipment and store in associated storage areas.

Vacuuming can continue until the debris body capacity is reached. Then vacuum operations must cease. Vacuum system must be off prior to draining excess liquid from the debris body.

In liquid vacuuming, the level indicator or the change of the sound of the blower (the float ball will get sucked up) will indicate a full tank. As the tank becomes full, the float in the debris body rises automatically with the load level to stop the flow of air through the filtration system. When this happens, the vacuum relief valve whistles. Shut the system down at this point and prepare for dumping.

Decant or Draining Water from Debris body

Draining the debris body before dumping will result in fewer trips to the disposal site, less weight for transportation and safer vehicle operation.

Do not raise the debris body fully when decanting water. Material in the debris body can slide against the rear door and thereby shutting off the decanting process.

A water drain located in the rear door allows draining excess water.

1. Position the unit with the rear door over a manhole at the work site.
2. Attach and unroll the drain hose and place it in the manhole.
3. Open the decant (optional) valve.
4. If the debris body is less than half full, raise the debris body slightly to help drain.
5. After excess water is drained, lower debris body, fold and replace hose.

⚠ WARNING

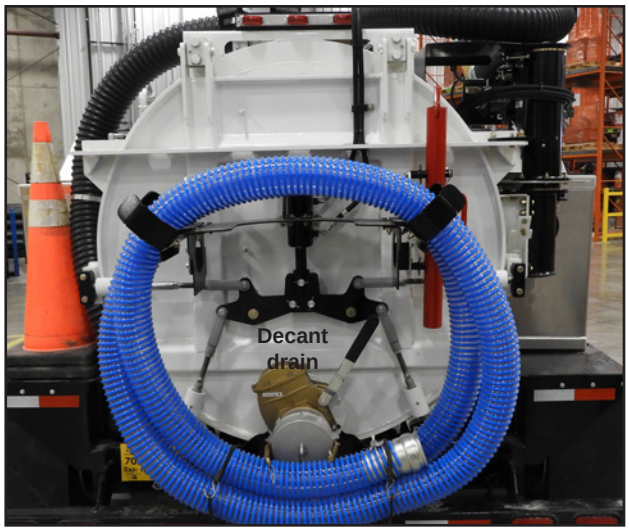
Crushing Hazard

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.



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.**

NOTICE

Before draining water into a storm drain, sewer or other location, ensure that local laws and regulations do not prohibit offload.

When dumping a load at an authorized disposal site, the operator must pick a level area with enough compaction to prevent the loaded unit from tipping or becoming stuck or unstable. Be sure to check for overhead obstructions. When in position, level the unit, chock the wheels, and engage the hydraulic pump.

The boom must be in the stored for travel position.

Open the rear door. The locks will unlock automatically before opening.

Raise the debris body.

After the material from the debris body is dumped, lower the debris body then pull forward to clear the dumped material.

Using the hydraulic control valve, raise the debris body with the door in the open position.

Note: The rear door must close with an airtight and watertight seal. Make sure all material is removed from the seal before closing the door.

Use the handgun to wash out the body, paying particular attention to the door seal, lock bolts, float balls and internal screens.

Note: The rear door must close with an airtight and watertight seal. Make sure all material is removed from the seal before closing the door.

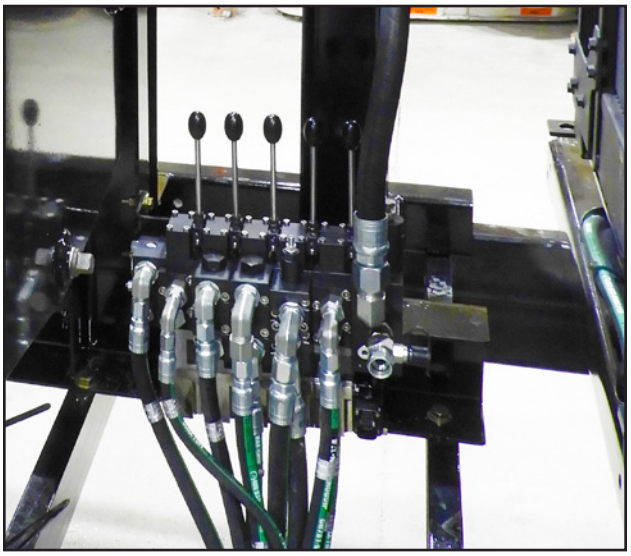
Lower the debris body.

Visually inspect the door seal.

Allow the rear door to close and fully lock.

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.**

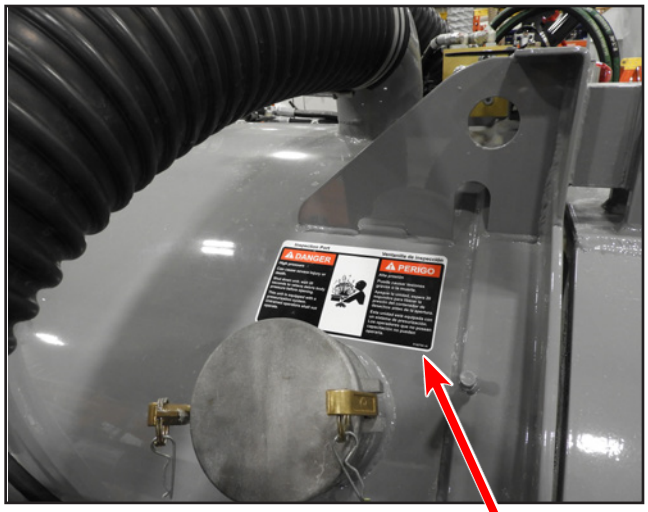


WARNING

Crushing / Tipping Hazard

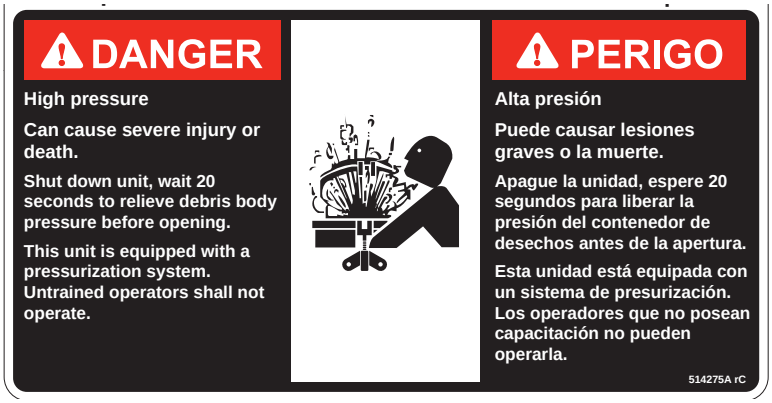
To avoid injury or death:

- **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.**



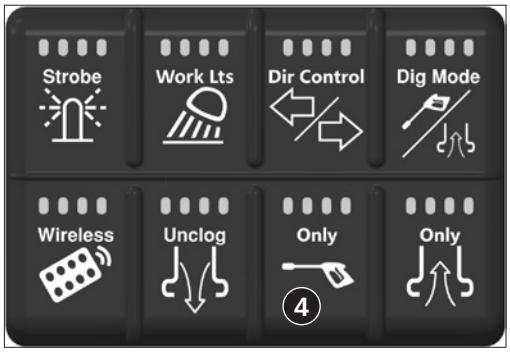
The debris body is equipped with an inspection port on the driver side and is sealed with a cam-lok fitting. It is important to know that the body could be pressurized and the proper procedure must be followed before opening:

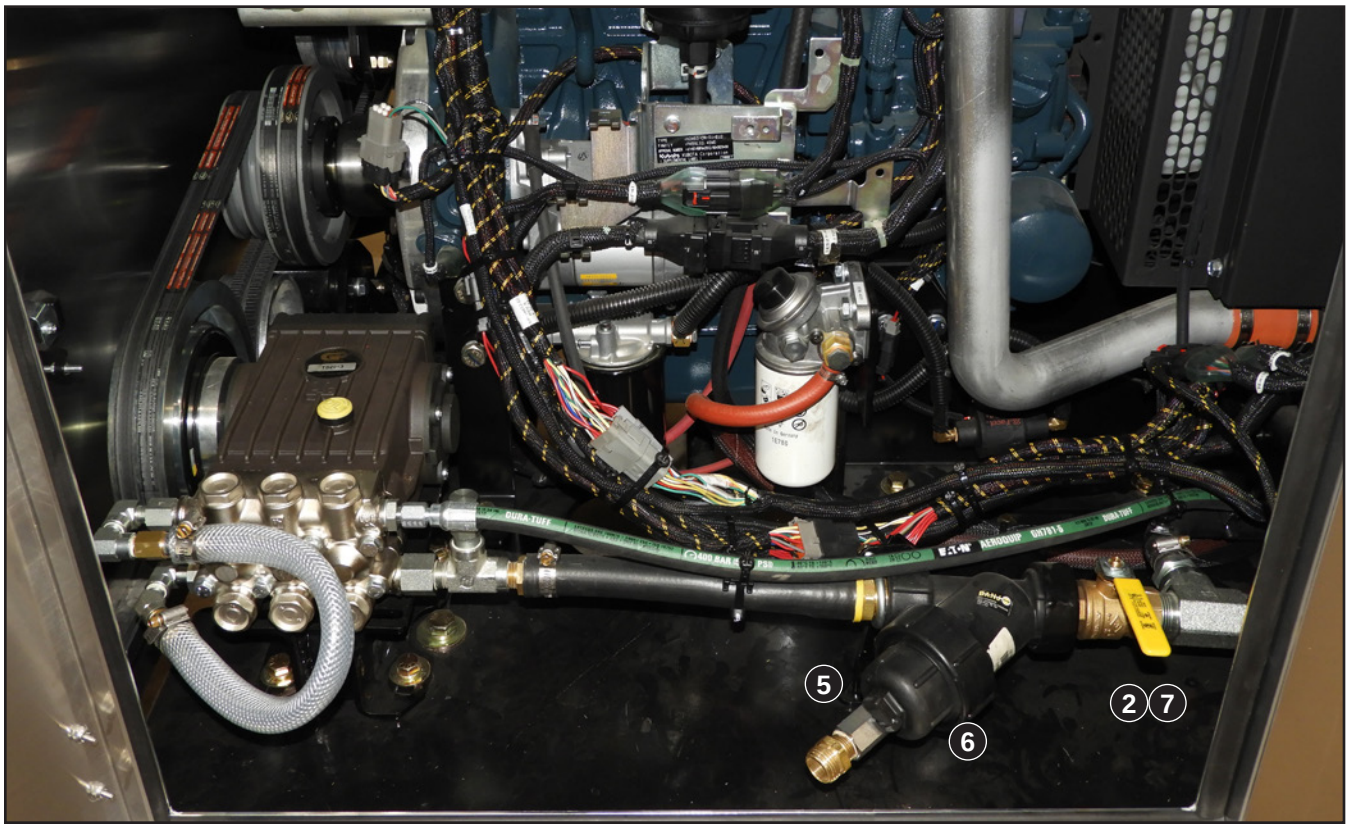
1. Make sure that the 4-way valve is in the neutral position.
2 Turn key off/shut down engine.
3. Wait 20 seconds for pressure to leak out of the pressure relief valve.
4. Open inspection port.



All drains must be left open to avoid freezing during cold weather when unit is not being used.

1. Open the Water Tank Drain Valve (located on driver side in front of wheels) and let all of the water drain out of the water tanks.
2. Open all drain valves on water pump, filter, and lines. Remove the handgun from the quick disconnect on the hose reel.
3. Start Engine.
4. Hold **Water Only** button in the depressed position for 5 seconds to purge the remaining water from the lines.





This decal is standard on all units and describes the general procedures for draining the system. More detailed information follows.

In addition to these specific drain points, the handgun ports should be drained as well. Open the handgun water ball valve and remove all the quick-connect handgun connections.

All drains must be left open to avoid freezing during cold weather when unit is not being used.

Winterizing

Draining the water system

1. Remove Y strainer water filter and leave out.
2. Open the tank drains and leave them open.
3. Allow water to drain from the system.
4. Slowly cycle the drain valves to drain any residual water and leave open.
5. Unwind all 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.

If equipped with air purge

7. Open the ball valve at the end of the hose on the hose reel to depressurize the system and remove the valve assembly.
8. Turn the water pump on for 10-15 seconds at lowest speed while SLOWLY turning on PURGE SYSTEM. Repeat purging until all the water is drained.
9. Repeat purging procedure to blow out the hose reel and lines until all the water is drained.
10. Place the Purge System ball valves in the OFF position.

For all units

11. Slowly rewind the hose onto the hose reel.
12. Open all mini ball valves on the pump.
13. Disengage the hydraulics.
14. Put the water pump ball valve in the OPEN position.

If equipped - Anti-Freeze System
Prepare for transport

1. Turn off the water to the water pump.
2. Open the antifreeze tank and pump valves.
3. Operate the handgun at low speed until antifreeze 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.

If equipped - Anti-Freeze System
Prepare for use

1. Turn off the water to the water pump.
2. Attach the handgun hose to quick coupling return to the anti-freeze tank.
3. Operate the water pump at low speed until all the anti-freeze has been pumped from the system.
4. Shut down the water pump.
5. The water system is now ready for use.

Refer to manual for details.

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).

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.

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NOTICE

Water System can be Damaged by Freezing

Instructions for draining water pump and lines in freezing weather:

1. Open water tank drains and allow tanks to empty.
2. Open all drain valves on water pump, filter, and lines. Remove the handgun from the quick disconnect on the hose reel.
3. Start Engine.
4. Hold **Water Only** button in the depressed position for 5 seconds to purge remaining water from the lines.

AVISO

El sistema de agua puede sufrir daños por congelamiento.

Instrucciones para drenar la bomba de agua y las tuberías en climas gélidos:

1. Abra los drenajes de los tanques de agua y deje que los tanques se vacíen.
2. Abra todas las válvulas de drenaje de la bomba de agua, el filtro y las tuberías. Retire la pistola manual de la desconexión rápida del carrete de la manguera.
3. Arranque el motor.
4. Mantenga presionado el botón **Solo agua** durante 5 segundos para purgar el agua que quede en las tuberías.

NOTICE

Water System can be Damaged by Freezing

If equipped with a Water Recirculation System:

1. Connect hose reel fitting to the recirc port.
2. Start Engine.
3. Press **Water Only** button one time.
4. This will run the water pump with the engine at idle, recirulating the water in the tank.

Note: Recirculator will not operate in a low water condition. Refer to draining procedure.

Refer to manual for details.

AVISO

El sistema de agua puede sufrir daños por congelamiento.

Si viene con un sistema de recirculación de agua:

1. Conecte el accesorio del carrete de manguera al puerto de recirculación.
2. Arranque el motor.
3. Presione el botón **Solo agua** una vez.
4. Esto pondrá en funcionamiento la bomba de agua con el motor en ralentí, lo que recircula el agua en el tanque.

Nota: El recirculador no funciona en condiciones con un nivel bajo de agua. Consulte el procedimiento de drenaje.

Consulte el manual para obtener detalles.

NOTICE

Water Tank can be Damaged

If equipped with Water Heater:

Overheating water tank can damage tank insulation.

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

AVISO

El tanque de agua puede dañarse

Si viene con calentador de agua:

El sobrecalentamiento del tanque de agua puede dañar el aislamiento del depósito.

El agua no debe calentarse por encima de los 100 °F (38 °C).

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- 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.

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

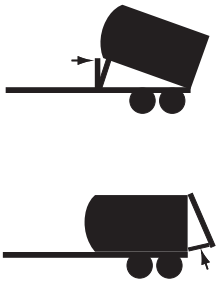
- NEVER leave the debris body raised or partly raised while the unit is unattended, nor when in motion.
- NEVER move the unit with the debris body in the up or raised position.
- ALWAYS disengage the PTO when hoist is not in use or when moving the unit.

WARNING

Crushing Hazard

Serious injury or death can result from falling debris body or rear door. Never go under a raised debris body or rear door 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. Open the rear door to just clear the prop(s) and lower door until it just rests on the prop(s).
- Shut down and lock out the entire system before servicing.
- Never leave debris body, rear door or optional equipment raised or partly raised while unit is unattended. Never move unit with debris body, rear door or optional equipment raised.
- The trailer must be attached to the tow vehicle for dumping debris.
- Be aware of the trailer's surroundings before operating any of the hydraulic functions to prevent death, injury or equipment damage.
- Unload any items stored in debris body before using machine.



Refer to manual for details.

Consulte el manual para obtener detalles.

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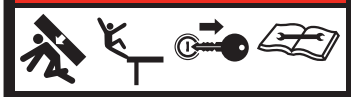
ADVERTENCIA

Peligro de aplastamiento

La caída de la puerta trasera puede provocar lesiones graves o la muerte. Nunca se pare debajo de un contenedor de desechos elevado, sin que se hayan colocado los puntales de seguridad.
El contenedor de desechos debe estar limpio y vacío para realizar las tareas de servicio.

- En una superficie firme y nivelada, eleve el contenedor por encima de la altura de los puntales. Incline los puntales en posición. Baje el contenedor de desechos hasta que apenas se apoye sobre los puntales.
  Utilice todos los puntales. Abra la puerta trasera para despejar los puntales y baje la puerta hasta que apenas se apoye sobre los puntales.
- Apague y bloquee todo el sistema y el chasis antes de realizar el servicio.
- Nunca deje el contenedor de desechos, la puerta trasera o el equipo opcional elevados, ni parcialmente elevados, cuando el vehículo está solo. Nunca desplace el vehículo con el contenedor de desechos, la puerta trasera o el equipo opcional elevados.
- El remolque debe estar conectado al vehículo remolcador para descargar los desechos.
- Sea consciente del área que rodea al vehículo antes de operar cualquiera de las funciones hidráulicas para evitar daños en el equipo, lesiones o la muerte.
- Retire todo artículo almacenado en el contenedor de desechos antes de utilizar la máquina.

DANGER



Crushing Falling Hazards

Can cause severe injury or death.

Before servicing, shut down unit, remove the ignition key, lock out electrical switches and hydraulic valves before working on unit.

Never ride on the trailer.

CAUTION

Noise can cause permanent hearing loss.

Always wear approved hearing protection when operating equipment.

Wear protective equipment including footwear and gloves when using or servicing this machine.

Read SAFETY section for details.

Electrical system can be damaged.

Do not weld on unit.

Disconnect all chassis and unit ECU's and batteries before welding on unit.

Electrical systems may be damaged by welding.

Read Service manuals for details.

WARNING

Cancer and Reproductive Harm

Required for compliance with California Prop 65.
Refer to: www.P65Warnings.ca.gov

WARNING

Explosion and fire hazards

To avoid severe injury or death never use an air mover to move hydrocarbon or other materials with a flashpoint below 140° (F). Vacuuming, or pump or pressurized off-loading is not permitted unless the flashpoint of the material is 140° (F) or higher.

Static electricity build up can result in electrical shocks, fire and/or an explosion when vacuuming dry and/or combustible materials. A static electricity charge may build up as material moves through the vacuum system. Grounding and/or bonding the unit may be required. Follow site procedures for static electricity.

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.

514275A rC

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, 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.

A cyclone separator uses air turbulence to remove dirt and debris from the airflow and deposit it in bottom of the separator.

Air leaving the float-ball vacuum shut-off in the debris tank enters the cyclone housings located on sides of the unit at the rear of the debris body. It protects the blower by removing material from the air stream before it reaches the blower.

The cyclone spins the air stream around the walls of the housing until it reaches the bottom of the cyclone house. The cyclone reduces particle matter in the airstream leaving relatively clean air to return to the top of the cyclone and in to the final filter.

The vacuum filtration system requires some specific cleaning for optimal operation. When a job is completed, or the unit will be driven and parked between work, or there will be more than a shift of downtime between work, the cyclones need to be cleaned. Some special conditions such as high humidity combined with certain materials may require more frequent cleaning.

The cyclones 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. Wear rates can be increased due to high operating RPM's. Material composition is also a primary factor in increase wear rates.

The cyclone separator should be inspected daily for dirt, dust and debris. Inspect the separator more often if working on jobs with excessive dust, dirt or debris.

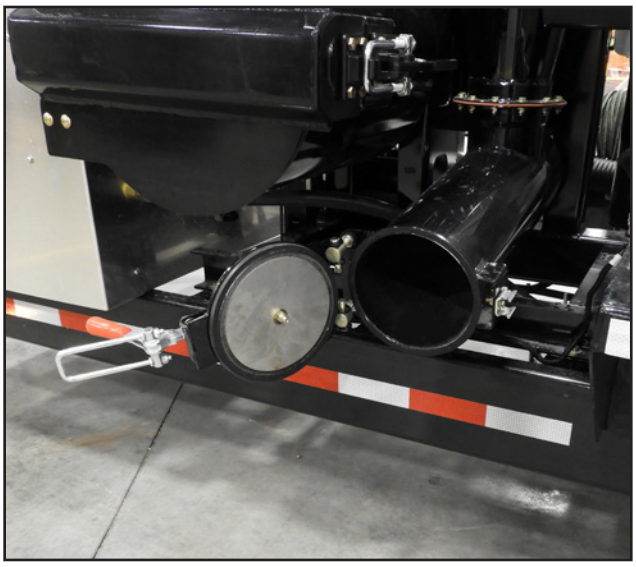
⚠ WARNING **Biological hazard**

Always stand to the side when opening the clean out door.

While standing to one side, open the separator door and allow the debris to fall out. Inspect and remove any remaining debris inside the separator.

Use the hand gun to thoroughly wash the cyclone separator and door. Make sure the door seal is clean and clear of any dust, dirt and debris.

For the cyclone separator to function the door seal must be clean and seal properly. Check the separator door seal by applying a thin layer of grease to the seal and closing the door. When the door is opened a complete imprint of the seal should be left on the frame. If the imprint does not reflect the entire seal the door is not sealing properly. Inspect the door, seal and frame for wear or damage and repair or replace as necessary.



NOTICE

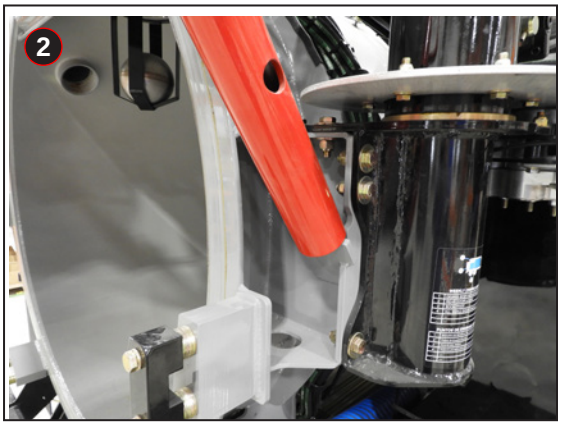
Rear Door Can Be Damaged

To avoid twisting damage to rear door always lower rear door until it just touches the prop. Never power door down onto prop.

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 prop in place.
2. Unpin prop from bracket and place it onto the stop on the debris body.
3. Lower the door so it just touches the prop.

   If the door is powered in to the prop 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.

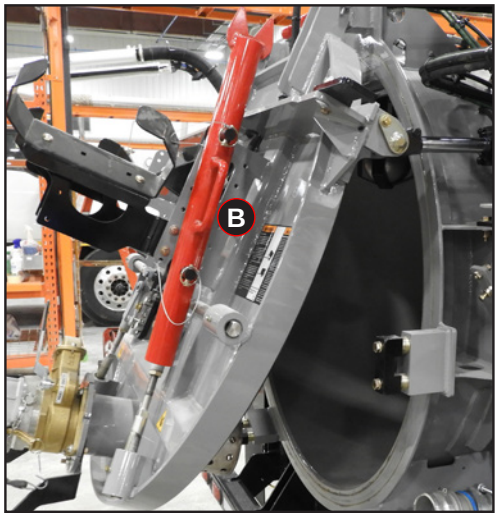


Disengaging Safety Prop

A. Raise the door to just enough for the prop to clear the door.

B. Put the prop back into the stored position and secure it with the provided pins.

C. The door can now be closed.



NOTICE

Rear Door Can Be Damaged

Remove and store 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.

