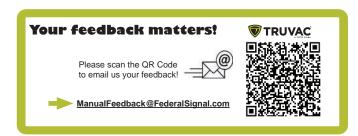
PARADIGM







TRUVAC PARADIGM

Operation & Maintenance Manual

Operation & Maintenance Manual Paradigm

Release history

- 0 Initial release (AC 8-12-2019)
- 1 Updated warranty. (AC 12-10-2019)
- 2 Maintenance update. (AC 4-21-2020)
- 3 Maintenance update. DigRight made standard for 2020. (AC 6-1-2020)
- 4 Maintenance update and updated vacuum relief valve. (AC 1-7-2021)
- 5 Maintenance update. (DE 9-28-2021)
- 6 Updated air purge and recirc pages. (AC 12-1-2021)
- 7 Maintenance update. (DE 6-21-2022)
- 8 Maintenance update. (AC 2-21-2023)
- 9 Airbag suspension content update (DE 4-3-2024)
- 10 Updating wireless content to Hetronic (DE 7-3-2024)
- 11 Added Dumping Best Practices, Longterm Storage, and Hyd. Oil Interval Update (DE 9-12-2024)
- 12 Added Boom/Body Out of Position content (DE 2-3-2025)
- 13 Updated water pump pressure (AJK 5-5-2025)

Manual and Parts Page Files

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

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

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NOTICE

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

NOTICE

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

NOTICE

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

NOTICE



Custom Machine Parameters

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

AWARNING

Overriding Controls

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

Follow service instructions for overrides during maintenance.

! WARNING

Cancer and Reproductive Harm

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

NOTICE



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

This manual is available at: www.vactor.com

NOTICE



Jump Starting Or Welding Can Damage Electrical System

To avoid damage:

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

SAFETY INSTRUCTIONS

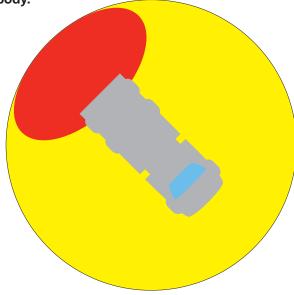
Unit operator must hold the pendant/remote during vacuum operations and stay within line of sight of the hose end operation. In an emergency, use the E-stop or pendant/remote to disable the vacuum. Maintain clear access to all E-stops and place an operator near one.

NOTICE

Safe Work Zone

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

body.



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
- 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.

A 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.



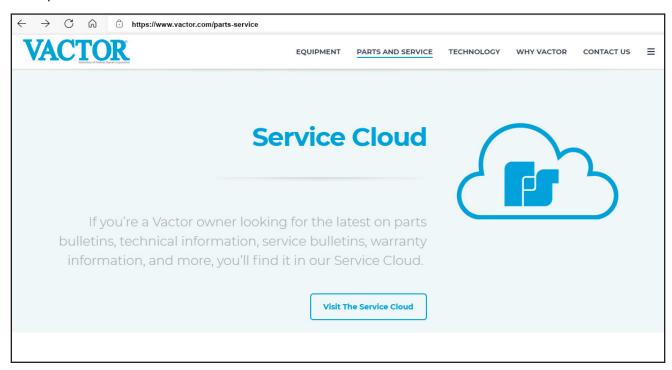
Guzzler/TRUVAC/Westech/Vactor Manual

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

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

Replacement operation manuals require the unit serial number.

Order part No.: 512459A-30





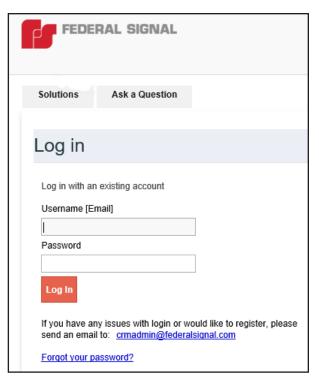
Note: Preferred browsers are Microsoft Edge or Google Chrome. Other browsers may not work correctly.

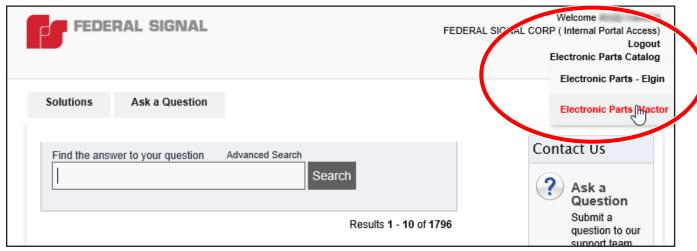


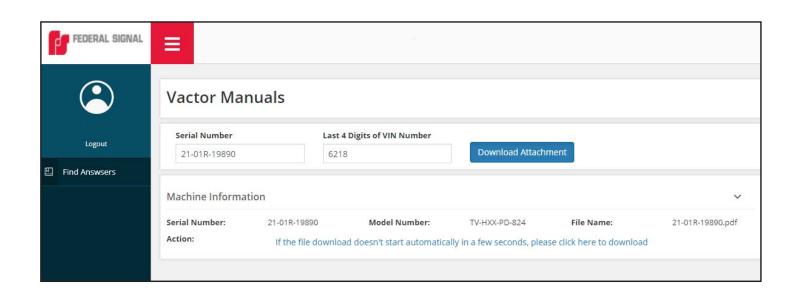
Selecting the Service Cloud will take you to the login page. Registration is required.

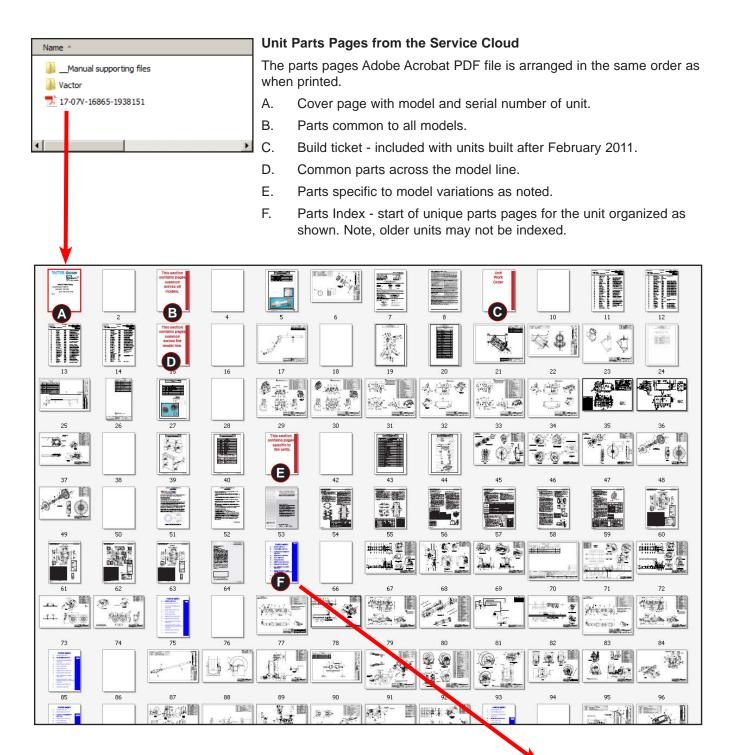
Once in you will find parts manuals for over 7000 Vactor products. Each manual contains relevant drawings and parts lists for the assemblies that make up the machine as a whole. The purpose of the EPC is to provide you with the parts information that is relevant to your machine.

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









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!

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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 jetrodding 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.





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!

Vactor

MODEL IDENTIFICATION - SERIAL NUMBERS



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

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

Serial Numbers				
		Exan	nple: 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	



REGISTRATION FORM

Serial Number:		Dealer Nam	Dealer Name:		
Hours:	Miles:	Delivery Date:	In-S	ervice Date:**	
		** Form must be acc	companied by a letter of req	uest/explanation if different from Delivery date.	
Comments:					
Dealer Rep	resentative		ESG Representa	tive	
Print Name		Signature	Print Name	Signature	
		ection, this form must be the time of delivery to the		and signed by an authorized er.	
Failure to co	omplete, sigr	n and return form to the fa	actory will void the li	mited warranty.	
operation, s	ervice, and i	•	ies for the above ES	res, and understand the warranty, G product dated this	
End/Retail (Customer Na	ame:			
Address 1:					
Address 2:					
				re / Province:	
Zip Code: _		Country:			
Customer C	ontact Name	e:			
Whom shou with product		ct after 6 months to inquir	e about machine rel	iability and level of satisfaction	
Name: Phone # ()					
Customer R	epresentativ	es Present at Delivery			
Print Name		Print Name		Print Name	
Signature		Signature		Signature	
_				(- (-) ()	

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

VACTOR MFG., LLC, 1621 S ILLINOIS ST., STREATOR IL 61364 • ATTN WARRANTY ADMINISTRATOR Original to Manufacturer Copy to Dealer Copy to Customer

Operation

Operation



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

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

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

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

Non-destructive

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

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



Overview Operation

The operational systems on the Vactor Paradigm 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 machine.

Note: Due to available options, the control panel illustrations reflected in this manual may not appear the same on all units.

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



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

Machine Can Be Damaged

- Beware of carry over material from debris body through the blower or fan.
- Running the blower/fan too fast with light material can carry the material over into the blower or fan. This can cause premature wear.
- Over filling the debris body can cause carry over and damage to the fan/blower.
- 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.

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

Water excavation

Water is the most productive process, especially in rocky soils. It outperforms air because it moves large amounts of material faster and more efficiently favoring larger excavation jobs. Heated water (optional) can be used to cut through frozen soils. There is minimal

abrasion to the underground utilities. Water system components tend to have a longer useful lifespan then compressed air systems.

Hydro-excavation advantages:

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



Air excavation

Compressed air offers advantages under the right conditions. And unlike hydro excavation which requires the resupply of water for excavating, the supply of air is unlimited. Also good for small jobs where the hole will back filled right after the work is completed. It may be a safer choice when working around buried power cables. Air, however does produce a sandblasting effect that may create issues with dust and abrasion.

Some utility companies, departments of transportation (DOTs) or power plants specify air vacuum excavation for a given job for a number of

reasons. Air vacuum excavation is desired in applications where the soil tends to be loose, water is not readily available, in small-scale excavation projects or where immediate backfill of the hole is required. When working around buried electrical lines or brittle utilities, air vacuum excavation is often preferred due to the lower operating pressures.

Air vacuum excavation advantages:

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

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

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

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

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

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

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

NOTICE

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

NOTICE

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

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

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

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

Understanding the vacuum system

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

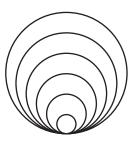
Air must be moving in order to move material. If the nozzle is totally submerged in the material no air can get in. When this happens, the material is pulled up only so high in the tube and it sits there. In the case of a blower (PD) machine, air movement becomes even more important because air is what cools the blower. Restricted air flow can cause the blower to over heat which can cause damage to the blower. The chart below shows the percent of restriction that is created as a six (6) inch nozzle is closed down.

NOTICE

Machine Can Be Damaged

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

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 trucks 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 valve, blower or fan, silencer (PD only), vacuum enhancer (optional)

Water System

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

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

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

Filtration System

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

Filtration System Components: debris body and prefilter, cyclone filter, filter element, microstrainer (PD only), silencer (PD only)

Hydraulic System

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

Air Compressor System

An air compressor is standard for air excavation and running power tools like a jack hammer or backfill tamper.

Operations Overview

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

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

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

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

Exiting the cyclone, the nearly dust-free air passes through the filter, 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!



According to hydroexcavation best practices, there are set pressure limits based on the depth of the excavation. For example, when excavating 18 inches below the surface, the water pressure limit is 1,500 psi. The maximum water pressure allowed in any situation with a straight jet nozzle is 2,500 psi, and when using a spinner, the limit is 3,000 psi. DigRight® technology coupled with Vactor's multi-flow, variable water displacement water pump feature, allows the operator of a Vactor HXX HydroExcavator® to select a maximum water pressure limit to prevent the pressure from exceeding site or industry requirements.

The system consists of a push button on the control panel with four default selections: off (manual control); 1,500 psi; 2,500 psi; and 3,000 psi. It automatically adjusts the pump's water displacement to match the user's nozzle selection. It also prevents wear and tear on check valves, unloader valves, and relief valves by avoiding bypassing water, which is typical with other variable water flow systems. Preventing bypassing of water also saves fuel and money by eliminating wasted energy.

The variable water flow, multi-flow, pump allows water flow adjustment with the push of a button for digging in various conditions. The DigRight® Technology water system allows the operator to set a maximum pressure to meet required pressure limitations. Vactor's DigRight® Technology includes:

- User selectable max water pressure settings to control the pump's maximum pressure output. Three defaulted selectable pressure limitations based on industry best practices for digging around utilities.
- The default settings are also custom configurable to tailor to your needs.
- A simple 'double-click' on the control brings the system to a pre-set set pressure level or the pressure can be increased incrementally to the maximum setting.





DigRight® is user configurable

The standard water system is rated at 10 gpm @3000 psi, the maximum pressure recommended for safe excavation. It is powered by a hydraulically operated triplex piston water pump. Each unit includes a standard handgun hose 3/8 inch x 75 ft. on a heavy duty retractable reel. The handgun and water pump can be mounted in an optional heated cabinet for protection against cold weather conditions. The Vactor HXX can be configured to include an additional handgun reel, hose, and digging lances for improved productivity.

Note: For proper functioning DigRight® requires a nozzle rated at 6gpm @ 3000psi.



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.

- Waste material first enters the through the boom hose.
- 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.
- The air flows into the secondary prefilter or cyclone chamber.

- 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.
- 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.
- Finally, the air passes through the vacuum pump (blower) and out through the silencer on the passenger side of the unit.



CONTROLS OPERATION

Note: switches vary with options

The IntelliView[™] displays most of the functionality of the unit. Among the things displayed are: chassis engine, blower, hydraulics and the electrical controls systems. A variety of settings can be changed through the controls of the display. The display controls work very much like many other devices we encounter in everyday life.

Note: Display is designed to operate at an internal temperature range of -13° (F) to 167° (F). Outside that range the display will shut down and the backlight will flash like a heart beat.

2 System/Blower switch panel



Wireless switch - selects which controls are active. The manual lever controls for the body and boom are locked out when the wireless controls are activated.

Alarm switch - silences the alarm



Vibrator switch - Momentarily operates the vibrator if equipped. Duty cycle is 33% with maximum continuous operation of 45 seconds.

Blower On switch - ON to allow the blower

to run. OFF returns the blower hydraulic

pump to neutral stopping the blower from any setting. +/- - increase or decrease







blower RPM.



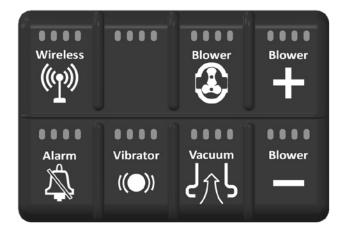


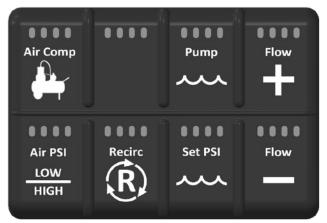
Vacuum Enable Switch - opens/closes the vacuum relief valve.

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.







CONTROLS OPERATION

3

Air/Water switch panel



Air Compressor ON switch - Activates the air system. The indicator light is on when the air compressor is active. Switching off/ on in too short of a time will activate the air compressor shutdown system. The shut down system must complete its cycle before the indicator light will show on. The blower and water pump must be off to activate the air compressor.

Air PSI LOW Air PSI switch - set air pressure to high or



Recirc switch - activates the cold weather water recirculation system



Water Pump switch - activates the water **pump**



Set PSI Switch - DigRight® - Toggles through four settings:

> Red - Max PSI OFF - Water system functions without the pressure transducer.

Amber - starts at 1000psi, 1500PSI max. default.

Green - starts at 1500psi, 2500PSI max. default.

Blue - starts at 1500psi, 3000PSI max. default.

On system start up, Set PSI will default to last selected Setting.

For each of the 3 DigRight® Settings, the Max PSI is user adjustable via the Water Screen.

Note: DigRight® system relies on the pressure transducer to function correctly. If the transducer fails the system will default to the off setting, and the truck can be operated in the standard multi-flow mode via controlling the current to the proportional valve.



Flow +/- - switches - set water flow

- 4 Rear work lights
- 5 **Boom work lights**
- 6 **Driver side work lights**

- 7 Passenger side work lights
- 8 Cabinet heater
- 9 Pendant plug outlet - The manual lever controls for the body and boom are locked out when the pendant is plugged in. The wired remote will only work when the wireless switch is set to ON.
- 10 Emergency Stop Switch - Opens the vacuum relief, turns off the PTO, stops the blower, water pump/air compressor and throttles down the engine. Pull out to reset. Before switching the E-stop to OFF reset ALL switches to their OFF positions and the vacuum relief to OPEN. Restart all functions as normal.