NOTA

La puerta trasera puede sufrir daños

Quite los soportes de seguridad antes de cerrar la puerta para evitar daños. Abra la puerta trasera antes de elevar el contenedor de desechos. Asegúrese de que los accesorios de la puerta trasera no toquen el paragolpes y la conexión a tierra al elevar el contenedor de desechos.

514275A rC

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.

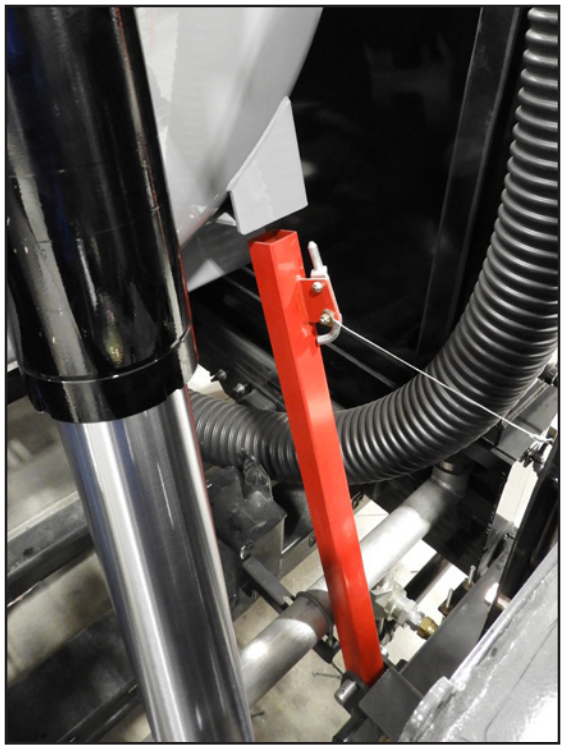
1. Raise the debris body so that the front of the body clears the safety prop or as shown. Release latch and tilt the prop in to position after dumping.

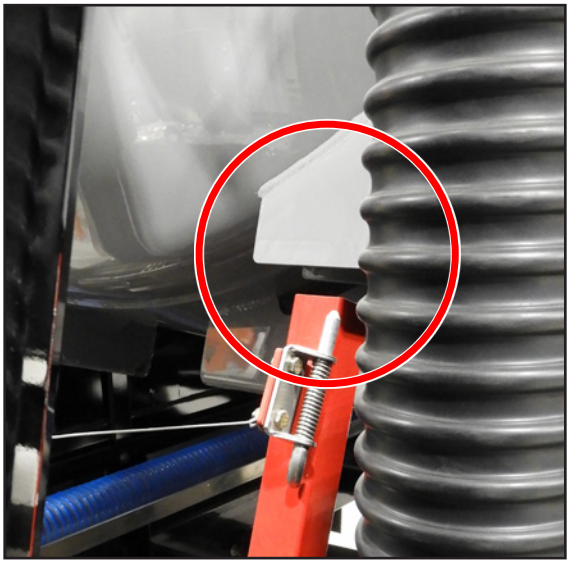
Note: It must be high enough in the air to allow the safety prop to clear the body and swing fully into position with the prop rest under the body.

2. Rotate the safety prop towards the prop rest until the stop-cable stops it.
3. After the top of the prop is in position, lower the body until the prop tab is just into the slot. Do not power the debris body down on to the prop. This will secure the body from falling.

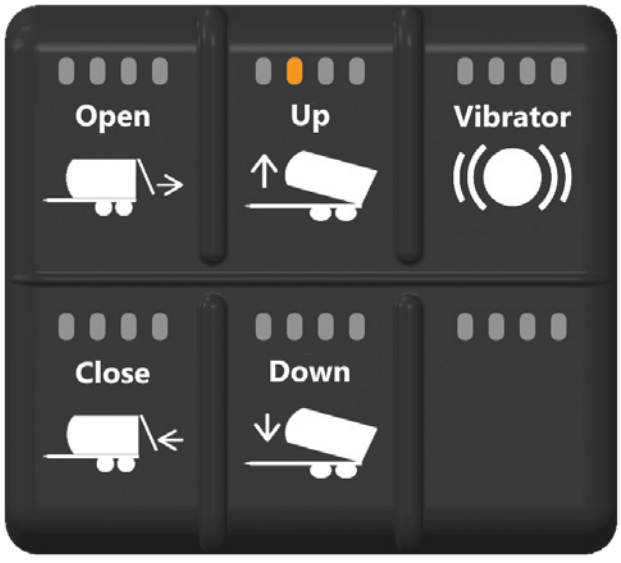
Disengaging Safety Prop

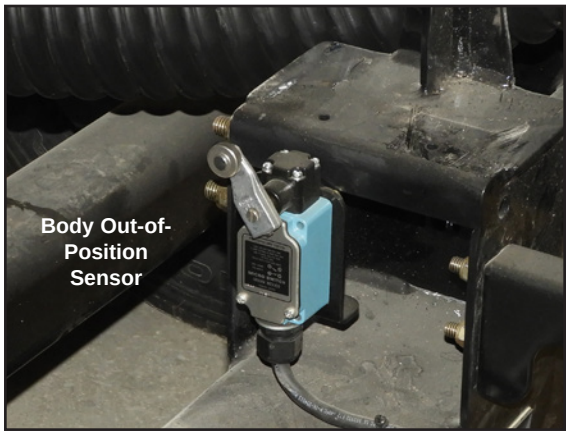
1. Raise the debris body just enough to clear the safety prop, rotate the prop back to the stored position until the pin clicks in.
2. The debris body can now be lowered.





Body out of position note: When debris body is not all the way down, an amber LED flashes as a warning on the body control button.





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.

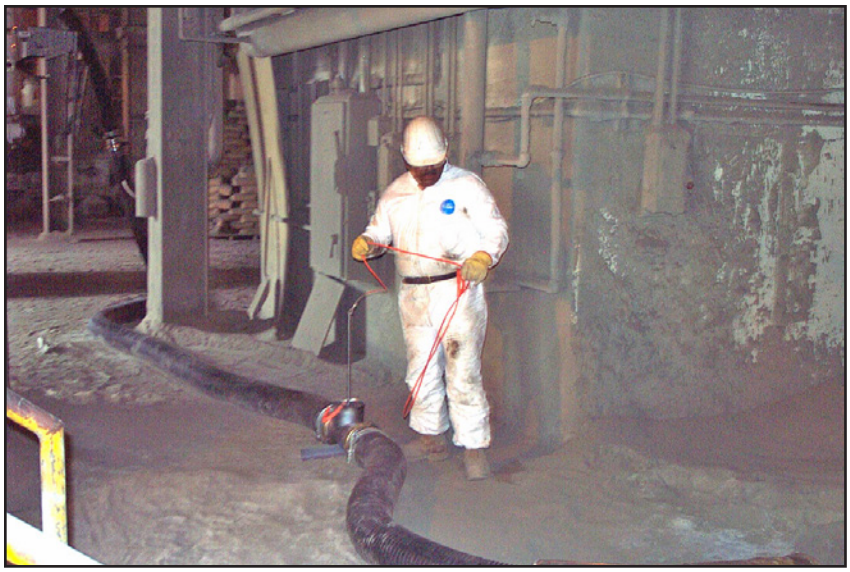
Use as large a tubing as possible. Light weight, smooth, bore flexible hose is recommended at the working end. Use rigid, aluminum tubes for longer runs, this reduces losses due to friction and have a longer life.

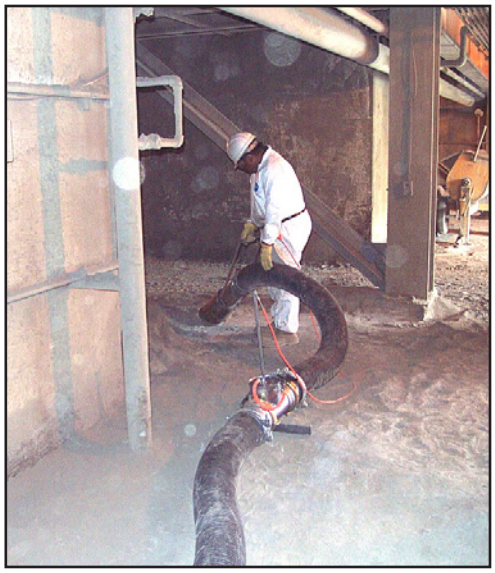
Do not reduce the diameter of hose in the middle of a run. For example 8” from the unit for 100 feet then reduced to 4” for 20 feet then back up to 6” for 50 feet. The change in air flow and velocity can result in debris plugging the hose closest to the unit.

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.

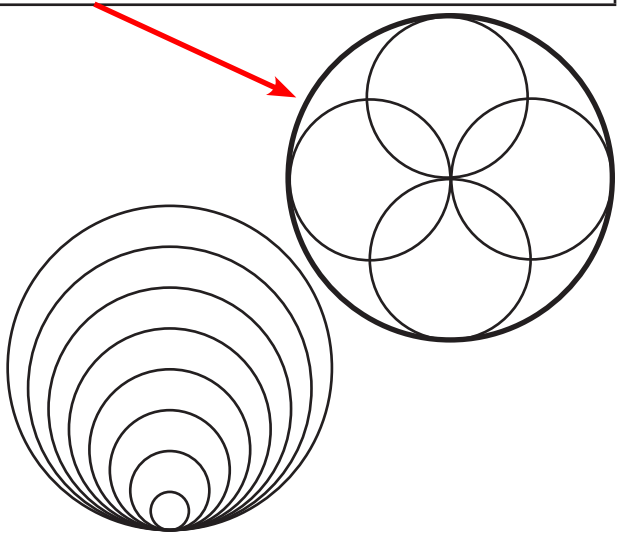
Before connecting the last section of hosing, install the in-line vacuum relief valve. Leave the in-line vacuum relief valve open until vacuum operations are ready to begin.





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%

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:

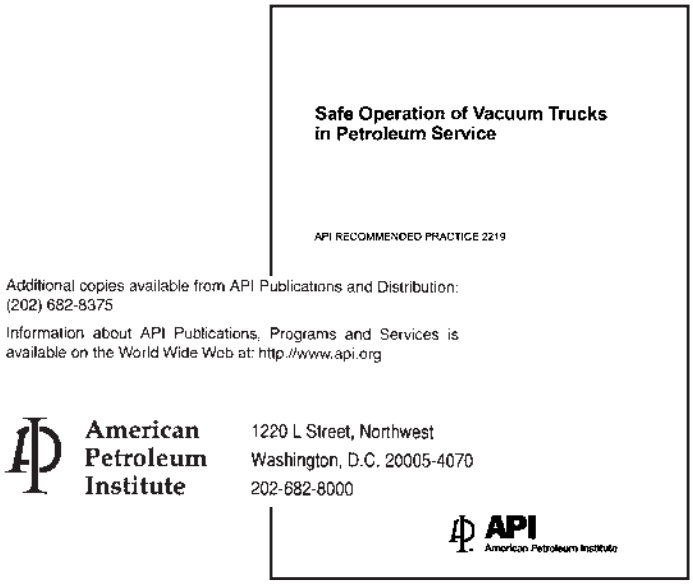
1. Visually inspect the debris body, cyclone(s), baghouse(s) and all material flow paths. They should be clean and clear of all visible debris and should be dry.
2. Replace all filter media in the debris path.
3. Disassemble and clean all filter screens and hoses.
4. Dispose of all waste in accordance 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.

WARNING

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

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202-682-8000

API American Petroleum Institute

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

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.

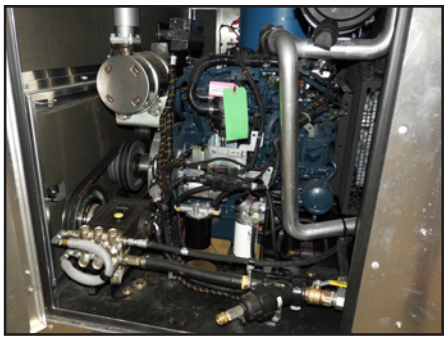
NOTICE

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.

Fill diesel fuel tank.

Check brake operation when coupled to tow vehicle.

Wheel chock hangers located in front of wheels on driver side.

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

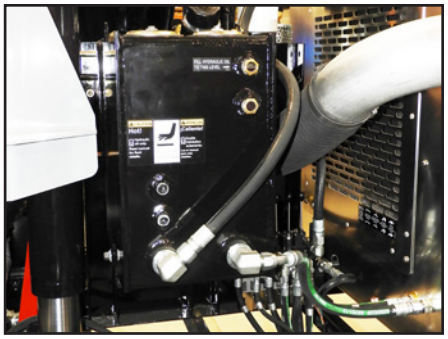
- Verify all safety decals are in place and legible
- All safety equipment should be with the unit including a safety tee if required

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.

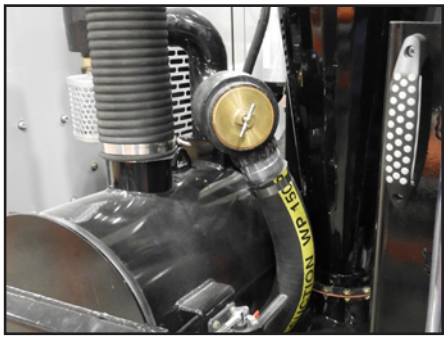
Perform a walk around to verify all items are properly secured for travel.

Note: A printable checklist is in the Maintenance section.

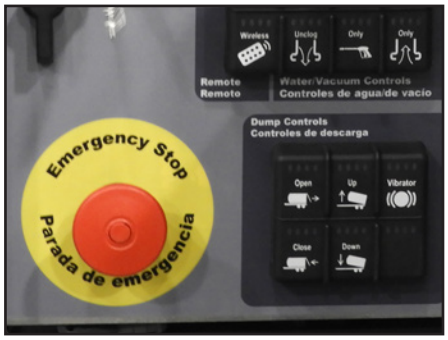
Check all hydraulic and electrical functions for proper operation.



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

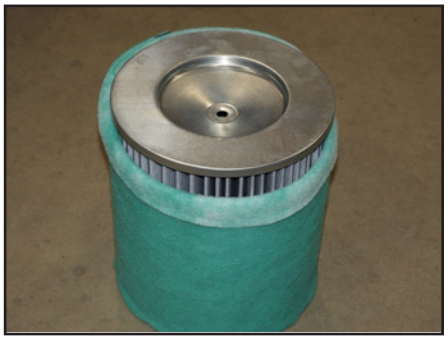


Activate the E-Stop to verify it functions correctly and that no error message appear on the display (if equipped).



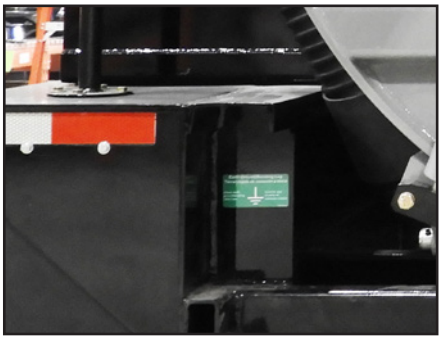
Check filters if equipped.

Replace any that have excessive build up.



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

Verify area for grounding cable connection.



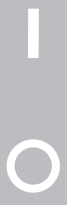
Shown are common industry standard symbols used on the various controls. Actual symbols used will vary with options.

Refer to manual

Refer to Service manual

Emergency Stop

Operator Alert



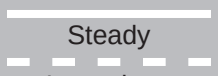
On Off

Lock Unlock

Adjustment Range
Max. to Min.

Alarm On / Off

Audible Alert
On / Off



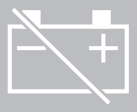
Steady
Intermittent

Remote Control

Counter

Timer

Hour meter



Battery power Disconnect

Battery charging and/or volts

Plug Connection or Socket

Scale

Slower / Faster

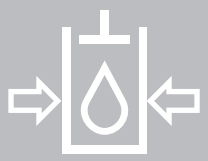
Increase Decrease

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.

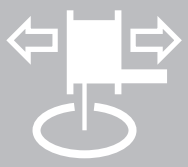
Worklights
Front - Side - Rear

Water Recirculation

Vibrator

Valve
Open
Closed

Heater or Cabinet heater



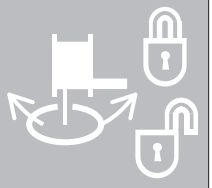
Hose reel IN/OUT

Hose reel Speed

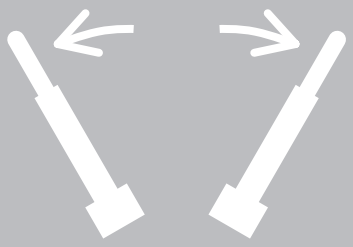
Hose reel PAY IN/PAY OUT

Hose reel IN/OUT

Hose reel pinch roller lock



Hose reel lock (swivel)



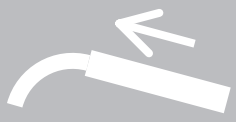
Boom rotate CCW or CW

Strobe/Beacon/ Revolving Light

Mirror Strobe

Boom retract

Boom DigFast (Clump Buster)



Boom extend

Debris Body Up/DOWN

High Rail UP/DOWN

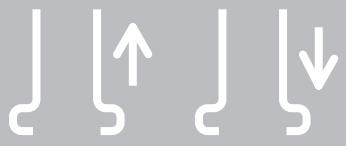
Boom down

Rear Door OPEN/CLOSE

ENGAGE/DISENGAGE

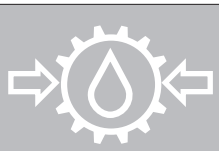
Boom up

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

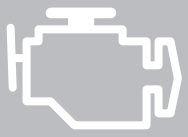
Engine Run

Engine Start

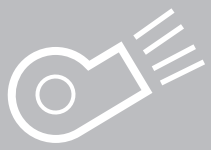
Engine Stop

Engine RPM

Power Take Off (PTO)



Engine



Fan

Park Brake

Road Mode

Blower or Compressor RPM

Blower or Compressor

Rotary Compressor, Liquid Ring or Vacuum Pump

Water Pump

Liquid Pump

Centrifugal Pump

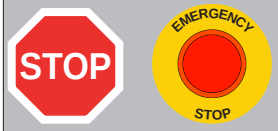
Engine REGEN

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.

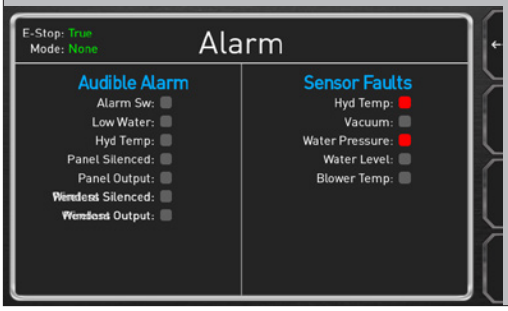
Oil Temperature

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.

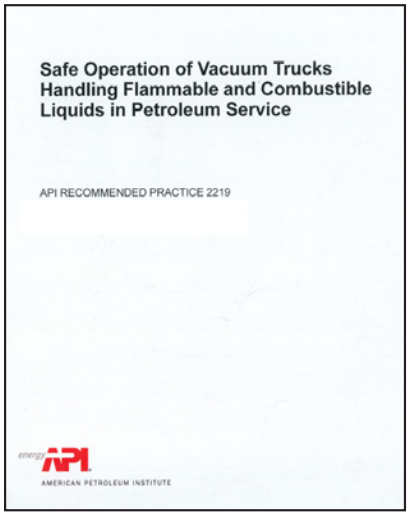
Note - on many older units (pre-2011) this indicator was used for the vacuum relief valve open/closed position. Refer to the unit's manual for details.



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.

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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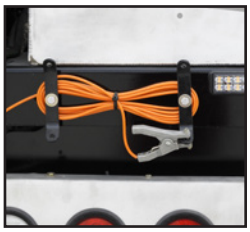

Typical static cable and clamp

Available from the WJTA-IMCA: *Recommended Practices for the Use of Industrial Vacuum Equipment*. Familiarize yourself with the Recommended Practices, particularly Section 2.0 Accidents & Section 5.5 Grounding/Bonding.

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.

Library of Congress Cataloging-in Publication Data
Britton, Laurence G., 1951–
Avoiding static ignition hazards in chemical operations / Laurence G. Britton.
p. cm. — (A CCPS concept book)
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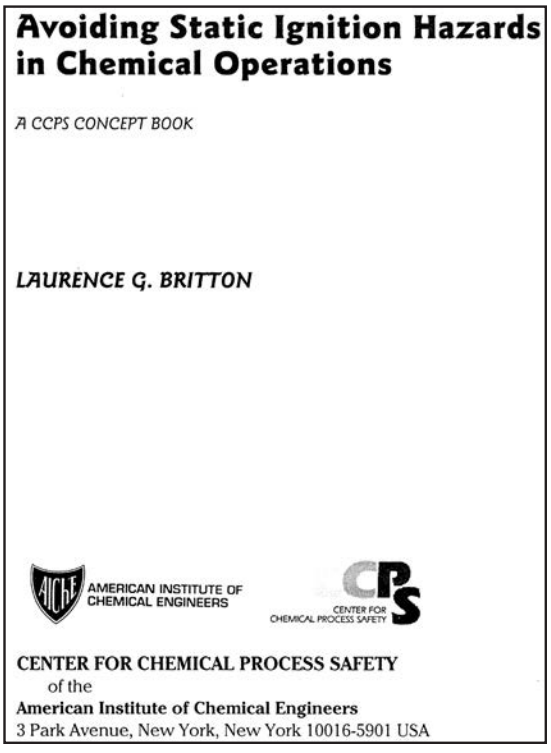


If use of Vactor equipment results in exposure to potentially hazardous dust, employers and users should consult any applicable SDS as well as OSHA regulations, guidelines, and information to ensure safety of operators. Under these circumstances, users should pay particular attention to possible increased 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.

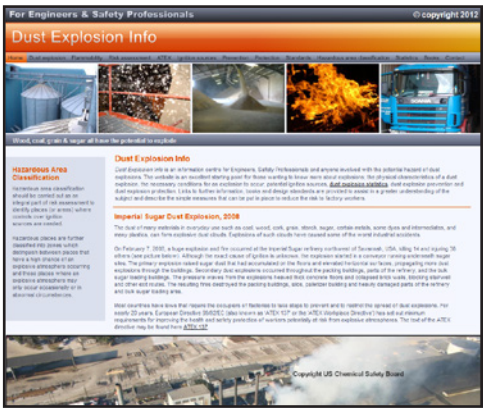
12. Ground the unit to an approved grounding point or grounding rod. If using a grounding rod(s), it must be designed for grounding and driven firmly into the soil per the site requirements. The grounding point should be wire brushed to remove oxidation or other materials that might prevent the free 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.

http://www.dustexplosion.info/



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.