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

12VDC outlet - 10A max. 11

Priority of functions

The established priority between the three possible control systems are:

- 1. Wireless remote
- 2. Pendant switches
- 3. Panel switches

Note: Any switch function not available on the active controls will function on the other controls in the established priority.



- 1 Water pressure regulator
- 2 Water pressure gauge
- 3 Water pressure relief valve
- 4 Air purge valve
- 5 Digital pressure transducer

AIR EXCAVATION OPERATION

Air excavation is similar to hydro-excavation in operation.

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

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

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

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



The air system on this unit consists of an air compressor and hose reel.

The hydraulic system must be engaged to operate with air. Prior to engaging the air system, connect the hose reel hose to the air gun and prepare to operate.

The system is designed so that either the air or water system can operate, but not both at the same time.

Controls

Air Comp switch - activates air compressor system.

High/Low switch - If equipped, 150psi for digging and 110psi for air tools.

Automatic blow down valve

There is an integrated blow down valve in the compressor system. It is located at the downstream side of the coalescer head and will automatically bleed the sump to zero pressure when the compressor is disengaged. Blow down time interval takes between 60 to 90 seconds and is controlled by a pressure sensor. If the air switch at the master control panel is quickly switched the air indicator light will not go on until the blow down time interval has completed.

Operation

To operate, switch air on at the master control panel.

The unit is equipped with a load sensing ability. When activating the air compressor (PTO engages automatically)



the engine's rpm drops to an idle mode then to full speed.

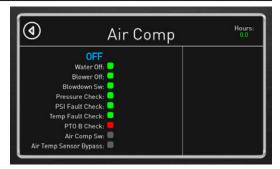
Note: The service valve at the air hose reel must be in the closed/off position when starting or stopping the air compressor to avoid tripping the velocity fuse. When shutting down this also avoids oil from accumulating in the coalescer.

Shut down systems

Excess flow (velocity fuse) - Closes when full free air flow is detected. Resets automatically when problem is corrected.

Temperature shut down - Unit will go in to shut down at about 245° F.











High pressure shut down - Unit will go in to shut down after 150 psi is reached.

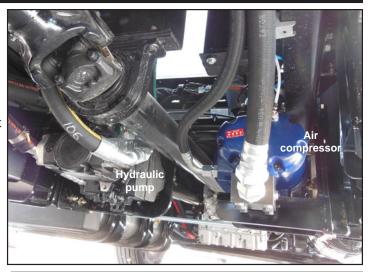
Housing pressure relief - Opens at 175 psi to protect the compressor. Resets automatically when problem is corrected.

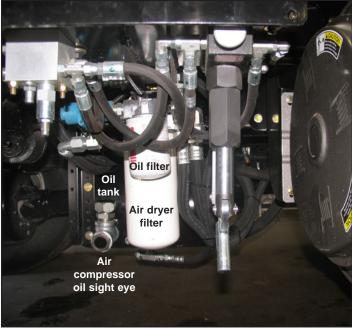
Sensor	Mode
Idle mode	Normally Open
Automatic blow down	Normally Closed
Temperature (sensor)	.25vdc - 4.75vdc
Pressure (sensor)	.5vdc - 4.5vdc

The air compressor is PTO driven and is located between the chassis frame rails on the passenger side.

Refer to the manufacturer's manual for service and maintenance.

The oil reservoir is located under the master control panel. A sight eye is visible to daily verify the correct oil level.





Debris Body Operation

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

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

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

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

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



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



The debris body is equipped with a float ball shutoff. 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.



NOTICE

Machine Can Be Damaged

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

VACUUM PIPE OPERATION

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.



AWARNING



Electrocution hazard

Serious injury or death can result from electrocution.

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

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

Refer to SAFETY section in manual.



1800149 rev A

NOTICE

Boom Can Be Damaged

This lift eye should only be used to lift and move manhole grates to 400 lbs max. weight. Break grates loose before lifting.

Other use can damage the boom.

Refer to manual for details.



A DANGER

Boom Can Injure or Kill

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

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

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

SAFETY INSTRUCTIONS

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

NOTICE

Machine can be damaged

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

NOTICE

Machine Can Be Damaged

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

The 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 pendant or wireless.





VACUUM TUBE OPERATION

The vacuum tube is maneuvered and controlled using the pendant control. Plug in the pendant control. The vacuum must be off when attaching or removing vacuum tubes.

- Release the boom brake with the pendant control and manually lift the boom tube from the stowed position.
- 2. Manually swing the boom to the desired dig location and reactivate the boom brake.



NOTICE

Boom Can Be Damaged

The lift eye should only be used to lift and move manhole grates to 400 lbs max. weight. Grate must be loose and free prior to lifting with boom. The rest of the boom is only rated for vacuum hoses, tubes and debris during normal operation.

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

A WARNING

Vacuum Hazard

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

Stay clear of the suction hose inlet end.

Turn vacuum off before attaching hose, pipe or accessories.

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

Refer to SAFETY manual for details.



ADVERTENCIA

Riesgo Por Altovacío

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

Manténgase lejos de la boquilla de la manguera de succión.

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

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

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



REAR DOOR OPERATION

The rear door is hydraulically opened and closed using the control valves 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 truck.

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.

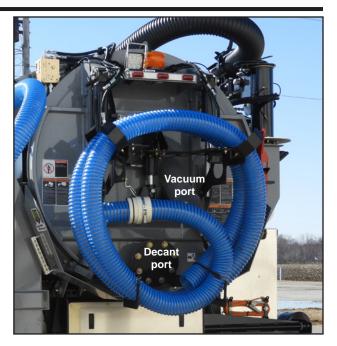
Be sure to check for overhead obstructions. If none, the hydraulic controls can be used to raise the debris body up to the height of the first stage of the hoist cylinder when the rear door is closed.

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.

Vacuum port

The rear vacuum port can be used in place of the boom when more convenient. A special hose adapter is supplied to attach the vacuum hose to the port.





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 is equipped with a rotation brake controlled from the remote control.

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.



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

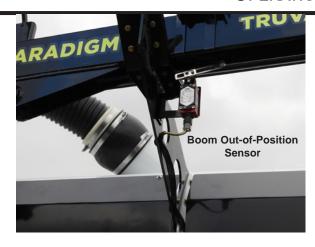
Functionality

Park Brake Set

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

Park Brake Released

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





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.

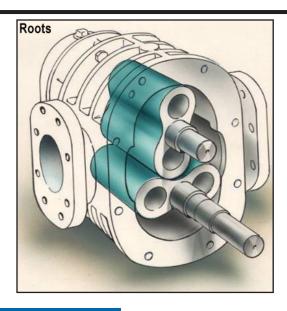
The vacuum pump is driven hydraulically by the chassis engine. Its fuel-efficient, positive-displacement design enables the unit to vacuum solids from beneath water surfaces and to convey material for distances more than 600 feet. Airflow created by the vacuum pump is controlled by the engine speed. 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 or reduce the engine rpm to eliminate the material being discharged through the blower exhaust.

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.

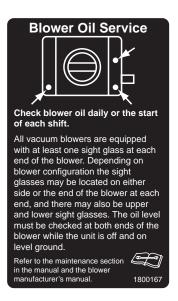


NOTICE

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 safety relief valve to relieve vacuum if the air intake system or nozzle become plugged or restricted beyond its capacity.

Note: Place the vacuum relief switch in the disabled mode when connecting nozzle or extension pipes to the boom with the blower running.

A switch on the control panel or pendant control activates or opens the relief valve. The relief valve should be in the disabled 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.

An automatic vacuum relief valve is a separate relief valve designed to relieve pressure so as to prevent damage to the blower. It is set to open at approximately 14 in-hg.





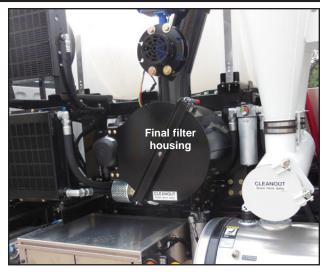


From the debris body, air enters the final filter housing. It's purpose is to prevent any objects or foreign matter which has entered the system from reaching the blower. If it becomes plugged, it will result in a high vacuum and a reduction of air flow. The filter should be replaced if necessary and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

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

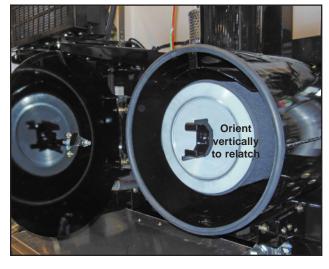
- Open the lid covering the housing by releasing the latches that hold the lid to the housing. After the lid is unhooked, it can be swung open.
- 2. Remove the threaded nut to remove the filter.
- 3. Slide the filter out.
- 4. Inspect the filter and remove any foreign matter or substance and replace if necessary.
- 5. While the filter is removed, drain any moisture from the housing.
- 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.





New style filter housing (mid 2017)





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

The cone of the outlet seal must be adjusted so that there is no air gap. See Maintenance for details.



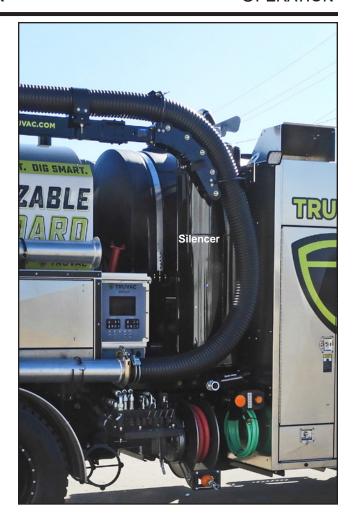
Air leaving the blower enters the silencer where it passes through a series of baffles and is vertically discharged into the atmosphere. The baffles are tuned to reduce pump noise by combining similar sound frequencies that are out of phase so as to cancel each other. Discharging air vertically further reduces objectionable ground-level sound.

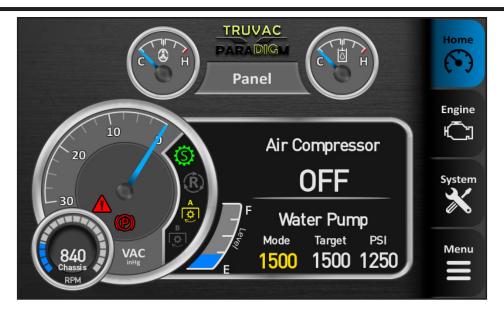
The silencer is installed on the passenger side of the unit because this is the discharge side of the blower. The inlet side to the blower is on the driver side and the blower is mounted in the middle of the chassis directly behind the truck cab.

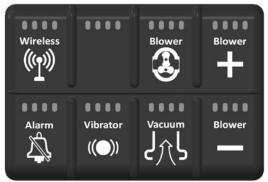
A drain plug is provided at the bottom of the silencer housing which is used to drain any excess moisture that has collected in the silencer during operations. It must be plugged during normal operations. The plug must be removed at the end of each day and the water drained out.

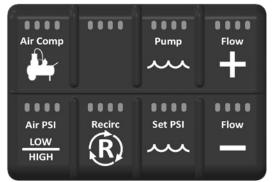
Leave the drain plugs out when not in use. This prevents rain water from building up in the silencer.

Verify the rain cap works correctly to assure rain and water cannot enter.









The IntelliView™ displays most of the functionality of the unit. Among the things displayed are: chassis engine, blower, hydraulics and the electrical controls systems. A variety of settings can be changed through the controls of the display. The display controls work very much like many other devices we encounter in everyday life.

Note: Display is designed to operate at an internal temperature range of -13° (F) to 167° (F). Outside that range the display will shut down and the backlight will flash like a heart beat.

Note: many of the control panel switches have indicator lights. Refer to the individual switch information for details.







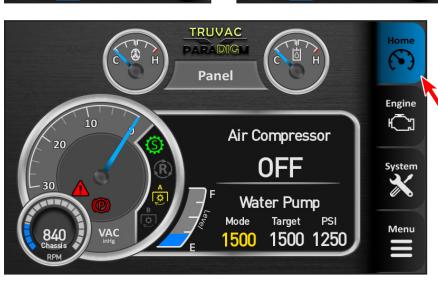








Blue notes selected page and blue outline indicates the selected button.



The IntelliView[™] system has number of key pages for normal operation. Use the side touch screen buttons to navigate.

Home - basic operations page.

Engine - Includes basic chassis information.

System - troubleshooting pages.

Menu - display settings and preferences.

Indicator boxes

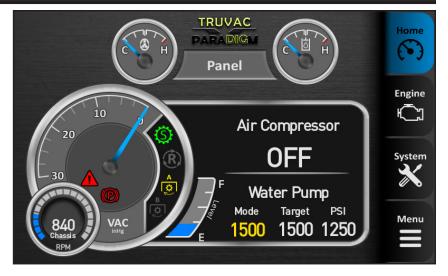
green - ON or active status

red - error, failure or fault status

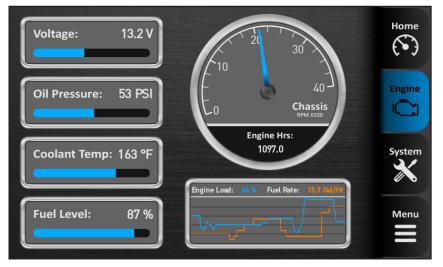
gray - off or disabled status

The various features of all display pages will vary depending on options and what systems are active.

This is the main screen during normal operations. The center section and tachometer change as required by what systems are in operation.



This is the chassis engine screen during normal operations. The center section and tachometer change as required by what systems are in operation.



Paradigm IntelliView™ Display - Menu Overview

Home Screen	Manual
Chassis RPM	IO Pin out
Blower Vacuum	Engine settings
Stationary Indicator	Trans settings
Recirculation indicator	Engine
PTO A indicator	Voltage
PTO B indicator	Oil Pressure
Selectable optional screens: Home, Systems,	Coolant Temp
Engine, Menu	Fuel Level
Systems	Engine load
Modules	Engine fuel rate
MD4	Engine hours
XC-10	Chassis RPM
G-11	Menu
R-260	Systems
PVG Valve	Info
Engine	Modules
System Key Pad	Settings(Locked)
Water Air key Pad	Truck set up
Functions	User Pref
Interlocs	Dig Right
Throttle	Options
Hydraulic	Pref
Air Comp	Display /Date/Time
Water	Back Light
Blower	Screen saver
Boom	
Alarm	
INFO	
Truck configuration	
Work order #	
Unit Serial #	
Program	
Park Brake	
Throttle Type	
Water pump flow	
Water level	
Air Comp type	
Active options	

Paradigm INTELLIVIEW™ DISPLAY - SYSTEM PAGES - FUNCTIONS





Functions - 2 pages





Modules - 2 pages



Info



Manual

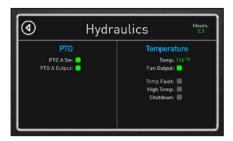






All interlocks need to be green to operate the unit. All PVG valve handle functions are locked out when the wireless remote or pendant is active. Any attempts to use the handle functions while the remote or pendant is in use will stop motion of the function.











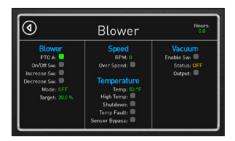


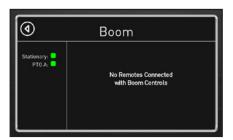




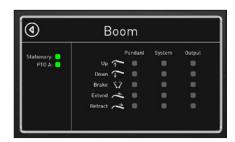












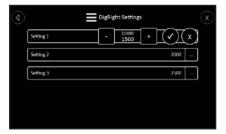
Paradigm IntelliView™ Display - System Pages - Functions











INTELLIVIEW™ DISPLAY - SYSTEM PAGES - MODULES







Input/outputs



Input/outputs



Module for wireless Bluetooth.



R170 is for the wireless remote.

INTELLIVIEW™ DISPLAY - SYSTEM PAGES - MODULES













Indicates spool position for water valve.

Paradigm INTELLIVIEW™ DISPLAY - SYSTEM PAGES - MODULES





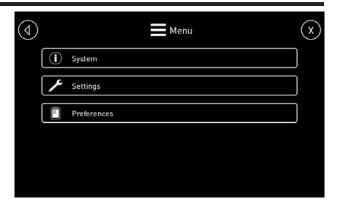


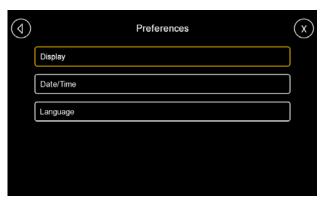
Chassis engine



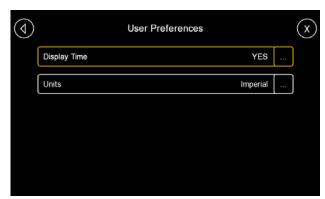
Chassis transmission

The Menu switch activates various screens for screen display and option settings. See troubleshooting section for details.