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

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

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

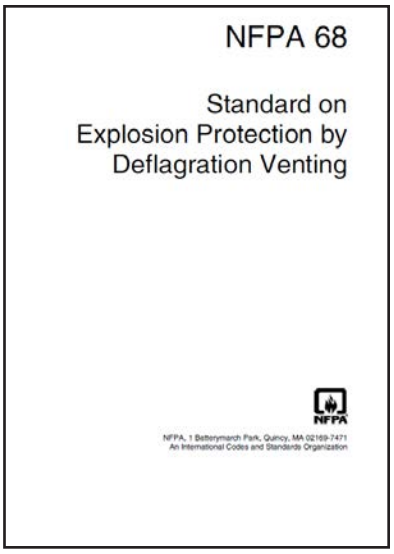
NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids

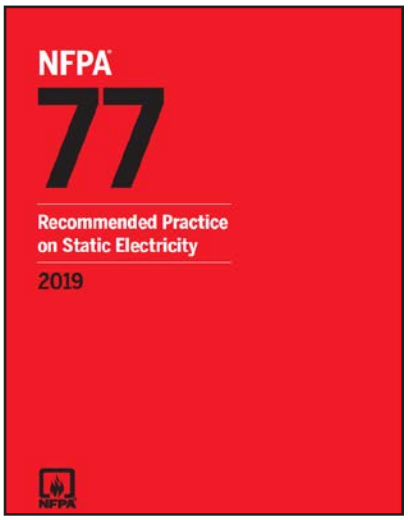
NFPA 655, Standard for Prevention of Sulfur Fires and Explosions

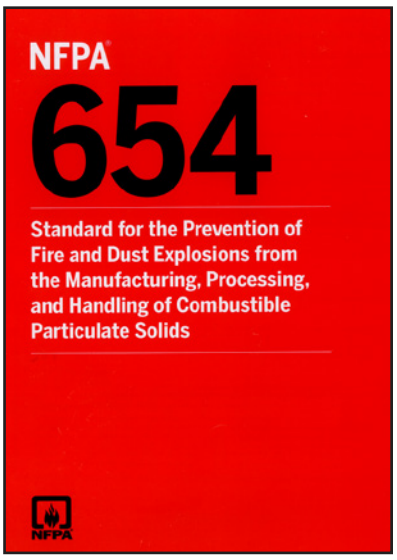
NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

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







OSHA® FactSheet

Hazard Alert: Combustible Dust Explosions

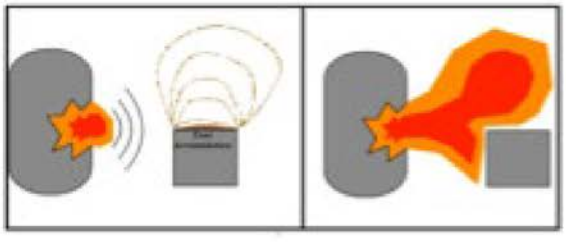
Combustible dusts are fine particles that present an explosion hazard when suspended in air in certain conditions. A dust explosion can be catastrophic and cause employee deaths, injuries, and destruction of entire buildings. In many combustible dust incidents, employers and employees were unaware that 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;
- 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.

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.

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

OSHA® Occupational Safety and Health Administration

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

U.S. Department of Labor

DSG FS-3791 05/2015

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

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.

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

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.

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U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3681 12/2017

Tow Vehicles

The tow vehicle must be rated for the trailer. The vehicles are rated by class based on gross vehicle weight rating (GVWR).

Light-Duty Trucks	
Class 1	GVWR 0-6,000lbs
Class 2	GVWR 6,001-10,000lbs
Class 3	GVWR 10,001-14,000lbs
Medium-Duty Trucks	
Class 4	GVWR 14,001-16,000lbs
Class 5	GVWR 16,001-19,500lbs
Class 6	GVWR 19,501-26,000lbs
Heavy-duty Trucks	
Class 7	GVWR 26,001-33,000lbs
Class 8	GVWR 33,001-150,000lbs

The tow vehicle must have a tow rating greater than the GVWR rating of the trailer even if the trailer will be towed unloaded. Typically there will be a GVWR rating decal for trailers on the tongue near the hitch.

Refer to the tow vehicle owner's manual for details.

Driving

Tow vehicles handle significantly different when towing. Common changes include braking distances increase, wind buffeting increases, turning radius is larger, visibility is reduced and acceleration is slower. Generally the vehicle must be driven slower. In the event there is some trailer sway let off the accelerator, do not brake or turn the steering wheel. If available gently apply the trailer brakes until trailer is stable again.

Refer to the trailer manufacturer's manual for details.

The following pages provide some common reference material for the safe use of trailers.

⚠ WARNING

Collision Avoidance

To avoid serious injury or death wear a safety vest with the appropriate safety symbols when working on job sites in traffic areas. Many accidents occur due to inattentive drivers and collision with cars and trucks.

NOTICE

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.

No one shall operate or service this Vactor Equipment until they have read and understand the operating manual. Additional copies of the manuals may be obtained from your Vactor distributor or by contacting the factory.

Please specify model and serial no(s).

NOTICE

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

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

Check unit daily making certain all decals are in place and readable. Replace as needed.

NOTICE

Disconnect ECU and batteries before welding on unit.

Consult chassis service manual.

Tire Safety.

Everything rides on it.

Protection against avoidable breakdowns and crashes. Improved vehicle handling. Better fuel economy. Increased tire life. Just a few of the reasons to take five minutes every month to check your tires. Simply use the handy checklist below, and see the reverse side for more information on tire safety.

Safety Checklist

- ✓ Check tire pressure regularly (at least once a month), including the spare.
- ✓ Inspect tires for uneven wear patterns on the tread, cracks, foreign objects, or other signs of wear or trauma. Remove bits of glass and other foreign objects wedged in the tread.
- ✓ Make sure your tire valves have valve caps.
- ✓ Check tire pressure before going on a long trip.
- ✓ Do not overload your vehicle. Check the tire information placard or owner's manual for the maximum recommended load for the vehicle.
- ✓ If you are towing a trailer, remember that some of the weight of the loaded trailer is transferred to the towing vehicle.

Safety Tips

- Slow down if you have to go over a pothole or other object in the road.
- Do not run over curbs, and try not to strike the curb when parking.

Remember to check your tires once a month!

EVERYTHING RIDES ON IT
Tire Safety

There's Safety In Numbers

You can find the numbers for recommended tire pressure and vehicle load limit on the tire information placard and in the vehicle owner's manual. Tire placards are permanent labels attached to the vehicle door edge, doorpost, glove-box door, or inside of the trunk lid. Once you've located this information, use it to check your tire pressure and to make sure your vehicle is not overloaded—especially when you head out for vacation.

Checking Tire Pressure

Because tires may naturally lose air over time, it is important to check your tire pressure at least once a month. For convenience, purchase a tire pressure gauge to keep in your vehicle. Gauges can be purchased at tire dealerships, auto supply stores, and other retail outlets. Remember, the tire inflation number that vehicle manufacturers provide reflects the proper pounds per square inch (psi) when a tire is cold. To get an accurate tire pressure reading, measure tire pressure when the car has been unused for at least three hours.

Step 1:	Locate the correct tire pressure on the tire information placard or in the owner's manual.
Step 2:	Record the tire pressure of all tires.
Step 3:	If the tire pressure is too high in any of the tires, slowly release air by gently pressing on the tire valve with the edge of your tire gauge until you get to the correct pressure.
Step 4:	If the tire pressure is too low, note the difference between the measured tire pressure and the correct tire pressure. These "missing" pounds of pressure are what you will need to add.
Step 5:	At a service station, add the missing pounds of air pressure to each tire that is underinflated.
Step 6:	Check all the tires to make sure they have the same air pressure (except in cases in which the front and rear tires are supposed to have different amounts of pressure).

Checking Tire Tread

Tires have built-in treadwear indicators that let you know when it is time to replace your tires. These indicators are raised sections spaced intermittently in the bottom of the tread grooves. When they appear even with the outside of the tread, it is time to replace your tires. You can also test your tread with a Lincoln penny. Simply turn the penny so Lincoln's head is pointing down and insert it into the tread. If the tread doesn't cover Lincoln's head, it's time to replace your tires.

For a free brochure visit www.nhtsa.gov or call 1-888-327-4236

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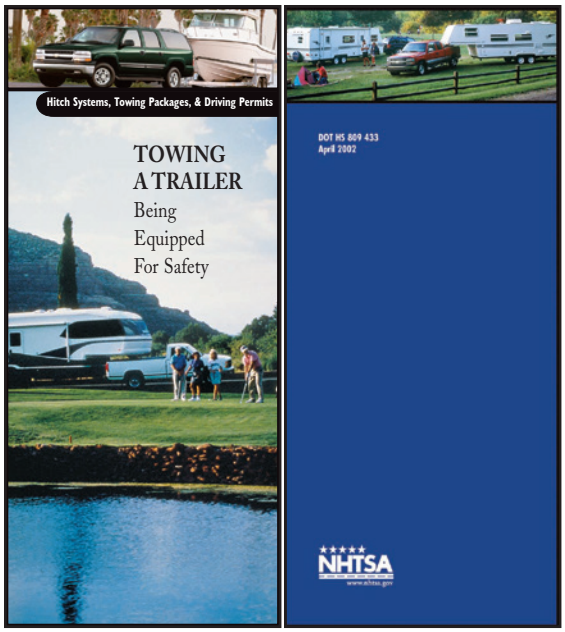


Selected pages for reference.

Brochure available at WWW.NHTSA.COM

PRE-DEPARTURE SAFETY CHECKLIST

Before driving, make sure your vehicle maintenance and trailer maintenance are current. This is very important because towing puts additional stress on the tow vehicle. (Review the next section of the brochure for an overview of maintenance requirements.)

- ❑ Check and correct tire pressure on the tow vehicle and trailer.
- ❑ Make sure the wheel lug nuts/bolts on the tow vehicle and trailer are tightened to the correct torque.
- ❑ Be sure the hitch, coupler, draw bar, and other equipment that connect the trailer and the tow vehicle are properly secured and adjusted.
- ❑ Check that the wiring is properly connected—not touching the road, but loose enough to make turns without disconnecting or damaging the wires.
- ❑ Make sure all running lights, brake lights, turn signals, and hazard lights are working.
- ❑ Verify that the brakes on the tow vehicle and trailer are operating correctly.
- ❑ Check that all items are securely fastened on and in the trailer.
- ❑ Be sure the trailer jack, tongue support, and any attached stabilizers are raised and locked in place.
- ❑ Check load distribution to make sure the tow vehicle and trailer are properly balanced front to back and side to side.
- ❑ Check side- and rear-view mirrors to make sure you have good visibility.
- ❑ Check routes and restrictions on bridges and tunnels.
- ❑ Make sure you have wheel chocks and jack stands.

SAFETY TIPS FOR DRIVING WITH A TRAILER

Take time to practice before driving on main roads and never allow anyone to ride in or on the trailer. Before you leave, remember to check routes and restrictions on bridges and tunnels. Consider the following safety tips each time you drive with a trailer.

General Handling

- Use the driving gear that the manufacturer recommends for towing.
- Drive at moderate speeds. This will place less strain on your tow vehicle and trailer. Trailer instability (sway) is more likely to occur as speed increases.
- Avoid sudden stops and starts that can cause skidding, sliding, or jackknifing.
- Avoid sudden steering maneuvers that might create sway or undue side force on the trailer.
- Slow down when traveling over bumpy roads, railroad crossings, and ditches.
- Make wider turns at curves and corners. Because your trailer's wheels are closer to the inside of a turn than the wheels of your tow vehicle, they are more likely to hit or ride up over curbs.
- To control swaying caused by air pressure changes and wind buffeting when larger vehicles pass from either direction, release the accelerator pedal to slow down and keep a firm grip on the steering wheel.

Braking

- Allow considerably more distance for stopping.
- If you have an electric trailer brake controller and excessive sway occurs, activate the trailer

brake controller by hand. Do not attempt to control trailer sway by applying the tow vehicle brakes; this will generally make the sway worse.

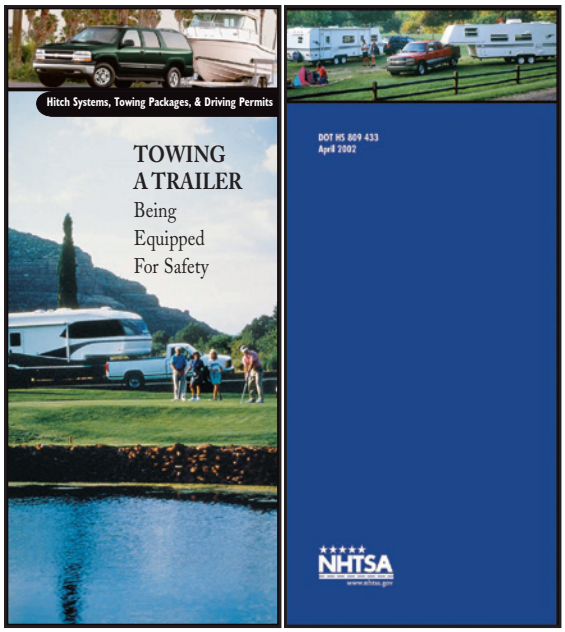
- Always anticipate the need to slow down. To reduce speed, shift to a lower gear and press the brakes lightly.

Acceleration and Passing

- When passing a slower vehicle or changing lanes, signal well in advance and make sure you allow extra distance to clear the vehicle before you pull back into the lane.
- Pass on level terrain with plenty of clearance. Avoid passing on steep upgrades or downgrades.
- If necessary, downshift for improved acceleration or speed maintenance.
- When passing on narrow roads, be careful not to go onto a soft shoulder. This could cause your trailer to jackknife or go out of control.

Downgrades and Upgrades

- Downshift to assist with braking on downgrades and to add power for climbing hills.
- On long downgrades, apply brakes at intervals to keep speed in check. Never leave brakes on for extended periods of time or they may overheat.
- Some tow vehicles have specifically calibrated transmission tow-modes. Be sure to use the tow-mode recommended by the manufacturer.



Selected pages for reference.

Brochure available at WWW.NHTSA.COM

Backing Up

- Put your hand at the bottom of the steering wheel. To turn left, move your hand left. To turn right, move your hand right. Back up slowly. Because mirrors cannot provide all of the visibility you may need when backing up, have someone outside at the rear of the trailer to guide you whenever possible.
- Use slight movements of the steering wheel to adjust direction. Exaggerated movements will cause greater movement of the trailer. If you have difficulty, pull forward and realign the tow vehicle and trailer and start again.

Parking

- Try to avoid parking on grades. If possible, have someone outside to guide you as you park. Once stopped, but before shifting into Park, have someone place blocks on the downhill side of the trailer wheels. Apply the parking brake, shift into Park, and then remove your foot from the brake pedal. Following this parking sequence is important to make sure your vehicle does not become locked in Park because of extra load on the transmission. For manual transmissions, apply the parking brake and then turn the vehicle off in either first or reverse gear.
- When uncoupling a trailer, place blocks at the front and rear of the trailer tires to ensure that the trailer does not roll away when the coupling is released.
- An unbalanced load may cause the tongue to suddenly rotate upward; therefore, before uncoupling, place jack stands under the rear of the trailer to prevent injury.

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MAINTENANCE

Tow vehicles often have more frequent maintenance requirements, including changes of engine and transmission oils and filters, lubrication of components, and cooling system checks. Check your owner's manual for information on scheduled maintenance of your tow vehicle and trailer. Here are some additional maintenance suggestions.

Tires

Periodic inspection and maintenance of tow vehicle and trailer tires and wheels are essential to towing safety, including spare tires. Proper tire pressure affects vehicle handling and the safety of your tires. You can find the correct tire pressure for your tow vehicle in the owner's manual or on the tire information placard.

- Underinflation reduces the load-carrying capacity of your tow vehicle or trailer, may cause sway and control problems, and may result in overheating, causing blowouts or other tire failure.
- Overinflation causes premature tire wear and affects the handling characteristics of the tow vehicle or trailer.

Brakes

On a regular basis, have the brakes on both vehicles inspected. Be sure that necessary adjustments are made and any damaged or worn parts are replaced.

Hitch

Check the nuts, bolts, and other fasteners to ensure that the hitch remains secured to the tow

page 21

vehicle and the coupler remains secured to the trailer. The connection point may require periodic lubrication to permit free movement of the coupler to the hitch ball.

Wiring

Make sure connector-plug prongs and receptacles, lightbulb sockets, wire splices, and ground connections are clean and shielded from moisture. Lightly coat all electrical terminal connections with nonconducting (dielectric), light waterproof grease.

Clean the prongs with very fine sandpaper, being careful not to damage the contact area.

Clean the surface deposits in the connector holes. (Make sure the lights are off to prevent blowing a fuse.) Try to clean off only the deposits and lubricate lightly with dielectric, light waterproof grease.

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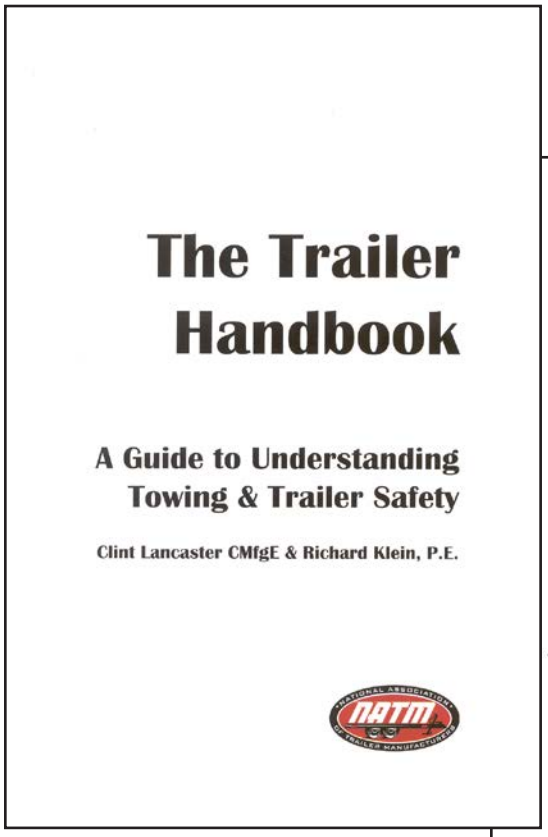
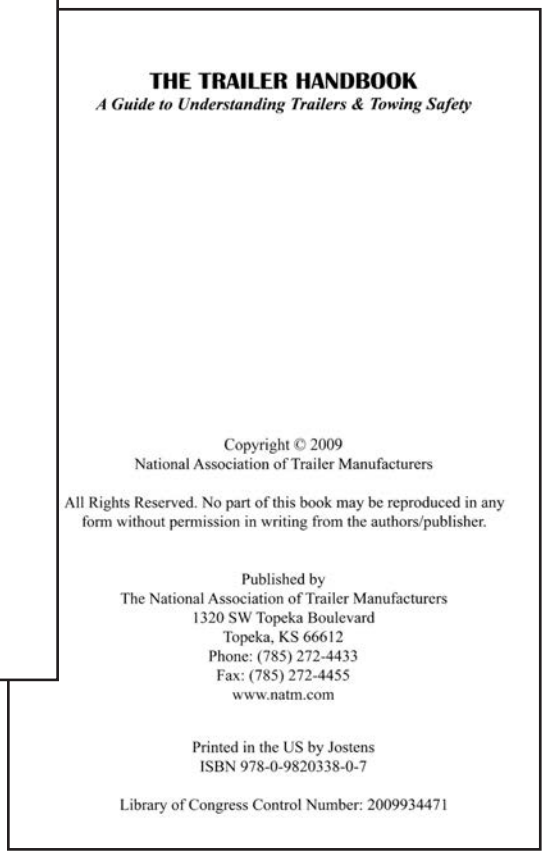
Additional resource





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

Options

The contents of the TRXX debris body can be drained using the pressure off-load operation. This consists of pressurizing the debris body then opening the gate valve to purge the contents.

Instructions for pressure off-load:

1. Start Engine.
2. Ensure knife gate valve is closed and remove the cam-lock cap from the 6 o'clock port.
3. Install plug into boom, ensuring the cam-lock levers are fully engaged with safety pins installed.
4. Install quick pin through plug securing it to the boom post.
5. Activate "Vacuum Only" and "Unclog" for 10-15 seconds to mix debris.
6. With "Unclog" held down, open knife gate valve. When pressure dissipates, close knife gate valve and allow the pressure to build again. Repeat this step until debris body is sufficiently empty.
7. With the engine at idle and no functions running, open rear door and raise debris body to fully clean out remaining debris.

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.

Note: The minimum pressure is 1,200 PSI for the water heater to fire. The water heater must have 3 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 100 degrees 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.

NOTICE

Fire hazard

Do not use water heater when unit is in motion.

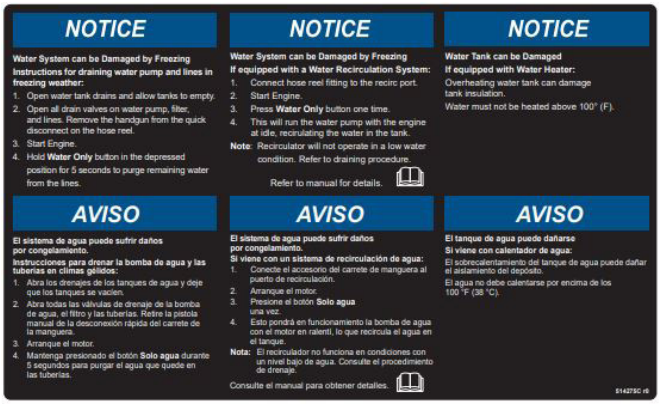
For proper combustion air flow and to avoid fuel build up the unit must be stationary and the cabinet door must be open during operation.

Recirculator

Options

If the unit is equipped with a recirculator, water can be recirculated to reduce the risk of freezing. If equipped with a water heater the water can also be preheated while stationary.

Recirculating water keeps the water from freezing. If a water heater, water can be preheated for cold weather applications, certain soil types, and cleaning the TRXX unit. The water heater can not be used at the same time as the recirculator.



If equipped, follow process below to operate:

1. Connect hose reel fitting to the recirc port.
2. Start Engine.
3. Press **Water Only** button one time.
4. This will run the water pump with the engine at idle, recirculating the water in the tank.

Note: Recirculator will not operate in a low water condition. Refer to draining procedure.

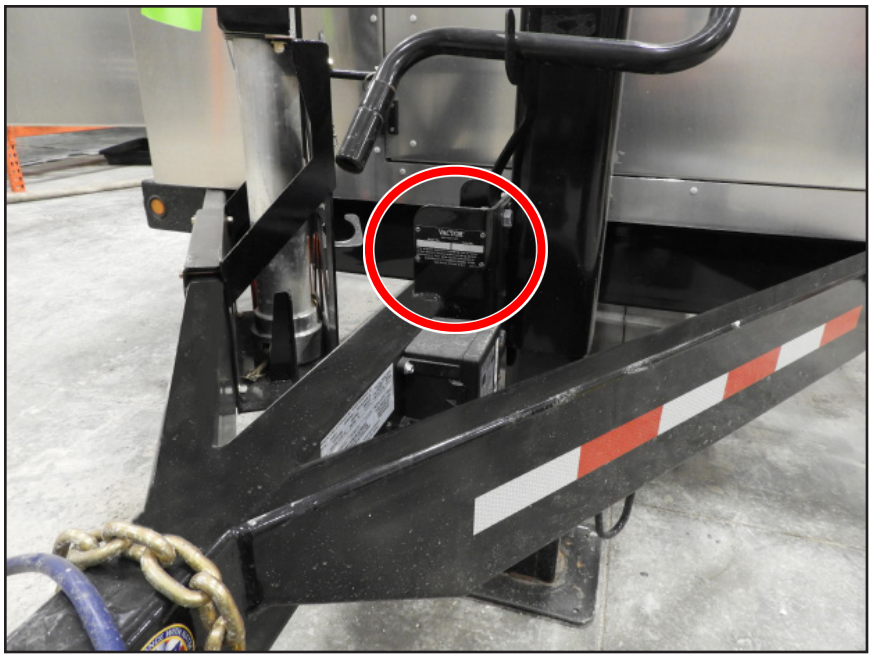
NOTICE

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.

Maintenance



Normal location is on the jack mount on the trailer tongue.

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	Inspect trailer running gear, lighting, etc.			
2	Inspect all door seals	1st week		
3	Inspect all vacuum hoses	1st week		
4	Wash and clean entire unit	1st week		
5	Inspect all safety equipment, guards, etc.	1st week		
6	All grease zerks (unless otherwise noted)	1st week		
7	Lift cylinder	1st week		
8	Debris body hinges	1st week		
9	Rear door hinges	1st week		
10	All clamp and lid screws	1st week		
11	Change blower oil if equipped	100 hours		
12	Change hydraulic oil filter	100 hours		
13	Belts	1st week		
14	Grease boom	1st week		
15	Inspect / repair leaks	1st week		
16	Change oil & lube water pump	50 hours		
17	Air compressor (if equipped; see manufacturer's manual)			

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.