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

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

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

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

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

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

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

Note: ParaDIGM wired remote will

only work when the wireless switch on the master control panel is set to ON.

Charging

The wireless remote needs charged before use. When the batteries are completely dead, with no charge at all, they will need to be hard wire charged. The batteries will need to be put in an individual charger or

connected to the tether to charge the batteries. If they still do not take a charge then they will need to be replaced. The induction charger will not charge a completely dead unit. Other charging options are also available.

SAFETY INSTRUCTIONS

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

The WSO uses a replaceable CR123A battery.





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

Wireless remote

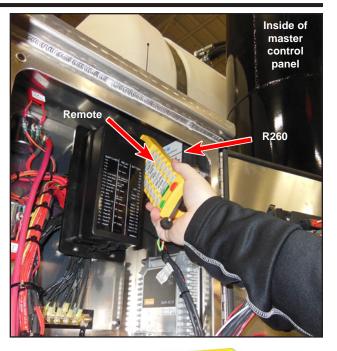
- 1. Hold down the red button.
- 2. Hold down the green button.
- Wait until the splash screen appear, in this case, wait until you see the Vactor logo appears on the screen.
- 4. Release the red button.
- 5. Release the green button. The remote is now in service mode.

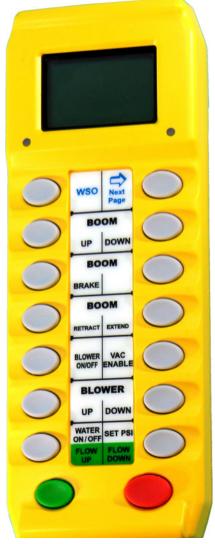
R260 - receiver

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

Wireless remote

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





Operation with the emergency shutoff

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

Note: FLXX-C - press both WSO buttons

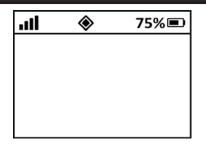
- 5. Connect WSO lanyard
- 6. Set Water Pump On

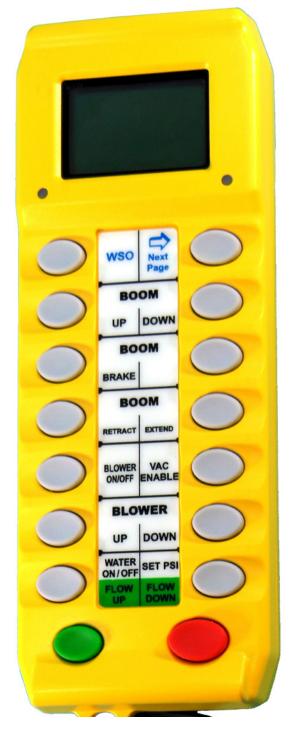
Note: if the WSO lanyard is disconnected during operation, the water pump will turn off and center dot icon \diamondsuit will disappear.

Only one WSO can be actively paired.

Operation without WSO

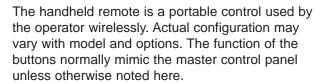
- 1. Water Pump is off
- 2. Set wireless on
- 3. Press Wireless switch at panel
- 4. Set Water Pump On





WIRELESS REMOTE - HETRONIC ERGO S HANDHELD





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

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

The common controls include:

- · Debris Body Controls
- Boom Controls
- Vacuum Controls
- Water Pump Pump ON/OFF
- Water Pressure variable
- Throttle UP/DOWN
- Vibrator
- Sludge Pump



A WARNING

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

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



Step 1: Pull out E-Stop button.



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



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



To turn remote off:

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

Step 3: Engage Wireless Mode by selecting the REMOTE button on the control panel System/Blower keypad.



Hetronic ERGO S - TRUVAC

REMOTE - E-STOP OPERATION

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

The following will trigger an E-stop:

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

E-Stop

- Press the red E-Stop button located on top of remote.
- After pressing the E-Stop on the wireless remote, the following screens will display.

To return to work condition, do the following:

- 3 Pull out remote E-Stop button.
- Press the Pair button when the screen prompts to do so.











2



Mode Selection Screen



Controls Interlock Screen



Standard Mode Selection



Dump Controls Mode Selection

REMOTE - DISPLAYS OPERATION



Vacuum and Water Page Standard Mode

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



Vacuum and Air Page Standard Mode

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



Dump Controls Page Dumping Mode

- Allows debris body controls via the boom joystick
- Displays water data

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





Water

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

- 1 Press the WATER button to engage the Water Pump.
- A water indicator on screen will show a blue dot when water is active..
- 3 Use the pink and green buttons to adjust water flow.

Pink - FLOW UP

Green - FLOW DOWN

Press WATER button again to disengage Water Pump.





Button Functions

YELLOW - OPTIONAL BOOM INTERLOCK FEATURE

BLUE - WATER PUMP PRESSURE

PINK - WATER FLOW UP

GREEN - WATER FLOW DOWN

EXTEND - BOOM EXTEND

RETRACT - BOOM RETRACT

VAC - VACUUM RELIEF

WATER - WATER PUMP

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





Dump Controls

Note: Must be in Dump Controls Mode

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

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





Joystick Functions

UP - BODY UP

DOWN - BODY DOWN

RIGHT - CLOSE REAR DOOR

LEFT - OPEN REAR DOOR

Button Functions

YELLOW - VIBRATOR

BLUE - SLUDGE PUMP

PINK - FLOW UP (WATER)

GREEN - FLOW DOWN (WATER)

Hetronic ERGO S - TRUVAC

REMOTE - BATTERY REPLACEMENT AND STORAGE

OPERATION

Battery Pack

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



Press in and pull out battery

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

Phone: 877-342-5374

Service Cloud: Vactor.com > Parts and Service >

scroll down to Service Cloud

Wired Pendant Cord

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



Wireless Remote - Wired Pendant

- 1 Press in and pull out battery from bottom of remote.
- Attach threaded end of cord connector to the Pendant port on the control panel.
- 3 Plug the battery insert end of the cable into the remote.
- Press the REMOTE position on the System Keypad

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

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

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



Paradigm

WATER SYSTEM - FILLING THE WATER TANK

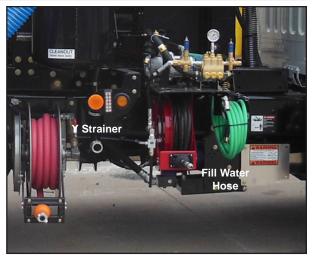
The water tank needs to be filled with clean water before every use. This procedure is the key to extending the life of the pump. Failure to do so may result in pump failure. At the end of each work day, allow the water tank to drain and dry out over night.

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 truck centered with the hydrant on the passengers side of the unit.
- Check and clean y-strainers 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 watertank 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.

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.

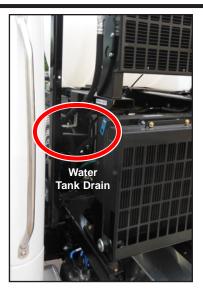
The watertank is equipped with a water drain.

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.



NOTICE

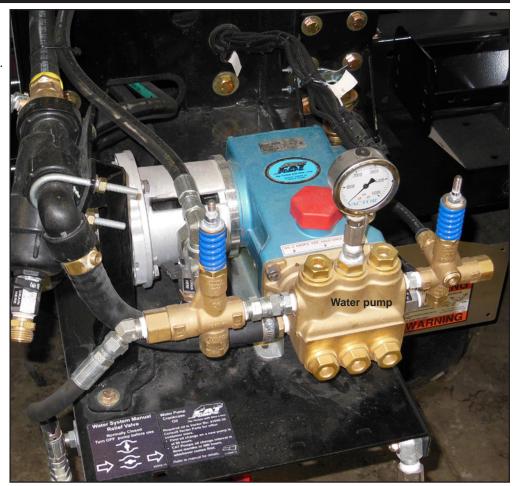
Water System Can Be Damaged By Freezing Ice in the water system can severely damage components. To avoid ice damage:

- 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 8 Gallons Per Minute (GPM) at 3,000 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 hydraulic proportional valve and the system controller.

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



Note: The water system must be full prior to connecting or turning on the water heater. The water heater will not operate unless there is at least 3 GPM water flow. See water heater instructions for proper operation of the water heater.

Water Lance Ball Valve

The water lance ball valve is removed when using the optional recirculator.