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	Check/service trailer running gear, lighting, etc.	x	x	x	x	x
4	Inspect all door seals		x			
5	Inspect all vacuum hoses	x				
6	Wash and clean entire trailer		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 piping boots	x				
13	Inspect and clean cyclone & dust box (if equipped)	x				
14	Check water Y-strainer Filter Screen	x				
15	Check Body/Boom Seals for Leakage & Condition		x			
16	Flush high pressure water pump		x			
17	Inspect and rotate vacuum suction hose			x		
18	Inspect and clean water tank sensor probes				x	
19	Inspect high pressure wand and hand gun for damage	x				
20	Water pump oil and piston lube points	x				
21	Check blower drive belts and pulleys	x				
22	Inspect water & hydraulic hoses for wear or damage	x				
23	Inspect hoses and gaskets for leaks and wear	x				
24	Check pressure limiting devices (hydraulic and water reliefs)		x			
25	Service water pump (see manufacturer's manual)	x	x	x	x	x
26	Check water pump couplings for movement/looseness			x		
27	Check blower couplings for movement/looseness			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.

TRUVAC®

Technical Service Hotline - 877-342-5374

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 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 unit
- 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
- 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
- Inspect for proper functioning of pressure relief valves
- Inspect cyclones for excess material (if equipped)
- Inspect all safety equipment, guards, etc.

Línea directa de servicio técnico: 877-342-5374

Funcionamiento general

- Consulte el manual del OPERADOR para conocer los detalles completos sobre la SEGURIDAD y el FUNCIONAMIENTO correcto de esta unidad.
- Llame al 811 antes de todas las operaciones de excavación para ubicar y marcar todos los servicios públicos conocidos
- Verifique que todo el equipo funcione de manera segura y esté apto para el trabajo a realizar.
- No opere si los alivios de altovacío de seguridad automáticos y manuales no están instalados o no funcionan correctamente.
- Trabaje en equipo con el segundo operador.
- Use ropa y equipo de protección.
- Coloque la manguera de vacío con la boquilla en el extremo de trabajo de la manguera.
- El extremo de trabajo del tubo de vacío debe ser blando y no conductivo.
- Siga los procedimientos del sitio para la electricidad estática y la conexión a tierra del camión.
- No use una presión o temperatura excesiva del agua.
- Funcionamiento en clima frío: vacíe según sea necesario.

Lista de comprobación de servicio diario

- Revisar todos los equipos de seguridad, las protecciones, etc.
- Revisar el nivel de aceite del soplador
- Revisar el nivel de aceite hidráulico
- Inspeccionar todas las mangueras de altovacío
- Vaciar, inspeccionar y limpiar el microfiltro (si está equipado)
- Vaciar, inspeccionar y limpiar todos los filtros de aire/agua y los tamices en Y
- Inspeccionar que las válvulas de alivio de altovacío funcionen correctamente
- Inspeccionar el cabezal de entrada y los sellos de la funda de entrada
- Inspeccionar las mangueras de alta presión para buscar desgaste excesivo, daños o montaje incorrecto de los accesorios
- Inspeccionar las mangueras y las juntas
- Inspeccionar y limpiar todos los sellos de las puertas antes de cerrar las puertas
- Inspeccionar el funcionamiento correcto de las válvulas de alivio de presión
- Inspeccionar los ciclones en busca de exceso de material (si están equipados)
- Revisar todos los equipos de seguridad, las protecciones, etc.

514275A rC

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 hydraulic oil and filter			First		x
9	Check the tightness of the blower oil case plugs			x		
10	Grease boom swivel bearing (2)		x			
11	Grease boom sleeve (3)			x		
12	Grease boom lift Cylinder (1)			x		
13	Grease boom hinge pin (1)			x		
14	Grease boom pivot pin			x		
15	Grease Debris Body Hoist Cylinder (2)			x		
16	Grease Debris Body Hinge (2)			x		
17	Grease Debris Body Door Hinge (4)			x		
18	Grease Debris Body Rear Door/Hyd. Locks (4)		x			
19	Water pump (see manufacturer's manual)	500 hrs or 3 months				

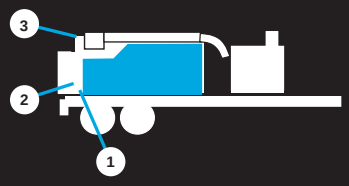
Grease - Unless otherwise noted grease all zerks and required surfaces with Castrol Pyroplex Protection ES Synthetic EP Grease NLGI #2 (purple) or equivalent. Special operating conditions (excessive temperature or speed) may require a different type of grease (consult the factory). Do not over grease.

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.

NOTICE

Keep grease fittings clean, accessible, and free from damage. Grease fittings should be checked every week. Examine and replace broken fittings.



WEEKLY (25HRS) GREASE POINTS

1	DEBRIS BODY MOUNTING HINGE - Monthly
2	REAR DOOR LOCKS
3	BOOM PIVOT
4	ALL SMALL DOOR HINGES
-	---
-	---

PUNTOS DE ENGRASE SEMANALES (25 H)

1	BISAGRA DE MONTAJE DEL CONTENEDOR DE DESECHOS: mensual
2	Trabas de la puerta trasera
3	PIVOTE DEL BRAZO
4	TODAS LAS BISAGRAS DE PUERTA PEQUEÑAS
-	---
-	---

514275A rC

DANGER

Rotating Drive Hazard

Contact with drive may cause severe personal injury or death.

Never operate with covers removed. Stay clear when operating.

PERIGO

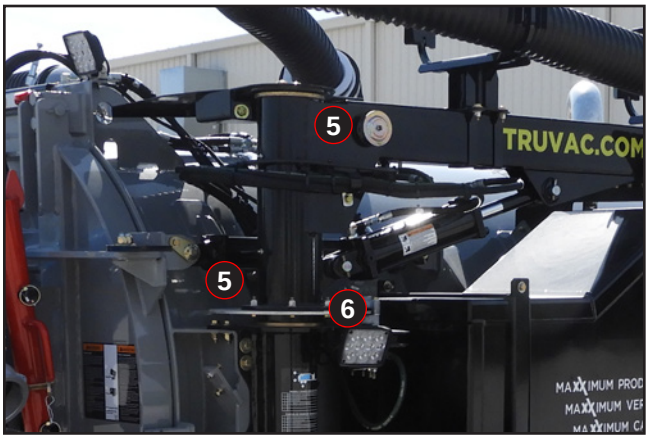
Peligro de línea de impulsión en rotación

El contacto con la línea de impulsión podría causar graves lesiones personales o la muerte.

Nunca opere con las cubiertas fuera de lugar. Manténgase alejado durante la operación.

514275A rC

1	Rear Door Hinges (2)
2	Rear Door Locks (4)
3	Debris body Hinges (2)
4	Debris body Lift Cylinder (not shown)
5	Boom Hinge Pin and column
6	Boom Lift Cylinder (2)
7	Top Rear Blower Bearing if equipped
8	Bottom Rear Blower Bearing if equipped



NOTICE

Keep grease fittings clean, accessible, and free from damage. Grease fittings should be checked every week. Examine and replace broken fittings.

The hydraulic system leaves the factory filled with Castrol Hydraulic Standard 46 oil. The system operates at 1GPM idle and 4GPM full RPM. 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.

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.

The first change is for the filter at 100 hours and oil every 500 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 which 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, and system off when checking level. Check the oil level every eight hours. If the oil level is low, add proper grade hydraulic oil.

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 can be accessed from the curb side near 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.

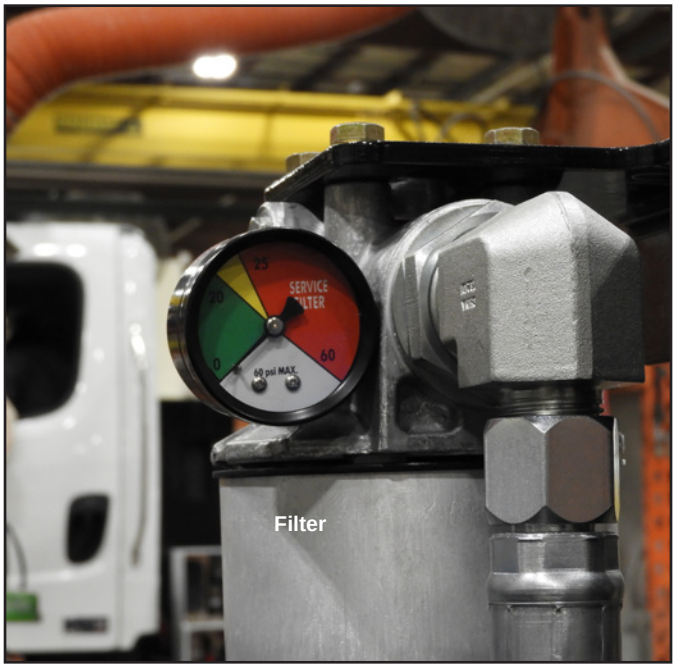
1. Shut down the system and relieve pressure in the filter line.
2. Remove the housing.
3. Install the new element.
4. Pre-fill the new style housing to the top of the filter element. This reduces the amount of air introduced into the system
5. Reinstall the housing
6. Start the hydraulic pumping system and check for leaks. If oil seepage is noted, apply additional hand torque to the canister until seepage stops.

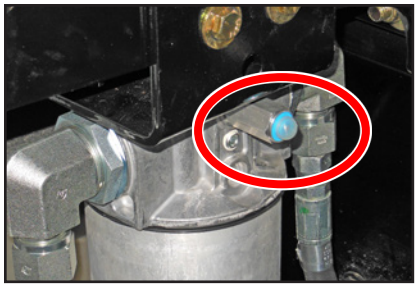
NOTICE

Machine Can Be Damaged

To avoid damage:

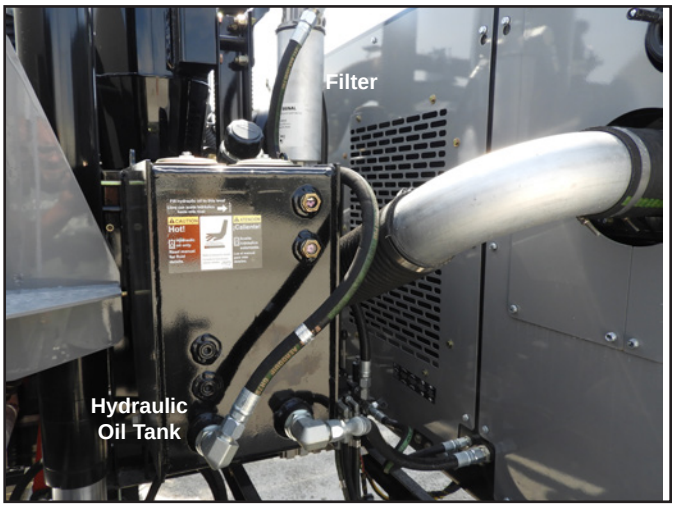
- **Never overfill or under fill lubricant or fluid levels.**
- **Maintain proper fill levels.**
- **Always use the correct lubricant or fluid.**
- **Overfilling can cause overheating in gear lubrication systems.**
- **NEVER operate with either a malfunctioning lubrication system or indicator light ON (if equipped).**





Note: besides the typical gauge used on the oil filter housings a second type shown above is used. A red indicator will pop out when ready to be changed.

The hydraulic reservoir should be drained, flushed and filled every 500 hours or six months, whichever comes first. The oil strainer should be removed and cleaned each time the hydraulic oil is changed.



Note: The hydraulic reservoir contains approximately 20 gallons of oil. When draining the reservoir, a suitable container must be used to hold the oil and prevent spills. It may be necessary to drain the reservoir a small amount at a time.

Change the Hydraulic Oil and Clean the Strainer

1. Place a suitable container below the hydraulic reservoir and remove the drain plug from the lower front of the reservoir.
2. Remove the reservoir cap and reach inside the reservoir and remove the oil strainer by unscrewing it.
3. Inspect the strainer for wear or damage. Replace the strainer if worn or damaged.
4. Using compressed air thoroughly clean the strainer.
5. Install the strainer in the hydraulic reservoir and tighten. (Hand tighten plus one-half turn.)
6. Inspect the diffuser and replace if any damage is present.
7. Inspect the reservoir cover and seal for wear or damage. If worn or damaged, replace the cover and seal.
8. Install the cover on the reservoir and secure with the cover bolt. Tighten to general torque specifications.
9. Fill the hydraulic reservoir using the oil specified in the chart entitled A/W Hydraulic Oils.

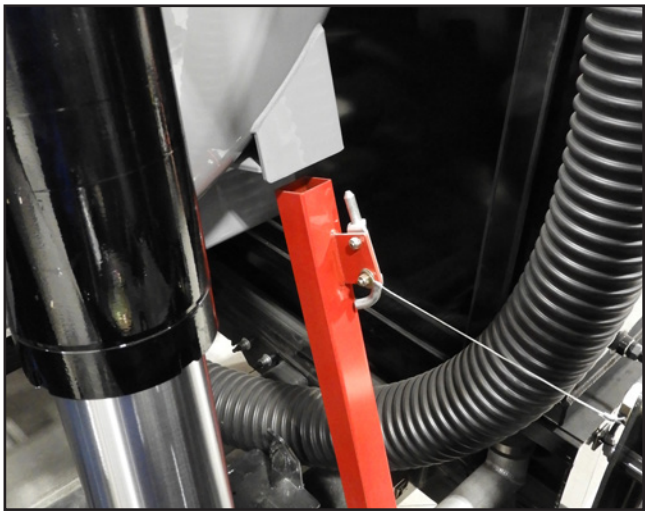
Each Truvac is supplied with two safety props. One is for the back door and one is for the debris body. If either is missing, notify your dealer immediately for replacements).

The safety props are used during certain maintenance procedures. If properly used, the rear door prop is designed to prevent accidental closure and the debris body prop will prevent accidental collapse.

Rear Door Prop

Rear door prop correctly locked in maintenance position.

Debris body Prop



Debris body prop correctly locked in maintenance position.

The blower requires proper alignment and belt tension for proper operation. Monthly visual inspections of the belt and pulleys are required to assure the condition and position of the coupling. It should be visually checked for any signs of movement, being loose, or any sort of belt wear. If required clean, reassemble and torque as noted here. Belt tension specs found below or on back of belt access panel (on unit).

The following tools will be needed to set belt tension:

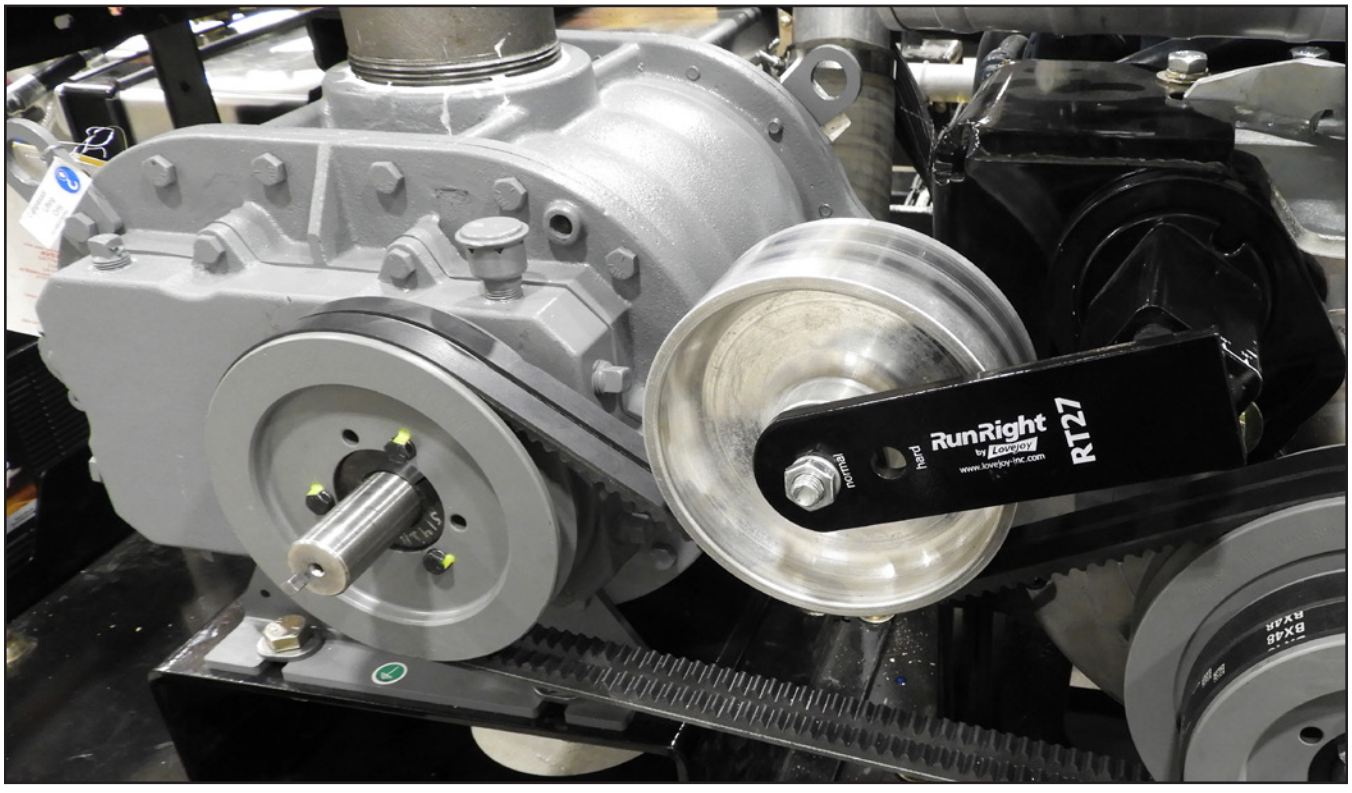
1. McMaster-Carr: 6018K16 (B-section V-belt tension gauge)
2. McMaster-Carr: 3273A1 (pocket laser)
3. McMaster-Carr: 2141A11 (aluminum line level)

Belt Tension Settings:

1. Base static tension per belt is 80.3 LBF.
2. Total base static tension is 160.7 LBF.

Sheave and bushing bolt torque specs:

1. Blower sheave to bushing bolts: 8.5 ft-lb (use blue serviceable loctite).
2. Engine/blower sheave to bushing bolts: 15 ft-lb (use blue serviceable loctite)



The water pump requires proper alignment and belt tension for proper operation. Monthly visual inspections of the belt and pulleys are required to assure the condition and position of the coupling. It should be visually checked for any signs of movement, being loose, or any sort of belt wear. If required clean, reassemble and torque as noted here. Belt tension specs found below or on back of belt access panel (on unit).

The following tools will be needed to set belt tension:

1. McMaster-Carr: 6018K16 (B-section V-belt tension gauge)
2. McMaster-Carr: 3273A1 (pocket laser)
3. McMaster-Carr: 2141A11 (aluminum line level)

Belt Tension Settings:

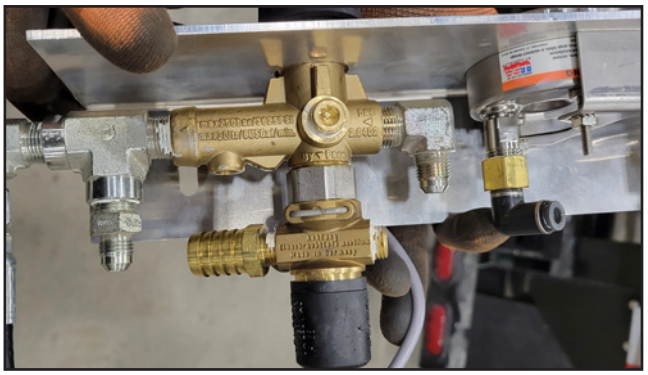
1. Base static tension per belt is 72.5 LBF.
2. Total base static tension is 145 LBF.

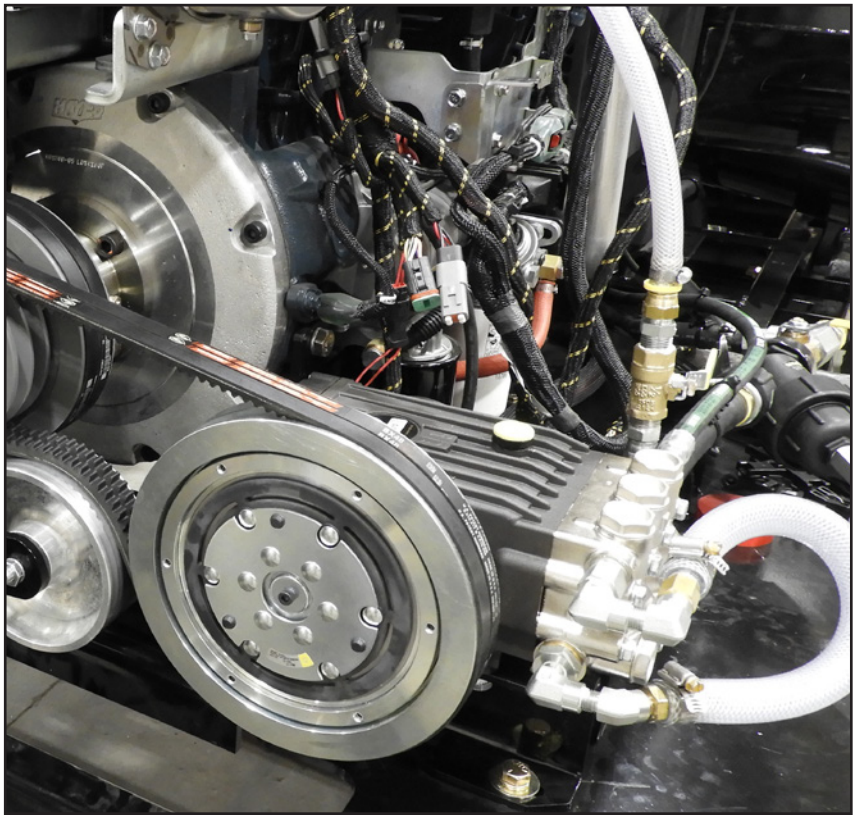
Sheave and bushing bolt torque specs:

1. Engine/water pump sheave to bushing bolts: 8.5 ft-lb (use blue serviceable loctite).

Confirming Unloader Valve Operation

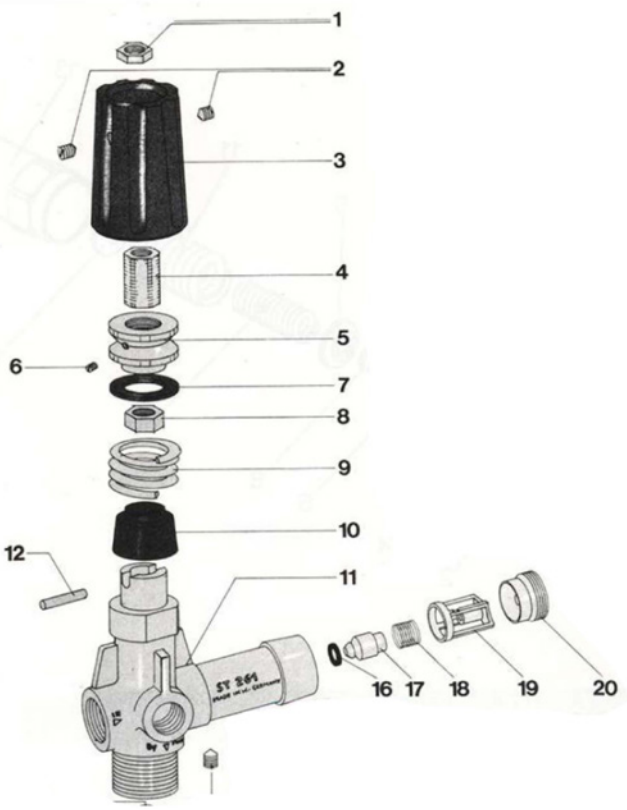
1. Attach handgun with the standard nozzle.
2. Unit needs to be running and water pump engaged.
3. With the handgun trigger depressed, adjust unloader valve to 3000psi.
4. When the handgun trigger is released there should be about a 100psi spike to around 3100psi and then the gauge will go to zero. The pump should still be running.
5. Repeat step 4 to verify pressure is consistent.