When using the handgun, use quick couplers to remove the water lance ball valve.

This unit is equipped with a high pressure handgun. The high pressure handgun can only be connected to the hose reel located in the water pump cabinet. The high pressure water system uses up to the full water pump pressure of 3,000 PSI and can only be used with the special high pressure handgun or a high pressure wand. The high pressure system also uses a high pressure water unloader valve and ball valve.

Note: Should the handgun high pressure relief valve trip (or open), water will unload straight down on the ground. The main control unloader dumps to the suction line.

A WARNING

Handguns Use High Pressure Water



High pressure water can cause serious injury or death.

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



Digging Faster With Less Water



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

Productive:

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





Rugged:

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

Safer:

• Urethane outer coating protects from electrical conduction

Specifications:

Minimum Inlet Pressure: 1,000 PSI (69 bar)
Maximum Inlet Pressure: 3,000 PSI (207 bar)

Maximum Water Temperature: 180 degrees F (82 degrees C)

Housing Material: Stainless Steel **Coating Material:** Urethane

Nozzle Tip Material: Tungsten Carbide Inlet Connection Thread: 1/2 inch FNPT

Rebuild kits available



			FLOW RATE CHART (GPM)				
Nozzle Size	Nozzle Part #	Repair Kit Part #	@ 1000 Psi	@ 1500 Psi	@ 2000 Psi	@ 2500 Psi	@ 3000 Psi
3.0	508544-30	508544A-30	1.5 GPM	1.8 GPM	2.1 GPM	2.4 GPM	2.6 GPM
4.0	508545-30	508545A-30	2.0 GPM	2.4 GPM	2.8 GPM	3.2 GPM	3.5 GPM
5.0	508546-30	508546A-30	2.5 GPM	3.1 GPM	3.5 GPM	4.0 GPM	4.3 GPM
6.0	508547-30	508547A-30	3.0 GPM	3.7 GPM	4.2 GPM	4.7 GPM	5.2 GPM
8.0	508548-30	508548A-30	4.0 GPM	4.9 GPM	5.7 GPM	6.3 GPM	6.9 GPM
10.0	508549-30	508549A-30	5.0 GPM	6.1 GPM	7.1 GPM	7.9 GPM	8.7 GPM
12.0	508550-30	508550A-30	6.0 GPM	7.3 GPM	8.5 GPM	9.5 GPM	10.4 GPM

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

Note: The minimum pressure is 1,200 PSI for the water heater to fire which with the minimum flows. The smaller water heater must have 3 GPM of water flow before it will ignite.

Heater controls are located below the heater. Separate operating instructions are supplied for the heater in the Options section.

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



A 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.

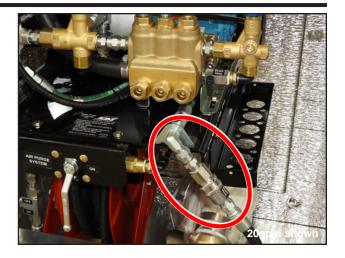


Hotsy Water Heater Control Panel

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. Flow can be adjusted during preheat.

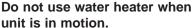
Recirculating water keeps the water from freezing. The water heater can be used to preheats\ the water for cold weather applications, certain soil types, and cleaning the HXX unit. The water heater can not be used with the recirculator.

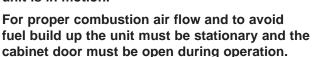
The adjacent picture shows the hose reel connected to the recirculator. Adjust the ball valve to build up enough pressure to allow the water heater to operate. Set the Multiflow to maximum to allow full flow for faster heating.





Fire hazard





HXX Recirculator Operation Recirculate

- 1. Fill water tank(s)
- 2. Connect hose reel outlet line to recirculator return line
- 3. Open ball valve on hose reel outlet line
- 4. Open all water suction valves to water pump
- 5. Turn Master switch ON
- 6. Turn Recirculator switch ON

Preheat - Stationary ONLY (Requires optional water heater)

- Fill water tank(s)
- 2. Connect hose reel outlet line to recirculator return line
- 3. Open ball valve on hose reel outlet line
- 4. Open all water suction valves to water pump
- 5. Turn Master switch ON
- 6. Turn Water Pump switch ON
- 7. Turn Boiler switch ON and set temperature **NOTE:** do not heat water over 140° (F) in tank





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

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

Note: The chassis air reservoir should be at 90 PSI when activating the air purge system. It may be necessary to refill the auxiliary tank multiple times to completely purge the water system.

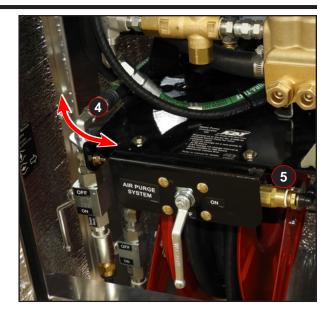
Purge the water system:

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

Note: The water system should be drained. Refer to the water tank pages in this section.

- 1. Open the ball valve at the end of the hose on the hose reel to depressurize the system.
- Disconnect the ball valve assembly from the end of the hose reel hose so the male end of quick disconnect is open to allow the purge air to flow freely.
- 3. Pull all the hose off the hose reel and lay it flat on the ground to gravity assist the water bleeding process.
- Close the water supply valve. This will create back pressure and force the check valves open when the air purge and Cat pump are turned on.

Note: Air above 90 PSI and high volume can damage the pump seal retainers and ceramic plungers.



- 5. Turn the water pump on for 10-15 seconds at lowest speed and at the same time SLOWLY turn on the ball valve.
- 6. It should not be necessary to run the pump more than the 10-15 seconds with the suction line closed; but additional air purging may be necessary.
- 7. Remove the water filter.
- 8. Repeat purging procedure to blow out the hose reel and lines until all the water is drained.
- Allow the hose to go back on the hose reel slowly. This will ensure all the water has been drained from it.
- 10. Open all mini ball valves on the pump.

When the water hose is purged of water, put the water pump ball valve in the OPEN position. Put other systems, such as the handgun, open for purging. After the system is purged, place the Purge System ball valve in the OFF position.

Note: Leave all drain plugs open to keep residual water from the tanks from migrating to the system during transport.

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.

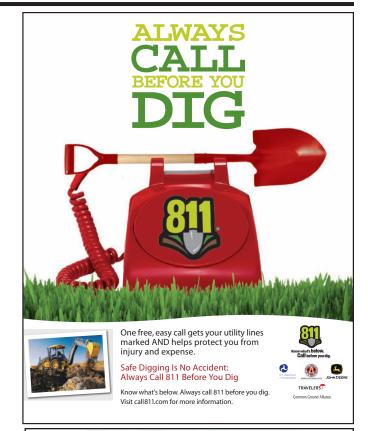
WARNING

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).



Do Not Enter an Unprotected Trench!



For your safety:

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

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



U.S. Department of Labor

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

OSHA 3215-04N-0

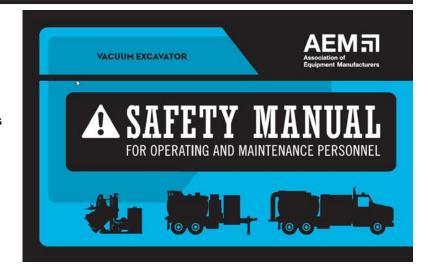
The AEM is a leading provider of training and safety material.



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

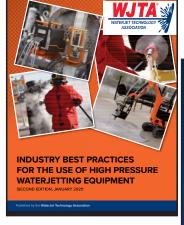
Recommended Practices for the Use of Industrial Vacuum Equipment



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







Guideline for Excavation in the Vicinity of Utility Lines



1-877-ESA-SAFE 1-877-372-7233 **Customer Service Center**

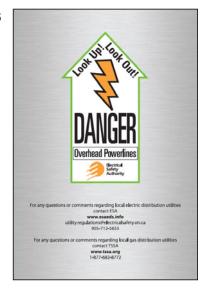
website: www.esasafe.com



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



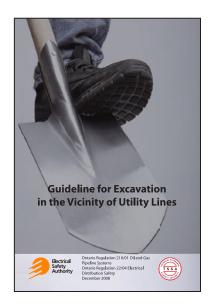


Work Safe for Life

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



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.

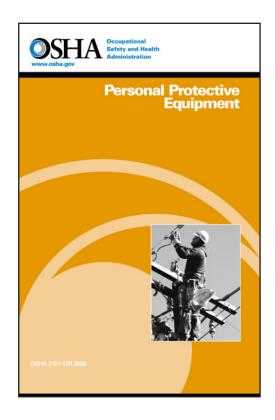
A hazard assessment should be made to determine the correct level of footwear safety protection. Underground electrical utilities may require the use of insulating gloves and dielectric footwear. The minimum requirements for gloves are compliant with OSHA 1910.137, OSHA 1910.268, NFPA 70E and exceeds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

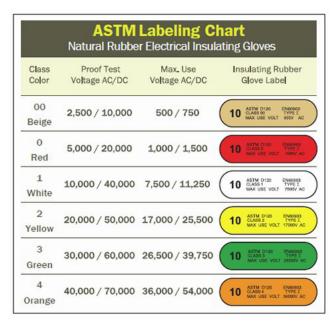
National Fire Protection Association (NFPA)

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.





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.
- Follow all recommended procedures for electrical bonding. Ground mats may be required.
- 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.
- The working end of the vacuum tube should be equipped with a soft nonconductive end to help reduce the risk of contact or damage to buried lines and pipes.
- 6. Water pressure, volume and temperature can have a big impact on the risk of damaging the various underground utilities. Some testing may be required to avoid damage. Lower the water pressure and temperature when getting close to the utilities. The water nozzles must always be in motion.
- 7. Teamwork is very important when trenching and digging large holes. One person is operating the wand or hand gun. The other person is positioning the boom so the vacuum tube is in the right position to move the material as soon as it breaks away. It is not productive to try to wash the material to the nozzle or to try to vacuum the material a great distance to the nozzle.

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

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



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

A WARNING

Underground hazards

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

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



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

Paradigm

ENGAGING THE VACUUM & HYDRAULIC SYSTEMS

- 1. With the parking brake on, start and idle the engine with the transmission in neutral.
- 2. Set the master switch to ON in the cab.
- 3. Engage the blower if needed. Only operate at an airflow level sufficient to convey the material without causing carryover.
- 4. Once the system is operating, enable vacuum.

A DANGER

Entanglement Hazard

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



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

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

NOTICE

Machine Can Be Damaged

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

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

Paradigm Engaging the Blower and Water Pump - Auto Transmission

OPERATION

On vehicles with automatic transmissions, engage the hydraulic pump and blower as follows:

- 1. Set parking brake
- 2. Set transmission to neutral
- 3. **Engage Master Switch**





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

Visual Inspection

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

- Make a visual inspection of the engine compartment, for oil or water/coolant leaks and loose or worn belts and hoses. Check and adjust fluid levels as needed. When finished under the hood, securely fasten the hood straps.
- Beginning at the front of the truck, inspect all lighting, head lights, running and marker lights and turn signals, beacon lights, engine hood, windshield, should be free of crack and excessive pitting and bumpers for condition and attachment.
- Moving to the right side of the unit, inspect tires for tread depth, air pressure and securement, mirrors for vision and securement. Cab access for condition, doors operate smoothly and side glass for condition.
- Battery box and batteries, check the tie downs, battery cable condition and tightness and the batteries should not signs of swelling which could indicate freezing or an overcharging condition.
- 5. Blower exhaust silencer, that it was drained the night before and the cap was left off, reinstall the drain cap. Inspect the blower outlet and inlet attachment for loose bolts or signs of excessive heat. Inspect the inlet silencer for condition. Both silencers are equipped with rain caps to prevent water from entering make sure they are in place and move freely.
- 6. If equipped, open the water heater cabinet and inspect the water heater for signs of excessive heat, water and fuel leaks. Inspect all wiring and valves to ensure the water heater is ready for service. Does the heater ignite, check this before going to a jobsite.
- 7. Open the water pump cabinet, check that the water filter/strainer was removed the previous day, reinstall it. Give a thorough inspection of the charge pump, hydraulic drive pump its coupler to the water pump and ensure all

- opened drain valves are closed. Ensure all ball valves operate freely and do not leak.
- 8. Inspect the air compressor hose and hose reel, make sure the hose coupler twist locks have the rubber gaskets and the hose is free of defects. Some air leaks may require the use of an electronic ear/listening device to pinpoint air system leaks
- 9. Inspect the vacuum nozzle for wear and holes, inspect the elbow transition to the upper boom.
- Inspect the water tanks for leaks, open the control panel cabinet and ensure the water level indicator is functioning, since the water system was drained the previous day the level indicator should be reading empty.
- 11. Ensure the cabinet is fully stocked with the needed tools and remotes to operate the unit, does the wireless remote activate are the batteries in adequate stage of charge?

 Does the wired pendant controller operate the controlled functions? Are there extra clamps for the vacuum hose sections? Do all the switches on the panel work?
- 12. Open any remaining tool boxes and check their inventory.
- 13. Deploy the ladder (if equipped) and inspect the boom, boom seals and boom pivot.
- 14. Rear hose reel cabinet, some cabinets are equipped with heaters ensure the heaters are operational if equipped, inspect the hose and reel in this cabinet, extra lance or wand section if needed. Make sure the hand gun is in one of the cabinets.
- 15. Check the rear lighting, brake lights, four ways, running and clearance light, license plate light and back up lights, The backup alarm should sound when the reverse lights come on. If equipped with an arrow board that it flashes in both directions, or a beacon light is operational and visible from the rear of the unit.
- Rear bumpers are in place secure and labeled with conspicuity tape according to your local DOT requirements.
- 17. Inspect the rear door seals for evidence of leaks or improper sealing, the best time to see a leak at the seal is when the debris body is full, remember to care for the seal and its mating surface after each dumping.

- 18. Inspect the hydraulic cylinders for actuation and leaks. Make sure the door latches are engaging the latches and they enter approximately the same distance for uniform clamping pressure.
- Ensure the rear door safety props are in place and functional.
- 20. If equipped with the optional sludge pump inspect its mounting and when not in use the hydraulic lines must be connected to the dummy plugs on the rear door. Flush the pump thoroughly with water when after each use..
- 21. Inspect any rear door decants for leaks and function.
- 22. Inspect the wire harness and hydraulic lines up the side of the body for attachment and condition.
- 23. Inspect the condition of the debris body as you walk around the unit, note any discrepancies and report to maintenance.
- 24. Inspect the make/break seal at the body to cyclone transition for evidence of leaks, this seal must be washed at each dump cycle.
- 25. Open any tool box or cabinet and inventory for jobsite needs. Clamps, auxiliary lighting, hydrant wrenches spare batteries etc.
- 26. Inspect the hydraulic oil cooler for cleanliness, it must be washed once a week to ensure adequate heat transference.
- 27. Inspect and clean the cyclonic cleanout, this door must remain open after dumping and cleaning to allow the cyclones to dry out.
- 28. Open the air compressor cabinet and inspect the air compressor for fluid levels, air filter cleanliness and overall condition.
- 29. Inspect the hydraulic tank, proper level with the correct fluid, the PD units have a separate filter head and cartridge located on the return line to the reservoir, ensure the restriction indicator is operating in the "green" zone if not the filter must be serviced.
- **NOTE:** cold hydraulic fluid can cause a false reading on the restriction indicator, allow the fluid to reach operating temperature before condemning the filter.
- 30. Inspect the rubber hose coming from the cyclonic filter housing, the clamps are in place and the tube is free of holes.

- 31. Inspect the Final Filter, the prefilter should be free of dried mud and allow free air flow to the element, if it is restrictive it can be washed in warm soapy water and dried. The filter element should be clean allowing air to flow freely to the blower inlet without creating any restriction. One way to know filter condition, when the filter is new observe the vacuum gauge on the control panel, when the airflow reveals an increase of 1" of Hg or more the filter needs servicing.
- 32. Crack the air tank bleeder petcocks open to expel any accumulated moisture, just because the unit may be equipped with an air dryer doesn't exclude the air tanks from a little preventative maintenance.
- Check the level of the DPF reservoir, if low fill to the appropriate level. The location of the DPF reservoir will vary by chassis manufacturer.
- 34. Fill the unit with diesel fuel daily.
- 35. Inspect the exhaust system for leaks and the clamps are secure.
- 36. Inspect all hydraulic component for leaks and ensure they function when the function is activated.
- 37. Inspect all fluid levels for the transfer case and blower reservoirs. The site gauge should have a ¼" air bubble in the top of the gauge.

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

Be especially aware of underground utilities.