Unloader Valve Adjustment Procedure

1. Loosen both set screws (2).
2. Remove knob (3)(lifts off). Remove nut (1) and set aside.
3. Loosen the set screw (6) in adjuster (5). Turn the adjuster counterclockwise to the top of the adjusting screw insert (4) then tighten set screw (6).
4. Using an adjustable wrench, turn adjuster (5) clockwise until adjusting screw insert contacts the nut (8).
5. Loosen set screw (6) so adjuster (5) can turn freely without turning adjusting screw insert (4).
6. With the proper GPM nozzle fitted, start the water pump and spray water at the max engine RPM. Turn adjuster (5) clockwise to achieve max system pressure, then tighten set screw (6).
7. Spray and release several times to confirm proper operation.
8. Install knob (3) and tighten set screws (2), then turn the knob counterclockwise to the lowest desired spraying pressure and install nut (1) until it contacts knob (3).



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.**

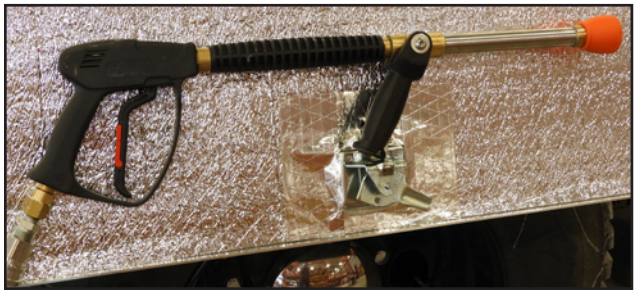
NOTICE

Machine Can Be Damaged During Cleaning

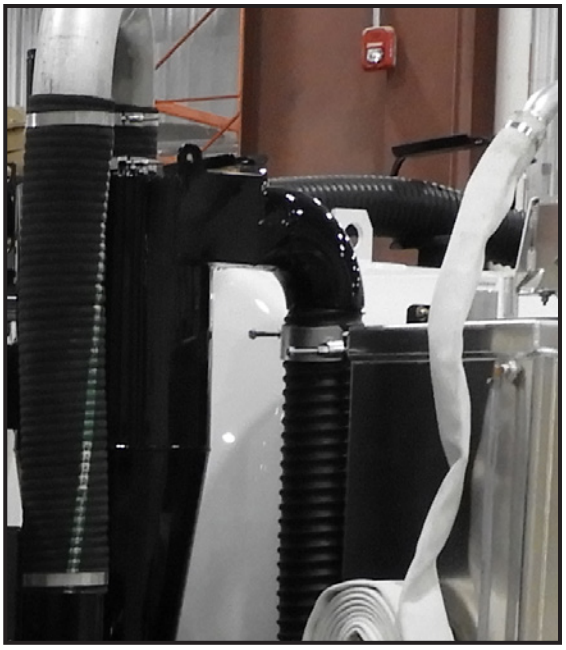
High pressure water can damage or remove safety decals, vents, paint, wash lubricants out of bearings, and damage seals or other soft components. Avoid spraying on or around electrical boxes and components.

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 clamp that connects the hose to the outlet should be inspected periodically. Make sure clamp is tight, hose is in good condition, and is properly sealed at the connection points.

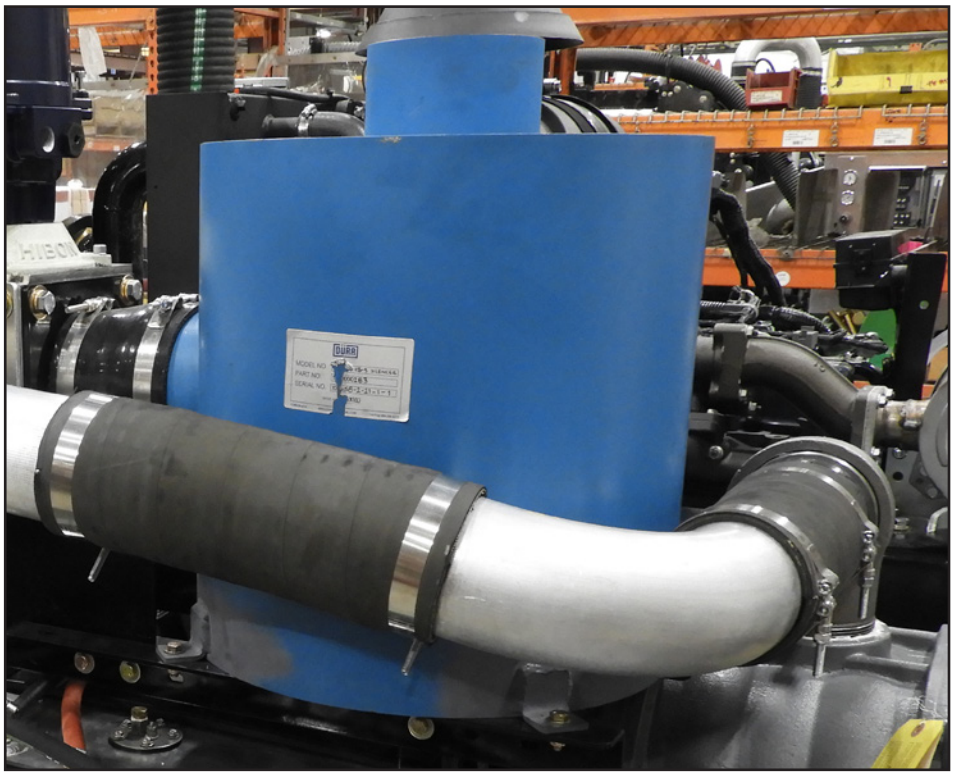


Replacement of the boom hose is made by rotating the boom out towards the rear of the unit so that the boom is aligned/straight with the debris body inlet. Drop the boom down so the hose goes across the boom pivot. This is the longest distance the hose has to make. After removing the old hose verify the new hose is the same as the old one before installing. Failure to utilize the same hose may result in kinking at the bend radius.

Note: Store all replacement boom hoses spread out straight to avoid inducing a preset memory to the hose which can happen when stored when coiled.

A silencer is located inside the enclosure that is plumbed post blower in order to lower sound levels during operation.

Verify the exhaust elbow is tight and facing rearward so as water cannot enter during travel. Also check periodically to make sure there are no obstructions.



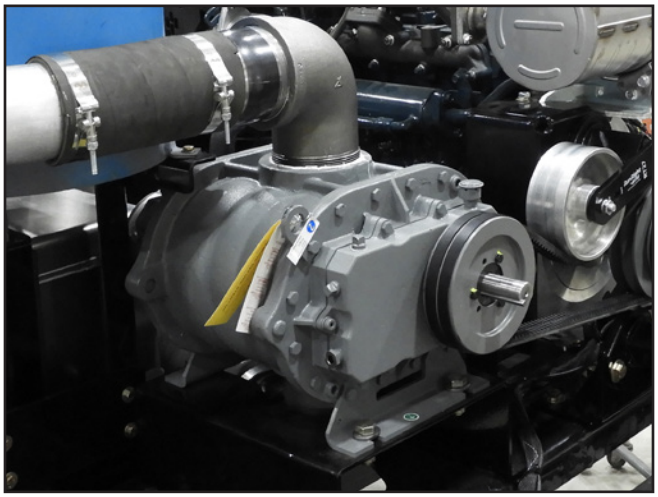
For blower description, maintenance and operation, see the blower manuals supplied with the vehicle.

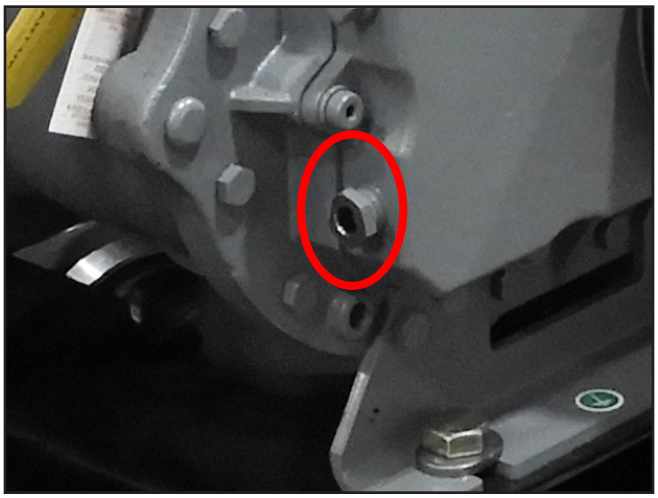
Freezing Weather

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 two 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.





For complete maintenance see the blower manuals supplied with the vehicle.

RECOMMENDED OIL GRADES	
Ambient Temperature °F (°C)	**ISO Viscosity No.**
Above 90° (32°)	320
32° to 90° (0° to 32°)	220
0° to 32° (-18° to 0°)	150
Below 0° (-18°)	100

Use a good grade of industrial type non-detergent, rust inhibiting, anti-foaming oil and of correct viscosity per Table 2. *ROOTS™ synthetic oil (ROOTS P/N 813-106-) is highly recommended. ROOTS™ does NOT recommend automotive type lubricants, as they are not formulated with the properties mentioned above.

NOTICE

Water pump can be damaged

To avoid damage never operate water pump without water.

Instructions for draining water pump and lines in freezing weather

1. Open drain for water tanks and allow tanks to empty.
2. Open all drain valves on water pump, filter and lines. Remove the handgun from the quick disconnect on the hose reel.
3. Run water pump for 5 seconds and blow remaining water from lines.

Refer to manual for details

Rear Door Can Be Damaged

Remove and secure 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.

Operation

No one shall operate or service this equipment until they read and understand the operation and maintenance manuals. Additional copies can be obtained by calling the 24 hour a day service hotline. In the USA or Canada

Call: 877-DIAL ESG or 877-342-5374

Outside the USA or Canada

Call: 847-741-4330

AVISO

La bomba de agua puede dañarse

Para evitar daños, nunca haga funcionar la bomba de agua sin agua.

Instrucciones para drenar la bomba de agua y las tuberías en clima de congelación

1. Abra los purgadores en los depósitos de agua y deje que los tanques se vacíen.
2. Abra todas las válvulas de drenaje de la bomba de agua, el filtro y las tuberías. Retire la pistola de la desconexión rápida del carrete de la manguera.
3. Haga funcionar la bomba de agua durante 5 segundos y sople el agua restante de las tuberías.

Consulte el manual para obtener detalles.

La puerta trasera puede sufrir daños.

Quite los soportes de seguridad antes de cerrar la puerta para evitar daños. Abra la puerta trasera antes de elevar el contenedor de desechos. Asegúrese de que los accesorios de la puerta trasera no toquen el paragolpes y la conexión a tierra al elevar el contenedor de desechos.

Operación

Ninguna persona operará ni realizará tareas de servicio en este equipo Vactor hasta que haya leído y comprendido el manual operativo y de mantenimiento. Se pueden obtener copias adicionales llamando a la línea telefónica de servicio las 24 horas del día. En EE.UU. o Canadá

Llame al: 877-DIAL ESG o 877-342-5374

Fuera de EE.UU. o Canadá

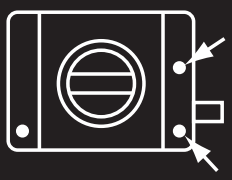
Llame al: 847-741-4330

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.

AVISO

El brazo puede sufrir daños.

El brazo solo debe utilizarse para su uso publicado, previsto y calificado. No sobrecargue. Para evitar daños, no lo utilice como dispositivo de elevación.

Servicio de mantenimiento del aceite del soplador

Revise el aceite del soplador diariamente o al comienzo de cada turno.

Todos los sopladores de altovacío están equipados con al menos una mirilla en cada extremo del soplador. Según la configuración del soplador, las mirillas pueden estar ubicadas en cualquier lateral o en ambos extremos del soplador y puede haber mirillas superiores e inferiores. El nivel de aceite debe revisarse en ambos extremos del soplador mientras la unidad está apagada y sobre un terreno nivelado.

Consulte la sección de mantenimiento del manual y el manual del fabricante del soplador.

514275A rC

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.

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).

Remove and store all drain plugs. This prevents rain water from building up in the filter housing. The plug must be reinstalled before use.

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 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.

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.

Pre-Job/Daily Checklist					
	Engine Off, Engine Cool			**Engine ON**	
Check	**Item**	**Date**	**Check**	**Item**	**Date**
	Radiator Coolant			Engine Sound and Exhaust	
	Battery Water			Taillights	
	DEF Tank			Turn Signals	
	Drive Belts			Marker Lamps, Front	
	Fan			Marker Lamps, Rear	
	Alternator			Instrument Panel Gauge/Keypads	
	Crankcase Oil				
	Fuel Tank				
	Trailer Brake Function				
	Instrument Gauges				
	Tire Wear				
	Tire Damage				
	Tire Inflation				
	Hoses				
	Frame				
	Engine Off			**Engine On, Wheels Chocked**	
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 Ball	
	Water Pump Oil Level			Inspect, Clean Rear Door Seal	
	Access Doors Secured			Store Rear Door Safety Prop	
	Hoses, Tubing, and Loose Items Secured			Close Rear Door	
				Verify Blower Operation	
				Activate E-Stop - check for messages	
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.

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.

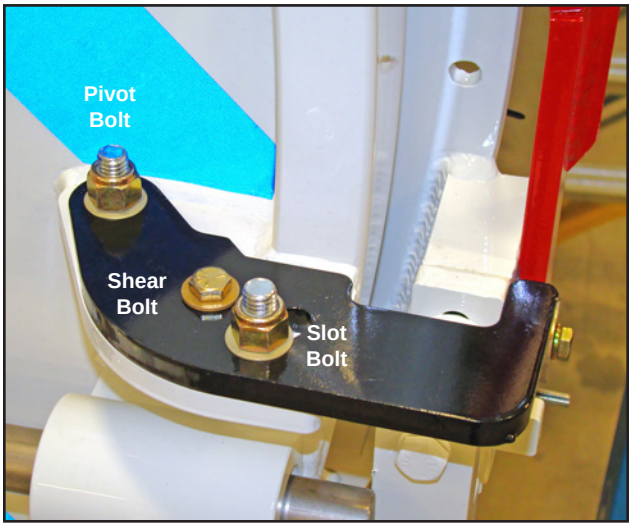
Remove the pivot and slot bolts and replace if damaged with standard grade 5 bolts. Reinstall all washers as shown.

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).



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

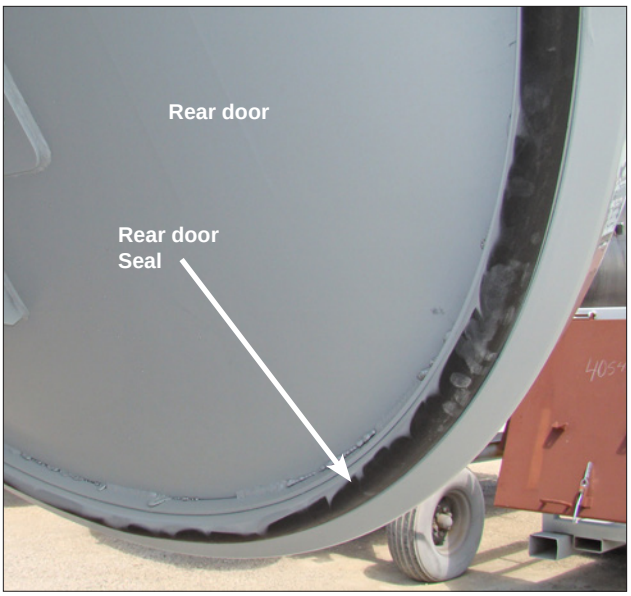
Seal Replaced with Door Removed

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:



a. Use the instructions posted in the cab to engage the hydraulic pump.

b. Raise the debris body. Install the debris tank and rear door safety prop.

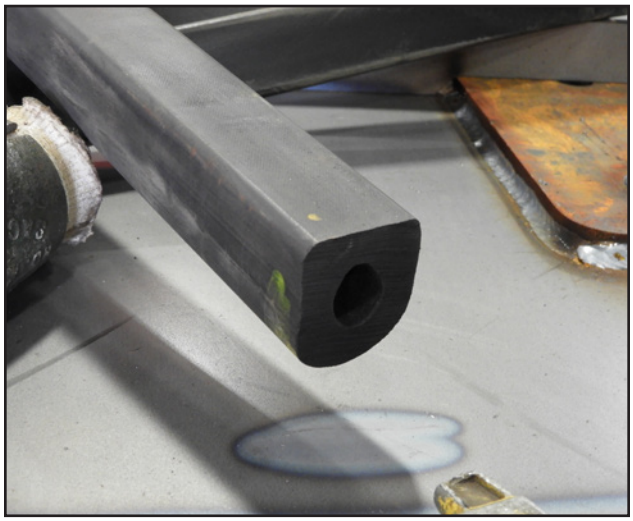
c. Shut down the engine and remove the ignition key.

d. Post a notice on the steering wheel that maintenance is being performed.

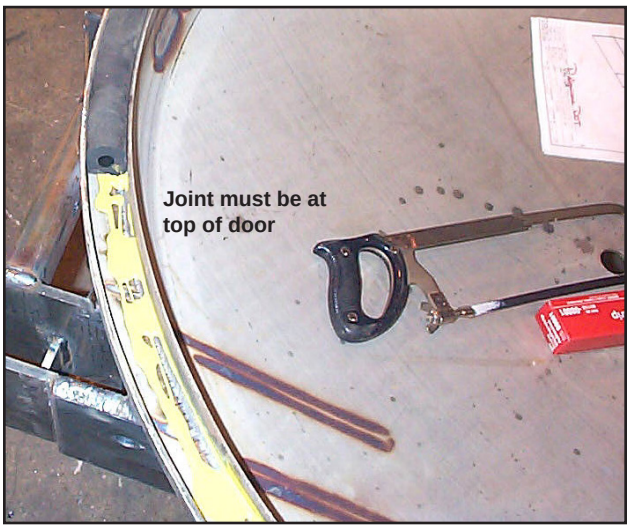
Procedure When Replacing the Door Seal

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.

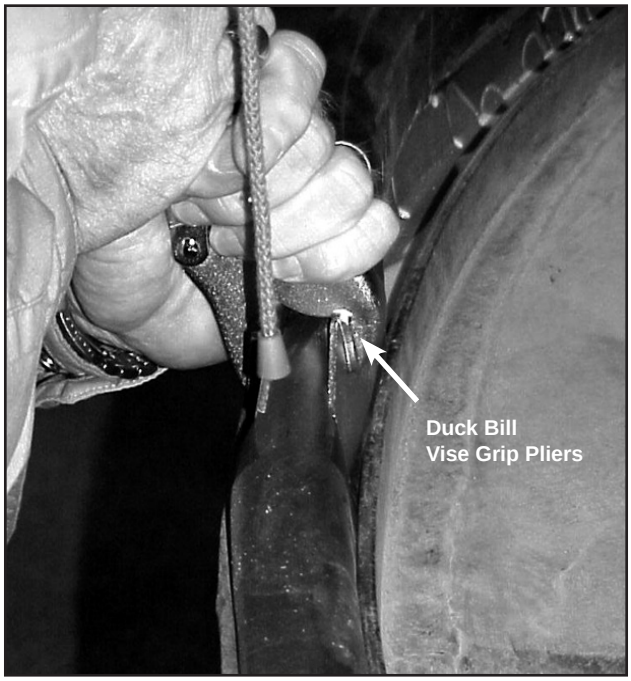
3. Make sure the end of the seal is cut squarely for a proper seal at the end of the procedure. A hacksaw works well.



4. Starting at the top of the door, place the flat surface of the new seal into the seal channel.

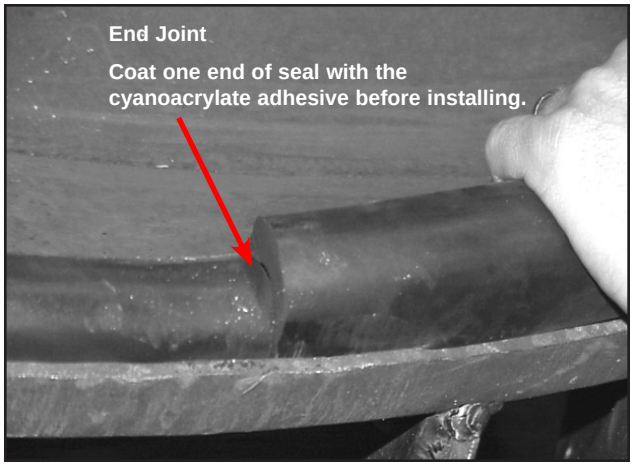


5. If installing the seal with the door on the vehicle, do the following:
   - Squeeze the seal with the duckbill pliers while feeding the seal into the channel.



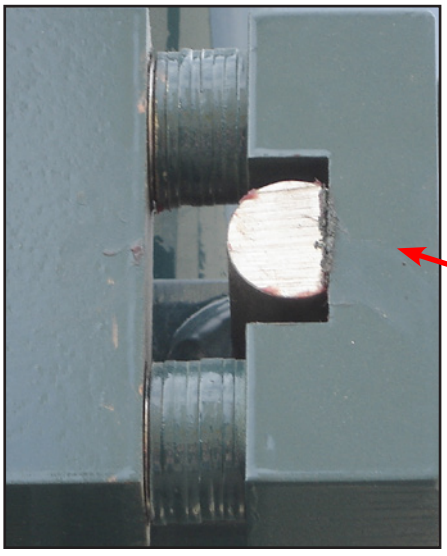
6. If installing the seal with the door removed do the following:
   - Using a mallet, pull on the seal while pounding the seal into the channel.

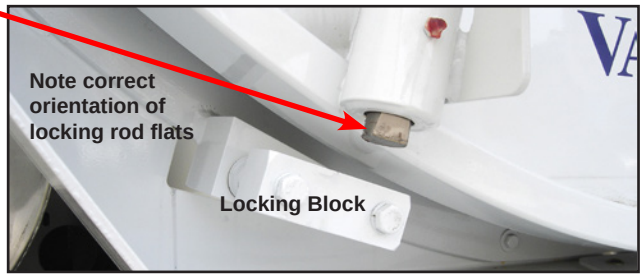
7. Use the hacksaw to cut off excess seal to form a flush, airtight mating surface between seal ends. Coat one end of seal with the cyanoacrylate adhesive before installing.
8. If installing the seal with the door off of the vehicle, use an overhead crane support and lift to install the door on the debris body.



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:

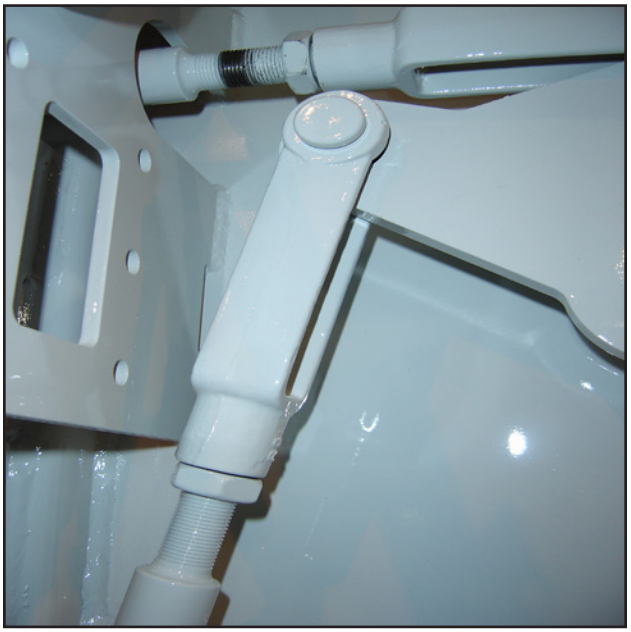
Note: A person at the rear of the unit watching the locks and one at the controls makes this task easier and provides immediate warning in case the locks are not set properly.

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 then 1/8” you can add washers to reach the required gap.
    b. If the gap is more then 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.

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.*

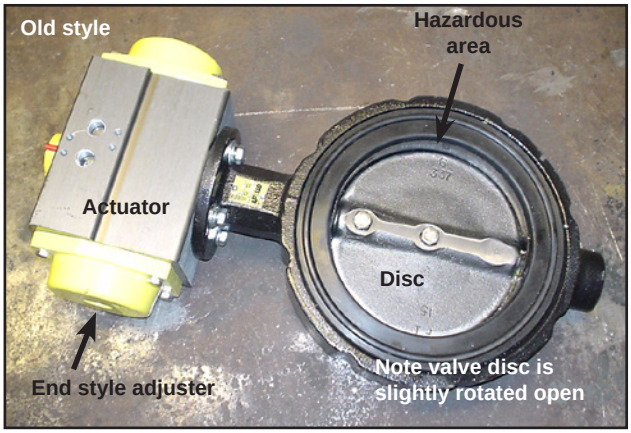
Butterfly pneumatic actuators are designed to allow adjustment without the removal of the actuator end caps. Typically there is a jam nut located on each end of the actuator in the center of the end cap. Newer style butterfly valves have the adjuster bolt on the side of the actuator. One adjuster controls the closed position and the other the open position.

With the valve in the CLOSED position:

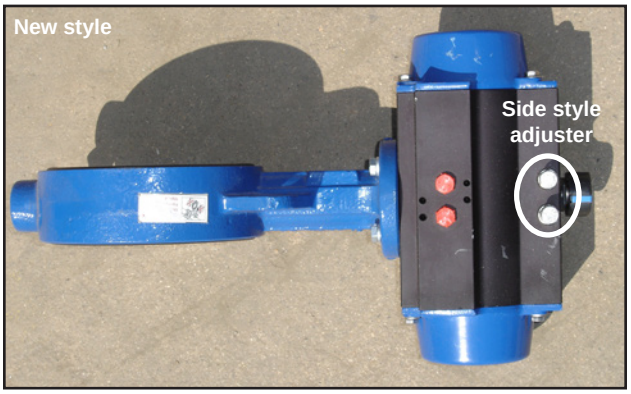
1. Determine which adjuster screw is for the closed position. It will be the one that moves the disc.
2. Adjust the screw all the way in (for side adjusters - out for end cap adjusters). This should give you about 5 deg. adjustment.
3. The disc should start to unseat in this position and still provide 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.

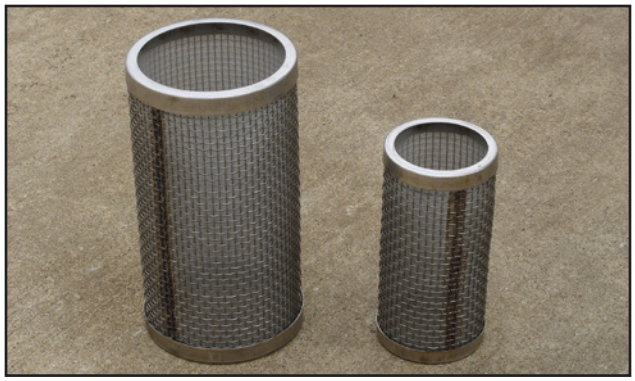
   Valve should open and close smoothly.



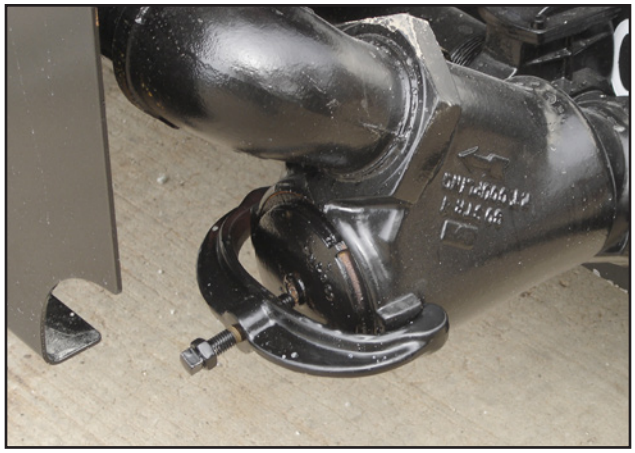
Butterfly Valve



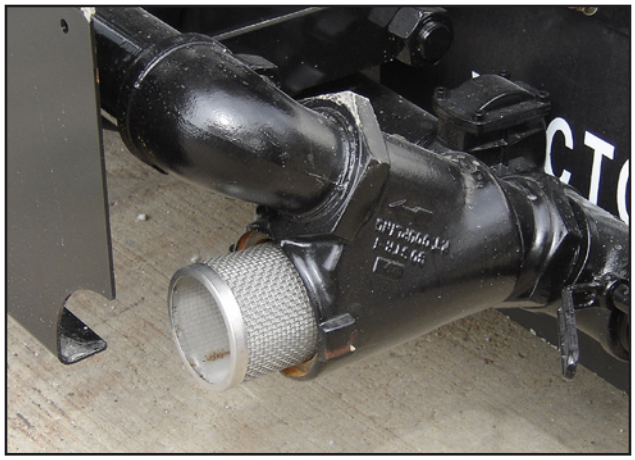
The Y strainer water filter is an important part of the maintenance program to protect the water pump from damage. The Y strainer comes in different sizes. Y strainers are normally either 2" or 3" and may be an option depending on where it is located. Each filter is inspected the same way and needs to 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

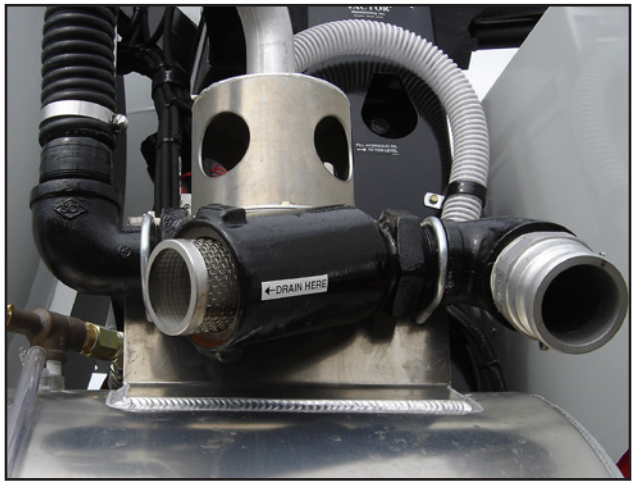


3" Y-strainer on water pump - Disassembled



2" Y-strainer at water fill - Assembled

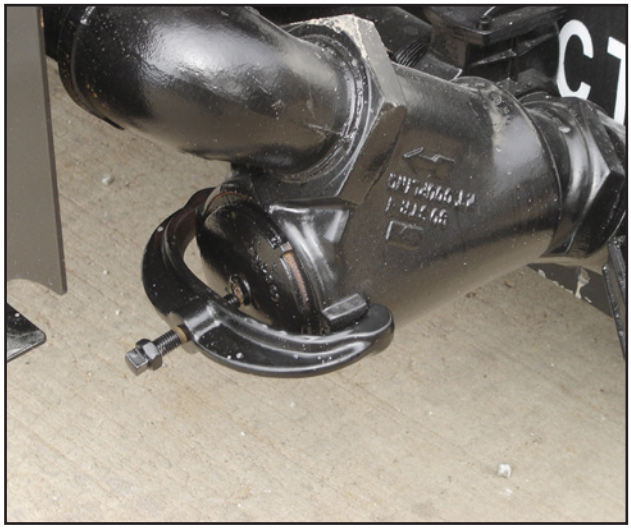
2" Y-strainer at water fill - Disassembled

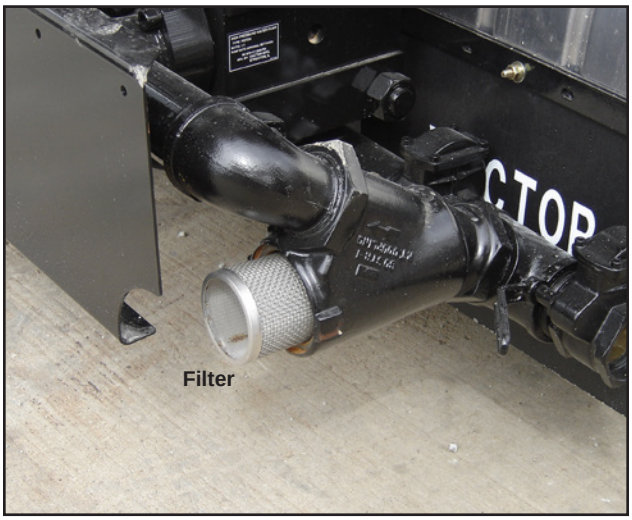


Remove the cap and the retainer from the filter housing. Then remove the filter. Inspect the filter for any damage. Replace any damaged filter. Inspect the inside of the filter for any dirt, stones, grime, etc. Be sure to clean any filter screen before reinstalling the filter. NEVER reinstall a dirty or damaged filter.

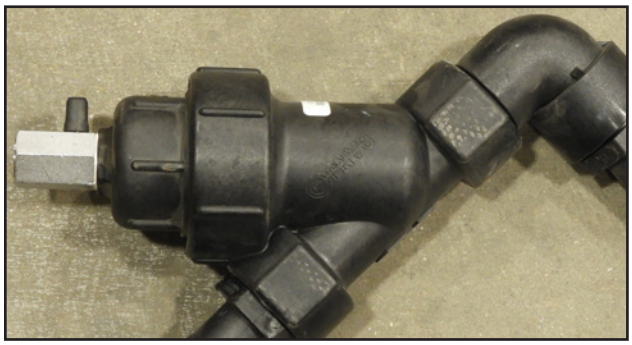
Always inspect the filter cap prior to installation. There are two gaskets on the filter cap. Both gaskets **must** be intact and in place before installing the filter cap. The outer gasket seals the cap to the housing. Water will leak out if this gasket is not in place.

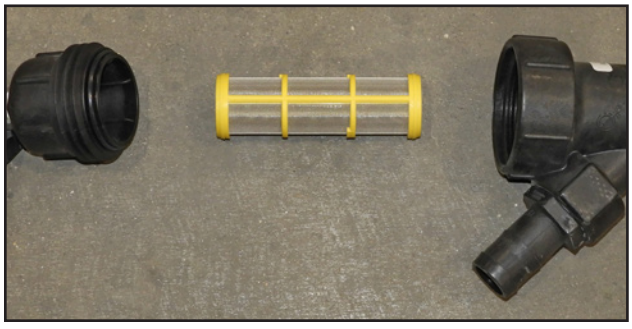
The second gasket seals the cover to the filter screen. If this gasket is missing, debris can bypass the filter screen and get into the water tank and eventually into the water pump causing damage to the pump. Both gaskets must be intact and in place. Replace any damaged or missing gasket.





Typical composite Y Strainer. Cap unscrews to remove filter.



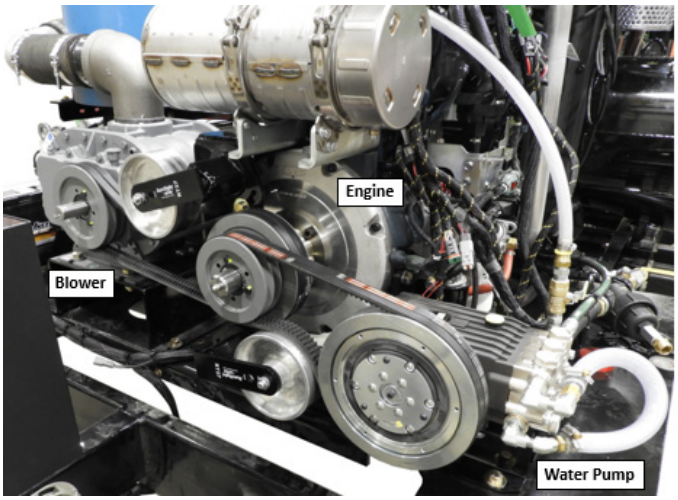


Belt and Sheave Alignment

Proper belt and sheave alignment is important for effective use of the HXX system. Misalignment can result in belt(s) coming off of the pulleys or premature belt failure. Proper aligment is achieved through angular and parallel measurement of the pulleys, as well as accurate adjustment. Alignment procedures are included below to achieve proper alignment.

Proper alignment assures:

1. Reduced belt/sheave wear and tear
2. Reduced friction, noise, and vibration
3. Reduced machine maintenance
4. Increased bearing and overall machine life

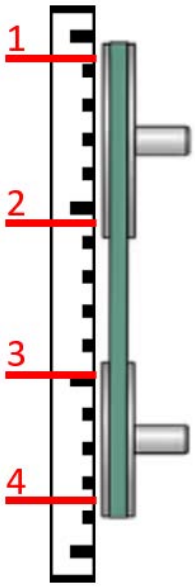


Blower V-belt P/N: 514219-30

Water Pump V-belt P/N: 514219A-30

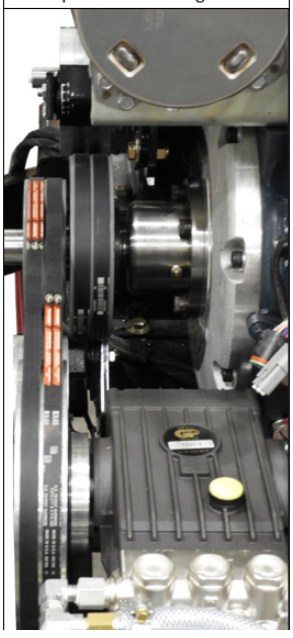
Alignment Measurement

A laser alignment device is the most ideal tool for aligning the sheaves; refer to its operator's manual for its model-specific instructions. When one is not available, alignment is measured by taking a straight-edge to the sides of both sheaves. The straight-edge may be a level, a ruler, or anything known to be straight that can span the distance across the sheaves. The straight-edge must make contact at four distinct points in a line along the outside of the sheaves (see picture). Any gaps between the straight-edge and sheaves can indicate misalignment and require adjustment. Refer to the chart below to recognize which misalignment, if any, is present.



Note: The technician must confirm that the sheaves' outer edges (measuring surface) thicknesses are equal, or, take note of and apply the difference since this will affect the measurement.

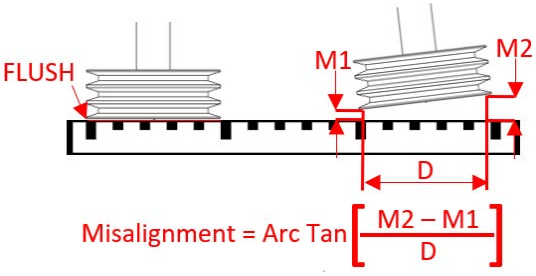
Proper TRXX Belt Alignment



Proper alignment is characterized by the sheaves being plumb, square, and parallel with the belt under the applications specified tension.	Vertical angle misalignment is characterized by a sheave being canted outward from the parallel plane of the sheaves.
Horizontal angle misalignment is characterized by the sheaves not being square with each other.	Parallel misalignment is characterized by one sheave being further outward than the other.

Refer to the specific belt manufacturer's guidance for acceptable terms of tension, wear, and misalignment values.

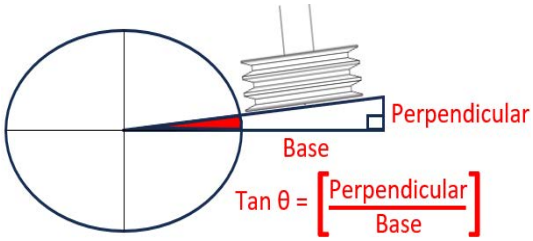
Alignment Measurement continued:



Angular misalignment is measured by determining the difference between two points (Measurements 1 and 2, M1 and M2, respectively) over a given distance (D).

Arc Tan is used to find the value of an unknown angle (Red) of a right triangle when its legs (the perpendicular and base) are known. The difference of M1 and M2 is the perpendicular of the triangle while D is the base.

The end result is a quantified value of angular misalignment (θ, Theta) measured in degrees (°) which can be reduced or eliminated through proper adjustment of components' positions or adjusting the sheaves' positions, themselves, on the components. This angular misalignment must be reduced to acceptable amounts to avoid the aforementioned symptoms.



Example: θ = Arc Tan ((1 - 0.5) ÷ 57.34)

θ = Arc Tan (0.5 ÷ 57.34)

= Arc Tan (0.00873) θ = 0.5°

Rule of Thumb Aligment Tolerances:

1. Synchronous, urethane 60-degree belts can endure up to one-quarter (1/4, 0.25°) of a degree in angular misalignment.
2. V-Belt designs can endure up to one-half (1/2, 0.5°) of a degree in angular misalignment.

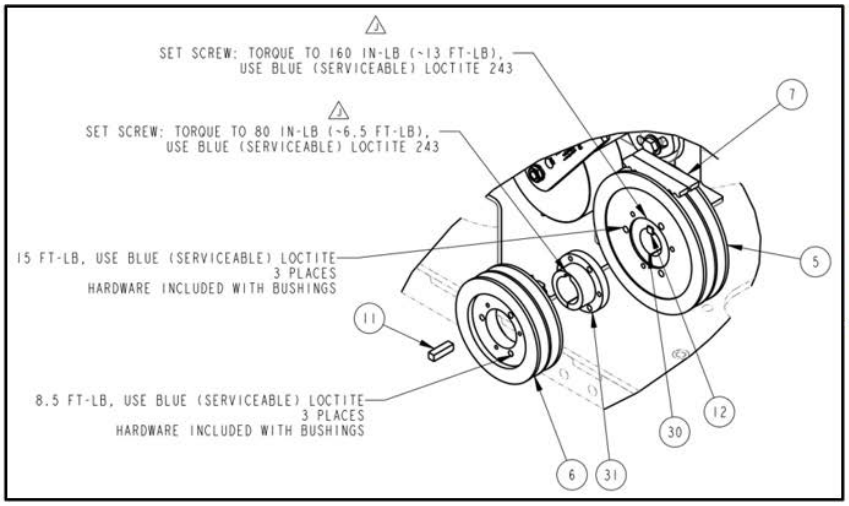
For synchronous, 60-degree angle, and V-ribbed drives:
1/4-degree angle = approximately 1/16-inch per foot of distance traveled.

For V-belt drives:
1/2-degree angle = approximately 1/10-inch per foot of distance traveled.

Sheave Position Adjustment for Alignment

For adjusting the sheaves, the "parallel" adjustment can be fine tuned by removing the three (3) bolts from the sheave, removing the sheave, and moving the bushing before re-assembling. While re-assembling, check the parallelism of the sheaves before finally re-tightening the bolts.

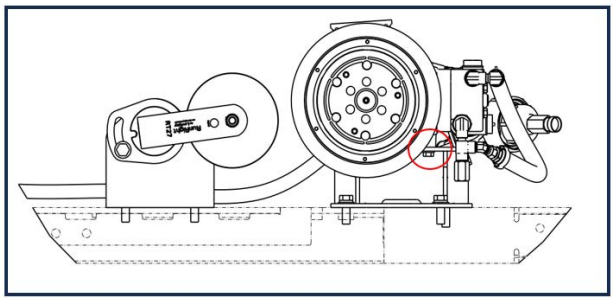
See diagram for items and their respective torque specifications.



Item #	Part #	Description
5	514217	SHEAVE, ENGINE TO BLOWER
6	514218	SHEAVE, ENGINE TO WATER PUMP
7	514219	BELT, ENGINE TO BLOWER
11	10075D	KEY, SQUARE, 3/8 X 3/8 X A
12	10075N	KEY, SQUARE, 3/8 X 3/8 X A
30	514217A	BUSHING, ENGINE SHEAVE
31	514218A	BUSHING, ENGINE SHEAVE

Component Posistion Adjustment for Alignment

Horizontal angle misalignment can be solved by loosening the base of the component needing adjustment, setting it in place, and re-tightening the bolts.



For the water pump, there are 4 bolts surrouding its underside securing it to the mount. These can be loosened to re-position the pump.

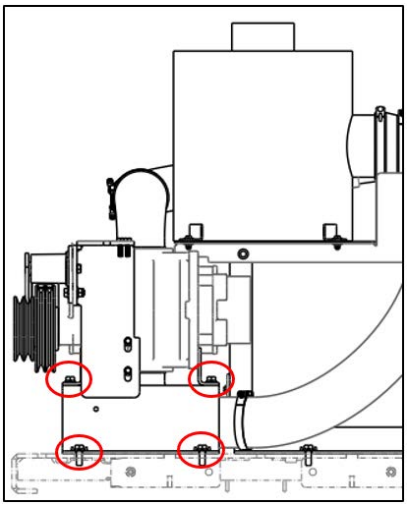
See diagram for bolt locations and note for tension.

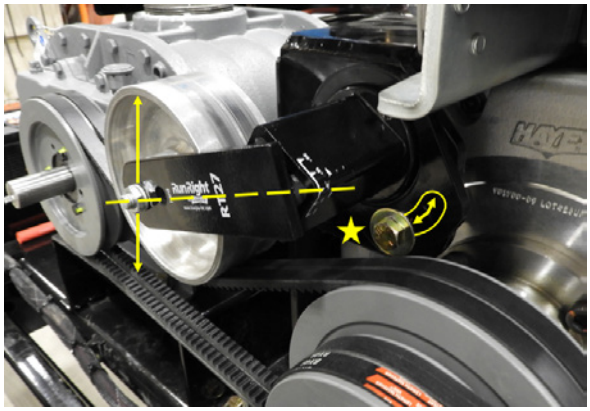
NOTE: FOR SETTING THE TENSION AND ALIGNMENT
OF THE BELTS, USE THE FOLLOWING TOOLS:
- McMASTER-CARR: 6018K16 (B-SECTION V-BELT TENSION GAUGE)
- McMASTER-CARR: 3273A1 (POCKET LASER)
- McMASTER-CARR: 2141A11 (ALUMINUM LINE LEVEL)
THE BASE STATIC TENSION PER BELT IS 72.5 LBF,
TOTAL BASE STATIC TENSION IS 145 LBF

For the blower, there are 4 bolts securing it to the mount and 4 bolts mounting the mount to the base. These can be loosened and the blower, and its mount, can be shifted independently for fine adjusting to align the belts.

See diagram for bolt locations and note for tension.

NOTE: FOR SETTING THE TENSION AND ALIGNMENT
OF THE BELTS, USE THE FOLLOWING TOOLS:
- McMASTER-CARR: 6018K16 (B-SECTION V-BELT TENSION GAUGE)
- McMASTER-CARR: 3273A1 (POCKET LASER)
- McMASTER-CARR: 2141A11 (ALUMINUM LINE LEVEL)
THE BASE STATIC TENSION PER BELT IS 80.3 LBF,
TOTAL BASE STATIC TENSION IS 160.7 LBF





The tensioners are adjusted by loosening both bolts (star location and one located above and behind the unit) on the mounting bracket, using a large wrench or crescent wrench to adjust for proper belt tension (see notes), then re-tightening the two bolts on the mounting bracket.

The idler pulley bolts are torqued to: 60 Ft-lbs. (LBF)

The tensioner mounting bracket bolts are torqued to: 60 Ft-lbs. (LBF)

Vertical misalignment can be indicative of other present problems. Before alignment, check all present components for damage or wear and tear. Replace if beyond serviceable condition.

Vertical misalignment can be reduced or eliminated by shimming the component and/or mount. This can be accomplished with washers between the components and/or mounts, as needed, to re-align the components within acceptable tolerances. Use sound judgment when shimming.

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.

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 ±20% ACCURACY*. TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS.

BOLT HEAD MARKING

GRADE 5

GRADE 8

	TORQUE IN POUND FOOT (LB-FT)	
NOM. DIA. INCH	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

	TORQUE IN NEWTON METER (Nm)	
NOM. DIA. INCH	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

*WRENCH TYPES WITH ±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 ±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 ±20% ACCURACY*. TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS.

BOLT HEAD MARKING

	TORQUE IN POUND FOOT (LB-FT)		
SIZE	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

	TORQUE IN NEWTON METER (Nm)		
SIZE	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

*WRENCH TYPES WITH ±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 ±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 trailer elbow or the horizontal hose connection location. Remove hose and inspect for blockage.
	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.
	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.

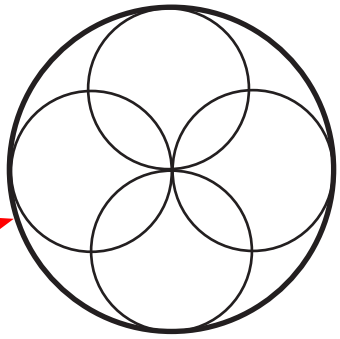
NOTICE

Machine Can Be Damaged

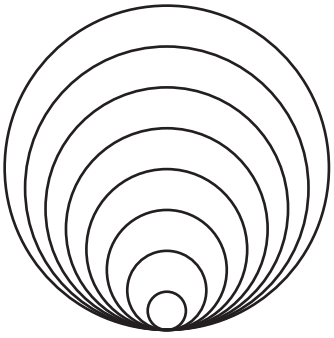
If ice builds up in the boom, shut down the vacuum system. Use hot water to heat the boom tubes or move the vehicle to a warm place. Slowly retract the boom when the tubes have warmed up. Do not retract the boom with ice build up in the vacuum tube. Damage to the boom and/or seal can occur. If hot water 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 using the process of elimination.

- Are the vacuum relief valves closed?

If not, close them. Never attempt to tape or cover any relief or safety valves shut. To do so will jeopardize safety and introduce the potential for serious bodily harm or death. Faulty valves need to be repaired, not bypassed or forcibly shut.

- Did you reduce the size of the hose 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 drops and some material falls out of 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 minor, 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, and if a smaller hose/tube is all that will work, run that size hose/tube right from the truck. Remember however that 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 the case of solids with an over-full body, debris might partially block the passageway. This translates to a loss of suction at the hose/tube end. If continued, debris will get carried over to the cyclone chamber (if equipped), choking the filter. Any blockage of the air path or a considerable reduction of airflow will not supply enough cooling to the blower causing it to overheat. 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 the failure of a water pump in an engine cooling system; if cooler water is not allowed to flow through the engine block, it will overheat rapidly causing damage.

How to correct

Stop vacuuming, empty the debris body, and clean it thoroughly. Check for or do the following procedures:

- 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.
- Replace a leaky gasket as soon as possible and repair any other sources of leaks.
- Repair or replace a damaged hose.
- Regulate the vacuuming speed. It is a misconception that increased blower RPM's will translate to completing the job more quickly, especially with lighter materials.

Note: 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, lightweight 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/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, but 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 housings.

- Is the silencer blocked?

Any dust that is small enough to pass through the system, also passes through the blower and silencer as well. 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 silencer, 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.

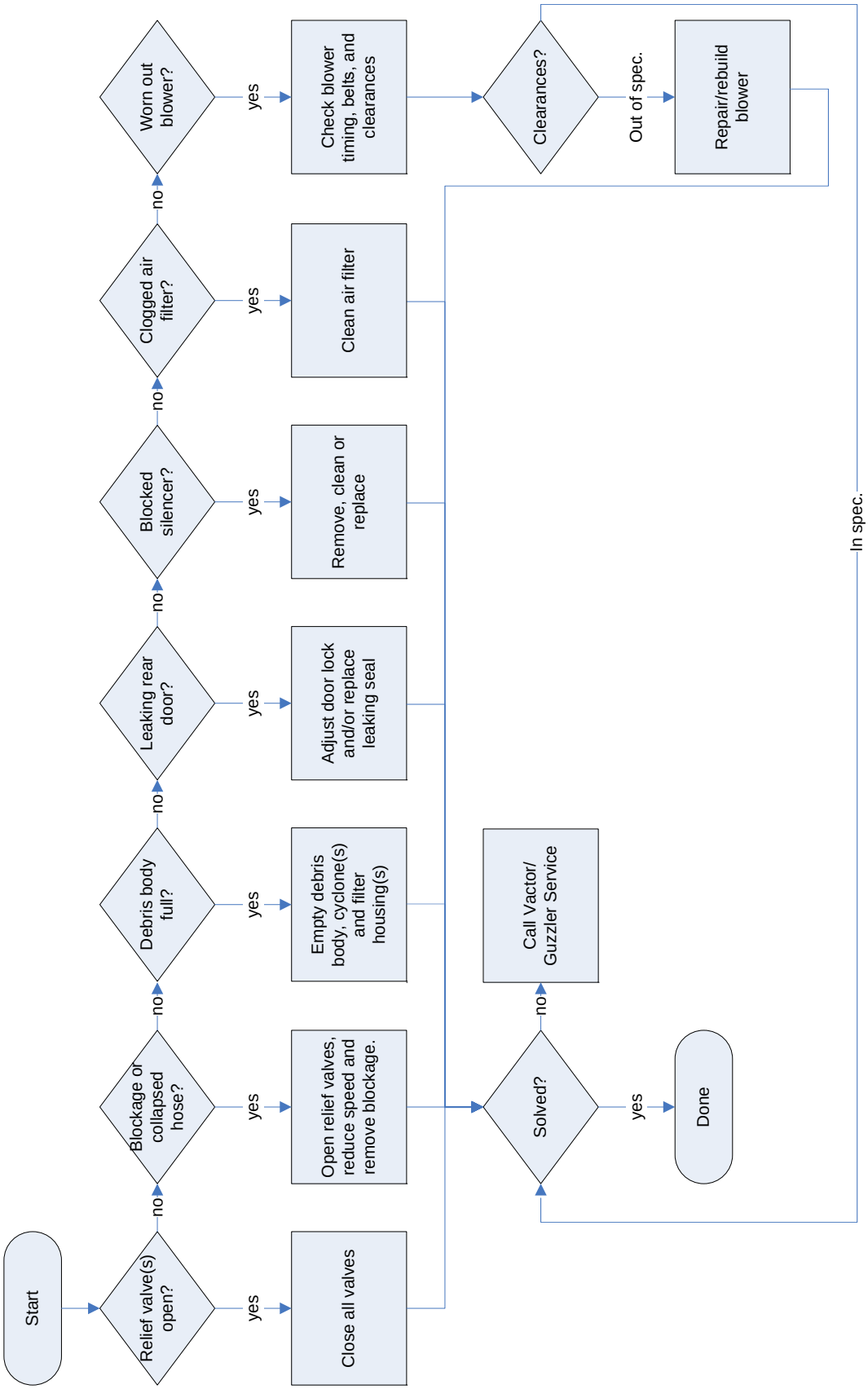
- Is the blower worn out?

Any dust particle that passes through the system, however small it may be and at the high speed it is traveling, sand blasts the internals of the blower. This will 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 at working temperature. This helps in creating a seal to trap air and pump it out. As the blower wears, the larger clearances provide a weaker seal, reduction in pumping performance, and decreased airflow. Eventually, the blower will need to be taken out of service and rebuilt.

The blower’s condition can be checked using the following method:

1. Find and repair all vacuum system leaks. This includes all door seals, hose connections, etc.
2. Cap the boom hose end to close it off.
3. Make sure unit is not in vacuum/dig mode.
4. Start the engine
5. Increase the blower speed to about 1500rpm.
6. Set the vacuum to dig mode.
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.


Start
Relief valve(s) open?
yes
Close all valves
no
Blockage or collapsed hose?
yes
Open relief valves, reduce speed and remove blockage.
no
Debris body full?
yes
Empty debris body, cyclone(s) and filter housing(s)
no
Leaking rear door?
yes
Adjust door lock and/or replace leaking seal
no
Blocked silencer?
yes
Remove, clean or replace
no
Clogged air filter?
yes
Clean air filter
no
Worn out blower?
yes
Check blower timing, belts, and clearances
Clearances?
Out of spec.
Repair/rebuild blower
In spec.
Solved?
yes
Done
no
Call Vactor/ Guzzler Service

Trouble	Probable Cause	Remedy
Noisy.	Low oil	Check sight gauge and add oil.
	Bearings bad	Disassemble and replace.
	Low RPM	Operate blower at 900rpm or higher.
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.
Protective strainer plugged (float ball cage)	Screen assemblies plugged	Dump debris, open body, lower safety props, clean screens.
	Float ball stuck	Remove and flush with water or air.

Trouble	Probable Cause	Remedy
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.
	Blower lobe wear or timing problem.	Refer to competent repair facilities (factory service can assist), or refer to blower manufacturer's maintenance manual.
	Slipping/squealing	Check belt tension per Maint. Section.
	Vacuum relief valves	Check for leaks and proper operation.

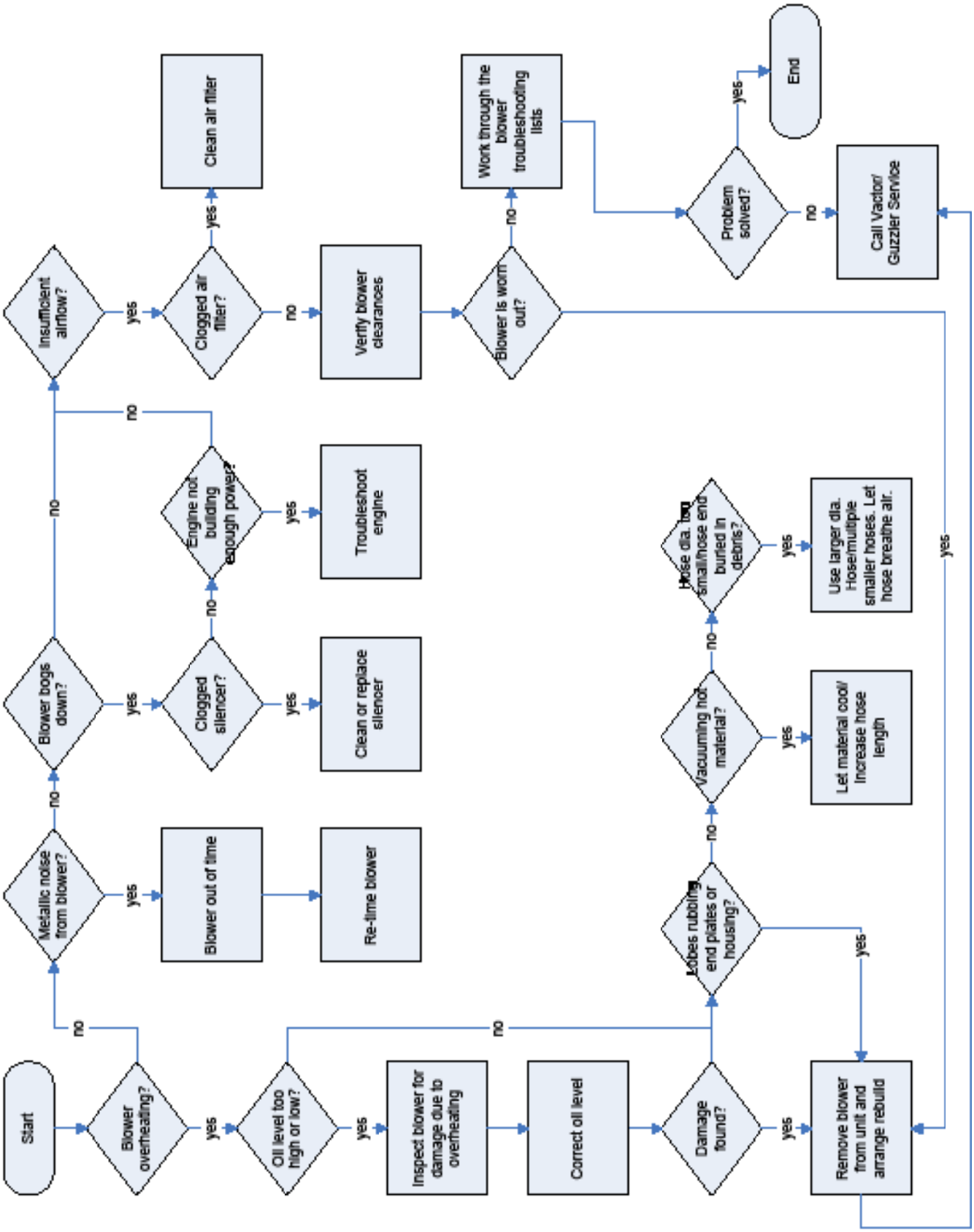
NOTICE

Machine Can Be Damaged

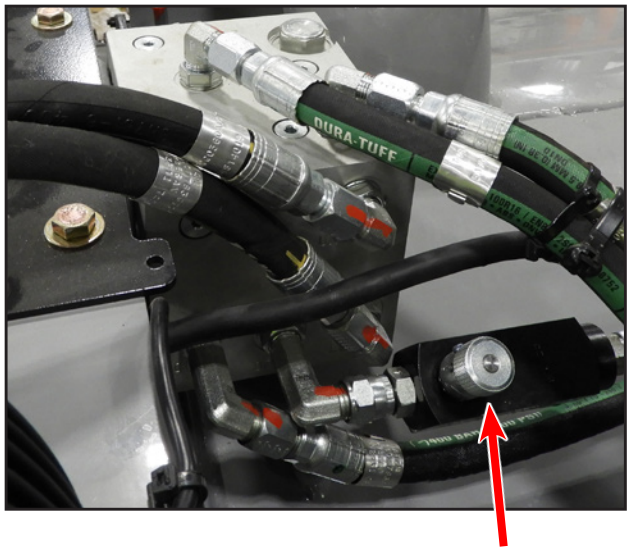
To avoid damage to the blower/fan and drive train immediately shut down the unit when any vibrations or material discharge at the exhaust is noticed. Immediately stop operations and correct problem.

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 exhaust.	Reduce engine speed to optimize vacuum operations.
	Over loaded cyclone section resulting in excessive carry over. Filter overloaded.	Dump the vacuum system and thoroughly inspect for material buildup. Clean vacuum system, as required.
	Overloaded filter.	Open the filter 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 filter.	Open the filter access door, remove the filter and inspect for dust buildup. If a general buildup or leak is evident, replace the filter. Material behind the filter is an indication of a leaking or damaged filter.
A plume appears for several minutes after filter change over.	Dust from previous vacuuming activities is being blown into the atmosphere.	Clean equipment between filter 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.

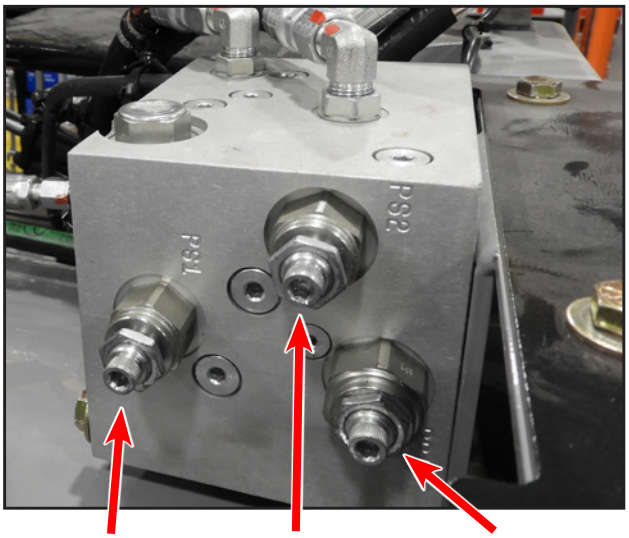
Trouble	Probable Cause	Remedy
Vibration	Driver of blower loose.	Tighten mounting bolts securely.
	Driveline bearings	Check and replace as needed both UPPER and LOWER driveline bearings.
	Misalignment.	See item “Overheating of bearings or gears.”
	Impellers rubbing.	See item “Excessive power.”
	Worn bearings/gears.	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.


Start
Blower overheating?
yes
Oil level too high or low?
yes
Inspect blower for damage due to overheating
Correct oil level
Damage found?
yes
Remove blower from unit and arrange rebuild
no
Lobes rubbing end plates or housing?
yes
no
Vacuuming hot material?
yes
Let material cool/ Increase hose length
no
Hose dia. too small/hose end buried in debris?
yes
Use larger dia. Hose/multiple smaller hoses. Let hose breathe air.
no
Metallic noise from blower?
yes
Blower out of time
Re-time blower
no
Blower bogs down?
yes
Clogged silencer?
yes
Clean or replace silencer
no
Engine not building enough power?
yes
Troubleshoot engine
no
Insufficient airflow?
yes
Clogged air filter?
yes
Clean air filter
no
Verify blower clearances
Blower is worn out?
no
Work through the blower troubleshooting lists
Problem solved?
yes
End
no
Call Vactor/ Guzzler Service
yes

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.
	Wireless remote active	Set wireless off. When activated the wireless functions lockout the manual valves on the manifold.
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



DOOR CLOSE FLOW CONTROL



PS1 PS2 PR1

To set the sequence valves:

1. Set system hydraulic pressure.
2. Ensure that the **DOOR CLOSE FLOW CONTROL** is backed all the way out (full flow).
3. Ensure that the door is in the closed and locked position.
4. Turn **PR1** all the way in. This will assure that the door will close under full system pressure.
5. Turn **PS1** all the way in. Doing this will allow the door to unlock but not open.
6. Turn **PS2** all the way in. Doing this will allow the door to close but not lock.
7. Command the door to open. The door should unlock but not open. Once the door is unlocked, gradually back out **PS1** until the door starts to open. When the door starts to open, **PS1** is set; lock it in place.
8. Command the door to close. The door should close but not lock. Once the door is completely closed, gradually back out **PS2** until the door starts to lock. When the door starts to lock, **PS2** is set; lock it in place.

To set the door close flow control:

1. Ensure that the sequence valves are set.
2. Fully open the rear door.
3. Loosen set screw on the flow control and turn the flow control in to slightly restrict the hydraulic flow.
4. Close the rear door and observe the door's behavior.

Note: When the **DOOR CLOSE FLOW CONTROL** is backed out too far, the door will chatter.

When the **DOOR CLOSE FLOW CONTROL** is turned in too far, the door locks will activate out of sequence (they will lock before the door is closed).

When the **DOOR CLOSE FLOW CONTROL** is adjusted correctly, the door will operate smoothly and in the correct sequence.

5. Adjust the **DOOR CLOSE FLOW CONTROL** as necessary and repeat step 4 if required.
6. Once the **DOOR CLOSE FLOW CONTROL** is set correctly, retighten the set screw.

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.

Extreme temperatures effects pump efficiency.

1. During hot weather, the oil may become thin and cause the hoist to be slow in raising because the pump efficiency is reduced by the thin oil.
2. 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."
3. Be sure to have the right viscosity oil for your operating conditions. (See suggested oils in the Maintenance section.)

Lift cylinder creeping down or drifting.

The terms "creeping down" and "drifting" refer to the

⚠ 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.**

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.

Raising the hoist at a higher speed than necessary may also "starve the pump," which will actually reduce hoisting speed and will result in damage to the unit.

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.**

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.
	Rotate hoses and tubes	Rotating the hoses and tubes evenly distributes the wear for longer life.
	Straighten hose runs	Avoid bends, turns and keep hose runs as straight as possible to reduce wear.
Debris leaks at boom turret elbow.	Abrasive action of debris has worn through elbow.	Replace elbow

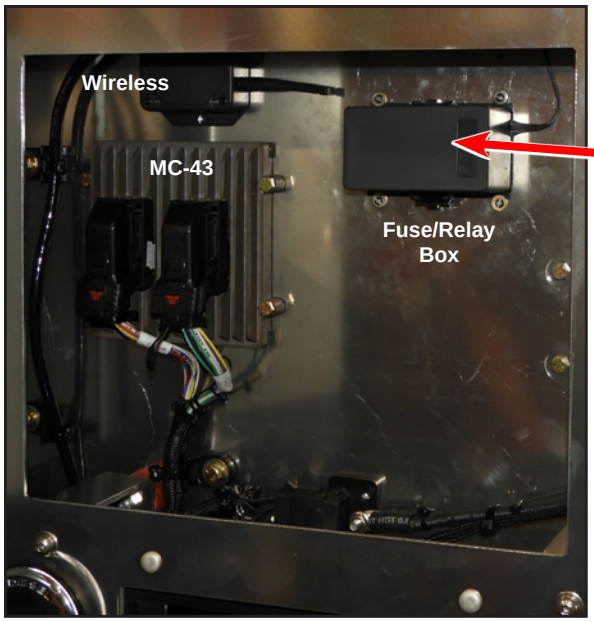
Trouble	Probable Cause	Remedy
Boom creeps up/down	Internal leakage in boom cylinder	With the hydraulic pump disengaged, remove the two hoses from the boom cylinder and plug them. If after a while the boom creeps down, the cylinder is leaking internally. Rebuild or replace cylinders). If the boom does not creep down with the ports plugged and creeps only with the engine running and the hydraulic pump engaged, the fault lies with the pilot valve. Proceed as below.
	Pressure hose in wrong control port	Review hydraulic schematics to verify correct plumbing.

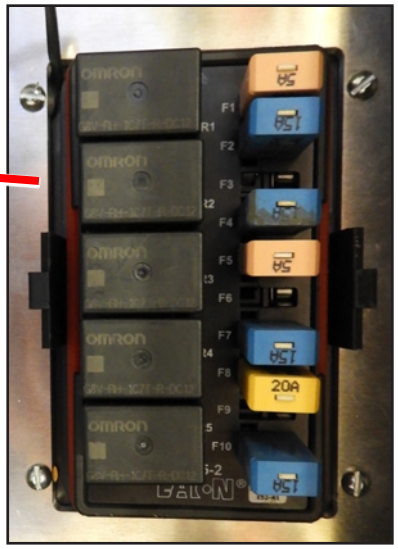
⚠ WARNING

Crushing hazard

NEVER go under a raised boom or rear door. To avoid injury or death:

- **NEVER loosen or disconnect any hydraulic components while the hydraulic pump is running.**
- **Always vent residual pressure from the hydraulic system before disconnecting any hydraulic components. High pressure hydraulic oil will injure by injection into the skin and by cutting.**





No power to Master Control Panel

All power for the master control panel is controlled by a large relay on the back side of the electronics plate.

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.

Fuse	Size	Function
F1	5A	CONTROL PANEL
F2	15A	WIRELESS
F3	15A	4-WAY VALVE/BODY OOP
F4	15A	STROBE/WORK LIGHTS
F5	5A	WATER PUMP
F6		
F7	15A	E-STOP
F8	20A	MC43
F9		
F10	15A	STACK VALVE

Relay	Function
R1	WATER PUMP
R2	WIRELESS
R3	STACK VALVE
R4	STROBE LIGHT
R5	WORK LIGHTS

Each VMM has unique programming. Swapping them can corrupt the programming possibly leading to extensive diagnostic issues. Consult your factory service contact for the correctly programmed VMM module for your unit.

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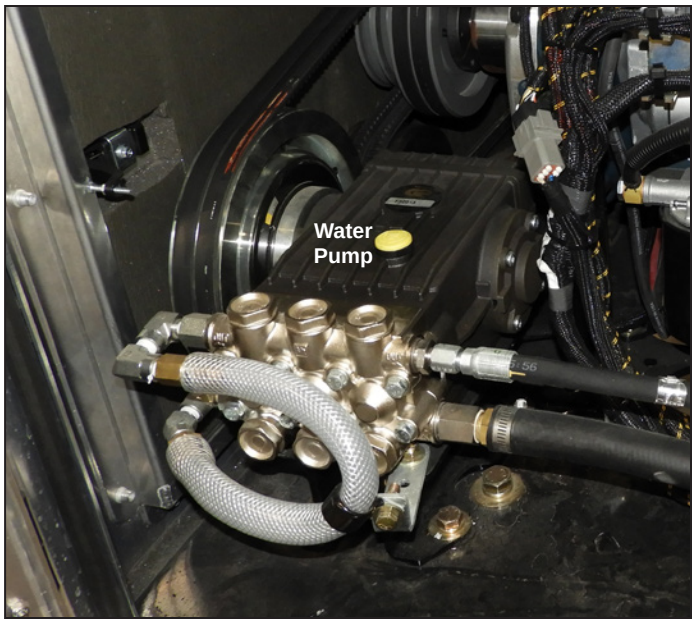
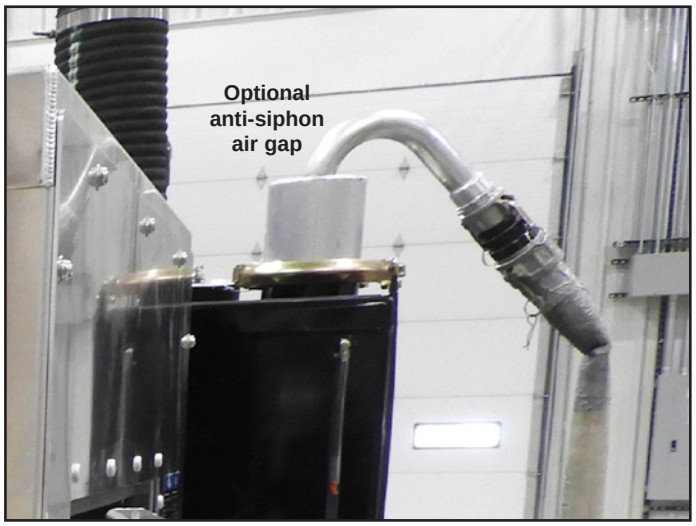
The water system is the component that allows the hydro-excavation feature to function. This system includes the following items:

- Water tanks and associated plumbing
- Y-strainer
- Water pump
- Water pump clutch & drive belts
- Unloader valve
- High pressure hose reel
- Handgun & nozzles

Watertanks

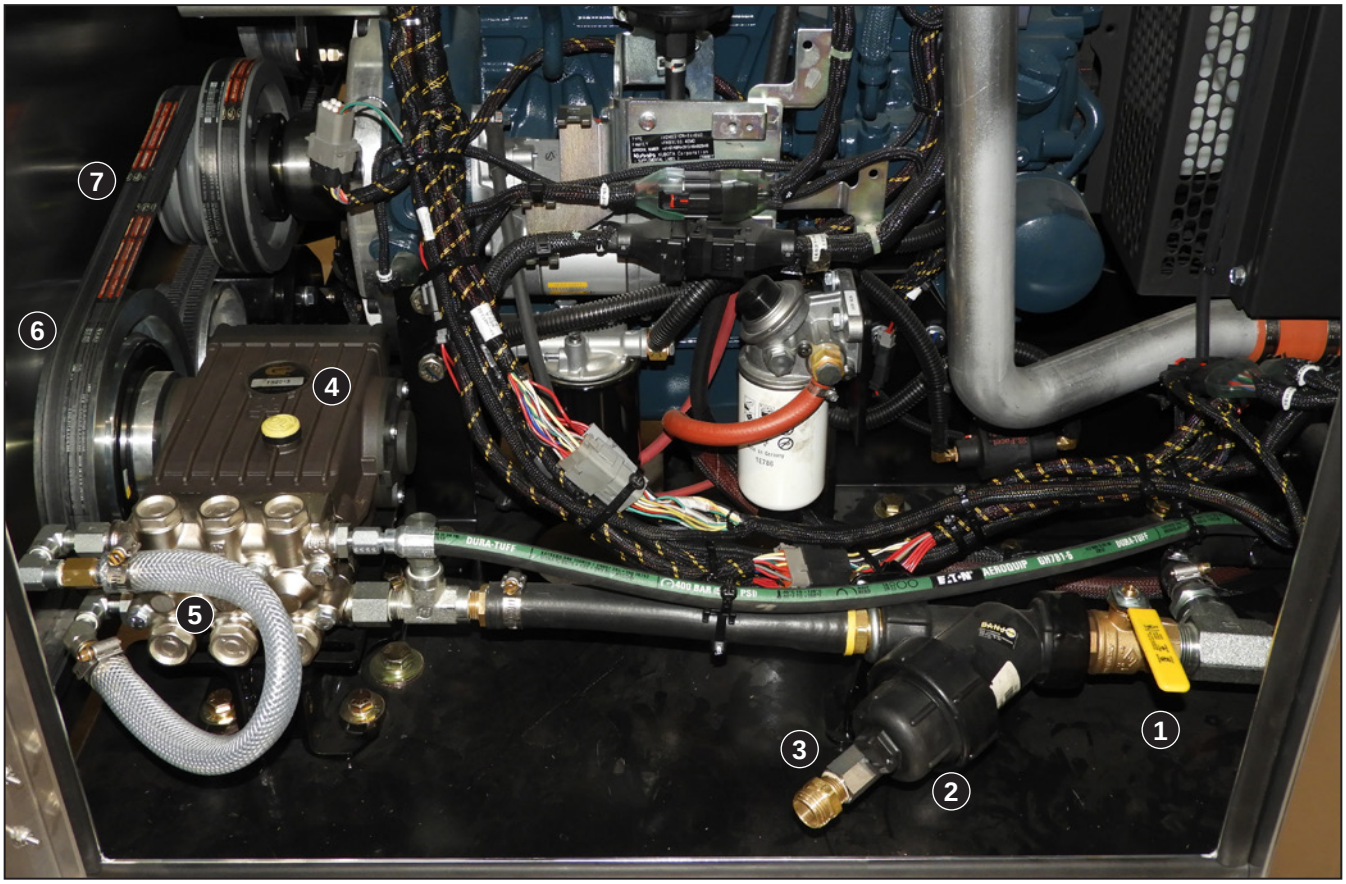
The water tanks are located on each side of the debris body. The tanks can be filled a couple different ways. All models come with an expansion plug on the top of each tank and can be filled via any water source. Optional fills include air gaps held on with band-lok clamps that have provisions for hydrant/high volume filling.





The water pump is rated at 5 gpm. However, the nozzle size at the end of the handgun will determine actual flow of the unit. A shut-off vlave controls water flow between the tank and pump. A y-strainer is located next to the pump. The strainer must be kept clean and should be checked before each use. Water flows into the pump and is pressurized. Proper knowledge of the water system in its entirety is necessary for troubleshooting issues. See system details below:

1. Water flow shut-off valve
2. Y-strainer
3. Y-strainer drain
4. Water pump
5. Water pump head/manifold
6. Drive clutch
7. Drive belts



Five items to check if the water pump is not making pressure or making low pressure.

1. Is the pump turned on correctly?

a. Ensure either Dig mode or Handgun Only mode is activated.

b. 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 lance.

b. Make sure the nozzle is clean of foreign debris which could create pressure spikes,causing the unloader to cycle sporadically.

c. Make sure you have the correct nozzle size for the required flow:

i. A large nozzle will allow high flow but cause low pressure.

ii. A small nozzle will reduce flow but create more pressure and the potential to stall the water pump.

Note: smallest nozzle needs to be sized accordingly so that it doesn't over-pressure/stall the pump. Same goes for any aftermarket nozzles used.

3. Is there adequate inlet conditions?

a. Ensure the tank has water via the sight gauge or level sensor readout.

b. Check that the shut-off valve from tank is open.

c. Pull the hose before the Y-strainer and check to make sure there is adequate flow of water out of the tanks.

c. If still low flow/pressure:

i. Close outlet valve

ii. Remove screen from y-strainer located before the water pump, 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

v. If flow is still low:

1. Make sure water pump is off.

2. Disconnect outlet hose from pump and divert flow of water to outside the cabinet.

3. Turn on water pump and observe stream intensity.

4. If stream is intense and travels out 20-25 feet, water inlet conditions are good.

5. Hook hose back up to pump.

6. If stream is still weak, water pump may need to be rebuilt/replaced.

4. Is the pump producing enough flow?

a. If the pump has adequate water supply and the pressure is still low, check to see that the pump is unloading by deactivating the handgun.

i. If it is not unloading the unloader, the check valve may be sticking causing partial bypass.

ii. If necessary, pull the unloader apart and clean it out.

iii. If corroded, replace unloader.

c. Check the inlet and outlet valves on the water pump head for contamination.

i. Remove the three upper and lower hex head caps on the inlet head.

ii. Allow water to free flow through the pump checking for debris.

d. After flushing check the water pressure by running the pump

i. If pressure is still low the replace seals

4. Are your handguns/nozzles/lances clean?

a. Check mechanical operation of handgun and look for contamination/corrosion that could be resulting in a loss of flow. Repair or replace accordingly.

b. Check condition of nozzles. Are jets clogged, corroded, or damaged? Repair or replace accordingly.

c. Check condition of digging lances. Are the connectors functioning correctly and/or sealing properly? Any bends, dents, or other damage? Repair or replace accordingly.

Hand gun nozzles - refer to the data chart in the Operation section.

Pump install		Frequency (hours)
	TRXX 800	
40030-30	BALL VALVE - 1/2" MINI	
40030B-30	BALL VALVE - 1" LEVER HANDLE	
46441L-30	UNLOADER VALVE, 3600PSI, 8GPM	
46846-30	GAUGE,PRESSURE,5000 PSI,REAR P	
47729DA-30	SCREEN,1-1/4,80 MESH	
514219A-30	BELT, ENGINE TO WATER PUMP	
514220-30	IDLER, BELT TENSIONER	
48047AK-30	GENERAL PUMP TS2013L	
48047AKA-30	KIT, VALVE (48047AK)	
48047AKB-30	KIT, SEAL (48047AK)	
48047AKC-30	KIT, SEAL (48047AK)	
48047AKD-30	KIT, CAP (48047AK)	
48047AKE-30	KIT, PLUNGER (48047AK)	
48047AKF-30	KIT, HEAD RING (48047AK)	
48047AKG-30	KIT, RETAINER (48047AK)	
48047AKH-30	KIT, PACKING (48047AK)	
48047AKJ-30	KIT, PACKING (48047AK)	
48047AKK-30	KIT, RING (48047AK)	
48047AKL-30	ORING, 2.675X.103 (48047AK)	
48047AKM-30	BEARING, ROLLER (48047AK)	
48047AKN-30	STICK, OIL DIP (48047AK)	
48047AKP-30	ORING, COVER (48047AK)	
48047AKQ-30	INDICATOR, OIL (48047AK)	
514221-30	REEL, MANUAL REWIND, 50 FT	
514221A-30	SWIVEL, REPLACEMENT (514221)	
514221B-30	HANDLE, CRANK (514221)	
514221C-30	CLIP (514221)	
47231M-30	65HP ENGINE	
47231MA-30	PLUG, DRAIN (47231M)	
47231MB-30	GASKET, DRAIN PLUG (47231M)	
47231MC-30	SCREEN, OIL PICK UP (47231M)	
47231MD-30	ORING, OIL PICK UP (47231M)	
47231ME-30	GAUGE, OIL (47231ME)	
47231MF-30	CAP, OIL FILLER (47231M)	
47231MG-30	ORING, FILLER CAP (47231M)	
47231MH-30	PLUG, DRAIN (GEAR CASE 47231M)	

Pump install		Frequency (hours)
47231MJ-30	GASKET,DRAIN (GEAR CASE 47231M	
47231MK-30	FILTER, OIL (47231M)	
47231ML-30	PUMP, FUEL ASSY (47231M)	
47231MM-30	FILTER, FUEL (47231M)	
47231MN-30	SEPARATOR, FUEL (Note: for engine S/N <=7LZZ999)	
47231MP-30	SEPARATOR, FUEL (Note: for engine S/N >=7MA0001)	
47231MQ-30	ALTERNATOR (SEE NOTES 47231M)	
47231MR-30	ALTERNATOR (SEE NOTES 47231M)	
47231MS-30	BELT, V (Note: for engine S/N <=7FXZ999, 39”)	
47231MT-30	BELT, FAN (Note: for engine S/N >=7FY0001, 40.5”)	
47231MU-30	ASSY, STARTER (47231M)	
47231MV-30	SENSOR, CRANK (47231M)	
47231MW-30	SENSOR, CAMSHAFT (47231M)	
47231MAK-30	SENSOR, BOOST (47231M)	
47231MX-30	SENSOR, WATER TEMP (47231M)	
47231MY-30	ORING, WATERTEMP SENSOR (47231	
47231MZ-30	SWITCH, OIL (47231M)	
47231MAA-30	PUMP, WATER (47231M)	
47231MAB-30	GASKET, WATER PUMP (47231M)	
47231MAC-30	FAN, COOLING (47231M)	
47231MAD-30	PULLEY, FAN (SEE NOTES 47231M)	
47231MAE-30	PULLEY, FAN (SEE NOTES 47231M)	
47231MAF-30	ELEMENT, INNER AIR (47231M)	
47231MAG-30	ASSY, AIR ELEMENT (47231M)	
47231MAH-30	SENSOR, AIR FLOW (47231M)	
47231MAJ-30	ELEMENT, OIL/WATER (47231M)	
47231ND-30	PLUG, CRANKCASE (47231M & N)	
47231NE-30	PLUG, CRANKCASE (47231M & N)	
47231NF-30	GASKET, GEAR CASE (47231M & N)	
47231NG-30	GASKET, GEAR CASE (47231M & N)	
47231NH-30	GASKET, RETURN (47231M & N)	
47231NJ-30	ORING, FUEL FILTER HSNG 47231M & N)	
47231NK-30	FILTER, FUEL (47231M & N)	
47231NL-30	SWITCH, FUEL/WATER (47231M & N)	

Part Number	Description	Frequency (hours)
47231NN-30	GASKET, WATER FLANGE (47231M & N)	
47231NP-30	GASKET, THERMOSTAT (47231M & N)	
47231N-30	49 HP ENGINE	
47231NA-30	GUIDE, ASSY (OIL GAUGE)	
47231NB-30	ORING, OIL GUIDE	
47231NC-30	ORING, BREATHER (47231N)	
47231ND-30	PLUG, CRANKCASE (47231M & N)	
47231NE-30	PLUG, CRANKCASE (47231M & N)	
47231NF-30	GASKET, GEAR CASE (47231M & N)	
47231NG-30	GASKET, GEAR CASE (47231M & N)	
47231NH-30	GASKET, RETURN (47231M & N)	
47231NJ-30	ORING, FUEL FILTER HSNG 47231M & N)	
47231NK-30	FILTER, FUEL (47231M & N)	
47231NL-30	SWITCH, FUEL/WATER (47231M & N)	
47231NM-30	PULLEY, FAN DRIVE (47231N)	
47231NN-30	GASKET, WATER FLANGE (47231M & N)	
47231NP-30	GASKET, THERMOSTAT (47231M & N)	
47231NY-30	ELEMENT, INNER AIR	
47231NZ-30	ELEMENT, OUTER AIR	
47231NAA-30	PULLEY, FAN (47231N)	
47231MF-30	CAP, OIL FILLER (47231M & N)	
47231MG-30	ORING, FILLER CAP (47231M & N)	
47231MJ-30	GASKET,DRAIN (GEAR CASE 47231M & N)	
47231MH-30	PLUG, DRAIN (GEAR CASE 47231M & N)	
47231MK-30	FILTER, OIL (47231M & N)	
47231MN-30	SEPARATOR, FUEL (Note: for engine S/N <=7LZZ999)	
47231MQ-30	ALTERNATOR (SEE NOTES 47231M & N)	
47231MR-30	ALTERNATOR (SEE NOTES 47231M & N)	
47231MT-30	BELT, FAN (Note: for engine S/N >=7FY0001, 40.5”)	
47231MU-30	ASSY, STARTER (47231M & N)	
47231MV-30	SENSOR, CRANK (47231M & N)	
47231MW-30	SENSOR, CAMSHAFT (47231M & N)	
47231MAK-30	SENSOR, BOOST (47231M & N)	
47231MX-30	SENSOR, WATER TEMP (47231M & N)	
47231MY-30	ORING, WATERTEMP SENSOR (47231M & N)	
47231MZ-30	SWITCH, OIL (47231M & N)	
47231MAA-30	PUMP, WATER (47231M & N)	
47231MAB-30	GASKET, WATER PUMP (47231M & N)	
47231MAC-30	FAN, COOLING (47231M & N)	

Part Number	Description	Frequency (hours)
47231MAH-30	SENSOR, AIR FLOW (47231M & N)	
47231MAJ-30	ELEMENT, OIL/WATER (47231M & N)	
514302-30	HOSE REEL INSTALL	
20188L-30	QUICK CONNECT X 1/2NPT FEMALE	
20188M-30	MALE DISCONNECT 1/2NPT FEMALE	
47366AK-30	HOSE ASSY,HYD, 3/8 X 600’	
514287-30	FUEL TANK INSTALL	
40792-30	CHECK VALVE 3/8” IN-LINE	
44306A-30	5/8” ID FUEL HOSE	
47572-30	FUEL LINE HOSE - 1/4” DIA	
511001B-30	STANDARD ELECTRICAL	
44596A-30	CIRCUIT BREAKER 5AMP	
44596B-30	CIRCUIT BREAKER 15AMP	
44596C-30	CIRCUIT BREAKER 20AMP	
44594F-30	RELAY	
47199F-30	SEALED POWER RELAY	
511009-30	TRAILER 4-WAY VALVE	
71261DA-30	HELLA MINI RELAY BASE WATER PR	
71261D-30	HELLA MINI RELAY WATER TIGHT	
44596B-30	CIRCUIT BREAKER 15AMP	
511008-30	TRAILER WORK ZONE LIGHTS	
70499QA-30	LED FLOOD LT, SQUARE 4IN W/CON	
509416G-30	BOOM HOSE INSTALLATION	
43322J-30	PVC FLEX HOSE 4” X 120”	
514303A-30	5” VACUUM HOSE, 5” X 120”	
46248-30	CAM-LOK, HOSE SHANK/FEMALE ADAP	
43389-30	POWER CLAMP, 4”	
43497-30	POWER LOCK CLAMP ASSY, 5”	
509417B-30	DEBRIS HOSE SEAL CUFF ASSY	
509285A-30	DISC BRAKE ROTOR 304SS	

Part Number	Description	Frequency (hours)
509826B-30	BODY COMPONENT INST, TRAILER	
46247-30	CAM-LOK DUST CAP - 4” ALUM, 40	
46858-30	CAM-LOK, 40F 4” ALUM, MALE NPT	
65364J-30	VALVE INSTALL 6” - INDUSTRIAL	
29898J-30	HOSE ASSY BLUE PVC 6” X 25’	
40019R-30	LEVER GATE VALVE BRASS W / HANDLE	
40019RA-30	HANDLE	
47456DK-30	O-RING, FOR FLANGE	
46228-30	ADAPT, CAM-LOK STYLE F, 6”, MNPTX	
46229-30	CAM-LOK DUST CAP 6” W / GASKET	
46229A-30	GASKET FOR 46229 6” CAM-LOK	
509693B-30	REAR DOOR HOSE INSTALL	
43389-30	POWER CLAMP, 4”	
509410-30	DEBRIS HOSE, 4” X 25’	
46248-30	CAM-LOK, HOSE SHANK / FEMALE ADAP	
1280140-30	CAM-LOK, 4” PART E (ALUM)	
509590E-30	BLOWER INSTALL, ELECTRIC 4-WAY	
514219-30	BELT, ENGINE TO BLOWER	
45799B-30	4” ID SUCTION HOSE, 36	
45799C-30	4” ID SUCTION HOSE, 12	
45799D-30	4” ID SUCTION HOSE, 8	
509611A-30	FINAL FILTER INSTALL	
45730F-30	BAND CLAMP T-BOLT 5.51-5.81	
42645J-30	GAUGE - PRESSURE / VACUUM	
45799E-30	5” SUCTION HOSE, 6”	
45799F-30	5” SUCTION HOSE, 33.5”	
42633-30	RELIEF VALVE 3 IN, 15 IN HG	
45111J-30	SEAL, RUBBER, TEARDROP, 50LG	
45112G-30	FILTER 10.5 OD X 6 ID X 12.2L	
1320021D-30	LATCH, LOCK, 8900LB	
29895-30	PLUG - 1” NPT SOLID FITTING	
1140064D-30	PRESSURE RELIEF VALVE 3”, 5PSI	
16374E-30	1/2-13 WING NUT	

Part Number	Description	Frequency (hours)
509616B-30	CYCLONE INSTALL	
43497-30	POWER LOCK CLAMP ASSY 5	
45799E-30	5” SUCTION HOSE, 6	
45799G-30	5” SUCTION HOSE, 32.75	
514303-30	5” VACUUM HOSE, 5” X 216	
45730F-30	BAND CLAMP T-BOLT 5.51-5.81	
	DUST BOX ASSY, LH	
26861-30	RUBBER GASKET	
49539-30	DOOR SEAL	
514282-30	WATER TANK INSTALL - TRAILER	
40758-30	VALVE - GATE 1-1/2	
43061-30	RED POLYETHYLENE BALLS	
45727-30	BAND CLAMP T-BOLT 3.38-3.71	
71801-30	PLUG 6” EXPANSION - LOW PRESSURE	
514278-30	WATER TANK STRAP	
43734A-30	CLAMP - WORM GEAR	
45800P-30	STRAP, RUBBER	
45800R-30	STRAP, RUBBER	
45800S-30	STRAP, RUBBER	
505640-30	PVC VENT PIPE ASSY, 2	
514372-30	VERTICAL PIPE RACK INSTALL	
47741-30	SAFETY SNAP PIN 3/8 X 2-1/2	
47761-30	SAFETY SNAP PIN 1/4 X 1-3/4	
47429-30	TRIM-LOK - 1/4” (3FT NEEDED)	
44334-30	CABLE CLAMP 1/8”, GALV	
44529-30	ROPE - 1/8” COATED WIRE (2FT NEEDED)	
500619AL-30	DIGGING LANCE PKG, TRAILER EXC	
48383D-30	HANDGUN, LINEAR 4000PSI	
20188L-30	QUICK CONNECT X 1/2NPT FEMALE	
20188M-30	MALE CONNECT X 1/2NPT FEMALE	
508546B-30	HXX ROT. NOZZLE #5 W / COUPLING (ASSY)	
508546-30	NOZZLE ONLY	
20188N-30	1/2” MALE COUPLER	

Part Number	Description	Frequency (hours)
510011AA-30	STRAIGHT SINGLE JET, 4 GPM (ASSY)	
510011A-30	NOZZLE ONLY	
20188N-30	1/2” MALE COUPLER	
509415B-30	HOSE EXTENSION ASSEMBLY	
43389-30	POWER CLAMP, 4 (2PCS)	
509410C-30	DEBRIS HOSE, 4” X 82”	
46248-30	CAM-LOK, HOSE SHANK / FEMALE ADAP	
1280140-30	CAM-LOK, 4” PART E (ALUM)	
47199F-30	SEALED POWER RELAY	
	LOW WATER LEVEL SENSOR INSTALL	
45952C-30	LOW WATER LEVEL SENSOR	
508123DX-30	TRAILER 2X4 KEYPAD, ADDR 2	
508123CS-30	TRAILER 2X3 KEYPAD, ADDR 1	
513510B-30	ZCASE ZCASE FUSE, LITTLE FUSE	
516501A-30	MACRO WIRELESS KIT	
516501AA-30	MACRO TRANSMITTER	
516501AB-30	MACRO RECEIVER	

GUZZLER TRUVAC VACTOR

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