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

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

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

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

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

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

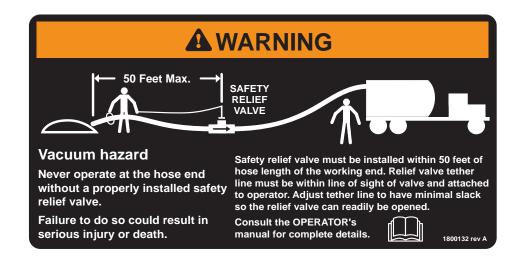
Chock the wheels. Set out road cones, if necessary, to keep traffic and people away from the hydro excavation activities. Place the cones at a distance so water and debris spray can be contained within the work area.







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



Vacuum Tubing

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

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

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

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

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

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

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

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

Water Hose

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

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

Select the nozzle tip for your specific application.



VACUUMING TIPS OPERATION

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 open vacuum relief valves and reduce rpm before attempting to dislodge any obstruction in the vacuum tube.
- For best performance, run the vacuum pump at a lower rpm.
- Do not bury the nozzle in the material. Air flow is required to convey the material through the tube.
- If air flow is not sufficient to convey the material, increase the rpm in moderation.
- Eliminate unnecessary bends or turns in the tube.
- If there is a sudden drop in air flow, check the debris level.

Safety Tips

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

SAFETY INSTRUCTIONS

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

To shut down the system:

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



Vacuum Hazard

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

Stay clear of the suction hose inlet end.

Turn vacuum off before attaching hose, pipe or accessories.

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

Refer to SAFETY manual for details.



A ADVERTENCIA

Riesgo Por Altovacío

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

Manténgase lejos de la boquilla de la manguera de succión.

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

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

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



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

- 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 weather and operating conditions cannot be controlled, but the air speed, water volume and water pressure can be. The blower speed controls the volume of air and the speed of air movement through the pipe and into the debris body.
- If the soil or material breaks up easily, the blower can run at higher speeds and allow faster material pickup. The air speed must be adjusted to move maximum amounts of material without carry-over into the blower.
- Air speed is important when working in freezing temperatures. High Air speeds cause wind chill conditions because of the air velocity. The wind chill conditions cause ice build-up in the vacuum tube or boom, which blocks material movement.
- 6. Proper air speed will vary depending on the material moved. Air velocity should be set so material does not hang in the pipe. Adjust RPM to the lowest setting to move the material efficiently. Increase the speed as needed to pick up large rocks or heavy sludge. Watch the air exhaust for carry-over material. Any type of carry-over should be avoided.
- 7. The further the distance from the work site to the debris body, the higher the air speed should be. The shorter the distance, the lower the air speed. Material moving through a pipe or tube creates a friction factor. The longer the tube or pipe, the higher the friction factor called friction loss. Pipe and tube diameter is a major factor when moving material. The standard unit comes with a eight-inch diameter hose.

NOTICE

Machine Can Be Damaged

- Beware of carry over material from debris body through the blower or fan.
- Running the blower/fan too fast with light material can carry the material over into the blower or fan. This can cause premature wear.
- Over filling the debris body can cause carry over and damage to the fan/blower.
- 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.
- To prevent rodder pump damage, always open at least one ball valve before engaging the pump.

OPERATION

Setting Up

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

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

Selecting a Nozzle

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

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

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

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

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

Cutting the Soil

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

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

A 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.

A WARNING

High pressure water

High pressure water can cause serious injury or death.

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

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

Vacuuming the Soil

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

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

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.

Position the vacuum hose near the material to be vacuumed.

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

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

All vacuum trucks move material through air conveyance. They rely on air movement to 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.

Determining Blower Speed

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

Air Flow

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

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

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

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

Debris Level

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

Check the debris level if air flow diminishes suddenly.

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

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

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

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



Freezing Temperatures

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

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

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

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

Rocky Ground

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

NOTICE

Machine Can Be Damaged

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





Operating Instructions

- 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
- 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.
- The weather and operating conditions cannot be controlled, but the blower speed, water volume and water pressure can be. The blower speed controls the volume of air and the speed of air movement through the pipe and into the debris body.
- 4. If the soil or material breaks up easily, the blower can run at higher speeds and allow faster material pickup. The blower speed must be adjusted to move maximum amounts of material without carry-over into the blower.
- blower speed is important when working in freezing temperatures. High blower speeds cause wind chill conditions because of the air velocity. The wind chill conditions cause ice build-up in the vacuum tube or boom, which blocks material movement.
- 6. Proper speed will vary depending on the material moved. Air velocity should be set so material does not hang in the pipe. Adjust RPM to the lowest setting to move the material efficiently. Increase the speed as needed to pick up large rocks or heavy sludge. Watch the blower exhaust for carry-over material. Any type of carry-over should be avoided.
- 7. The further the distance from the work site to the debris body, the higher the blower speed should be. The shorter the distance, the lower the blower speed. Material moving through a pipe or tube creates a friction factor. The longer the tube or pipe, the higher the friction factor called friction loss. Pipe and tube diameter is a major factor when moving material.

NOTICE

Machine Can Be Damaged

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

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

Blower Speed

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

Use a high rpm for heavier material. Low rpm for lighter. Higher air speed causes a wind chill factor, causing ice buildup. The blower has three speeds.

Material

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

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

Freezing Temperatures

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

Carryover

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

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

Distance

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

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

Debris Level

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

NOTICE

Machine Can Be Damaged

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

Water Pressure

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

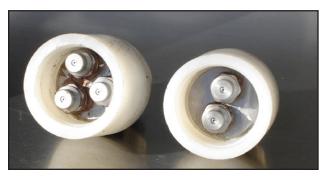
Lower pressures are good in easy digging conditions and when working around older utilities where the protective cover may be in poor condition. It is also safer and uses less water. Keep the nozzle as close to the ground that you are cutting to maximize the water pressure. In general, 2000 psi at the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

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



Typical nozzles





Water Volume

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

How damp is the material?

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

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

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

What are the soil conditions?

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

What are you doing?

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

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

What nozzle head are you using?

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

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

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

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

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

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

Ceasing Operations

- 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.
- Disable the vacuum and set the blower to off.
- 3. Set water system to off.
- 4. Disconnect water wand or high pressure hand gun and store in cabinet.
- Hold onto water line and let it rewind slowly onto hose reel.
- 6. Disconnect digging tubes and store them.
- 7. Remove any safety equipment and store in cabinet.

Note: The service valve at the air hose reel must be in the closed/off position when starting or stopping the air compressor to avoid tripping the velocity fuse. When shutting down this also avoids oil from accumulating in the coalescer.

NOTICE

To avoid transmission and/or PTO damage

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

Never attempt to engage PTO while the truck is moving.

NOTICE

Machine Can Be Damaged

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

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

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.

- Position the truck 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.

A 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.

NOTICE

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

Paradigm

ENDING OPERATION - DUMPING DEBRIS BODY

When dumping a load at an authorized disposal site, the operator must pick a level area with enough compaction to prevent the loaded Vactor from tipping or becoming stuck or unstable. Be sure to check for overhead obstructions. When in position, set the parking brake and keep the truck running. Using the instructions in the cab, 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. Release the parking brake and pull the truck 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.



Serious injury or death can result from falling debris body.

Never go under a raised debris body without the safety prop(s) in place. Debris body must be clean and empty for service work.

On firm level ground raise the bo above the height of the props. Tilt the prop(s) in place. Lower debris body until it just rests on the prop(s). Use all props.

Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.

Refer to manual for details.



Serious injury or death can result from falling rear door. Never go under the rear door when open. Use door prop(s) or safety pin(s) to secure door before entering body, working under or around the door.

Open the rear door to just clear the prop(s) and lower door until it just rests on the prop(s). On units that use a safety pin(s) open the door until the pin holes are aligned and insert pin. Use all props or pins. Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.

WARNING

Electrocution hazard

Serious injury or death can result

Check for overhead wires and obstructions before raising debris body, opening rear door or raising optional equipment. Never leave debris body, rear door or optional equipment raised or partly raised equipment raised or party while vehicle is unattended. Never move vehicle with debris body, rear door or optional equipm raised.

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





Crushing / Tipping Hazard

To avoid injury or death:

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

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 and let all of the water drain out of the water tank.
- 2. Close the Water Pump Shut Off Valve.
- 3. With the engine running and all the drain valves closed, open the Air Purge Valve.
- 4. Wait until the hose reel is purged of water.
- Open the Hand Wash Valve wait for the water to be purged from the line, then close the valve.
- 6. Open the Bypass Valve Drain Valve for 30 seconds then close the valve.
- 7. Open the Water Pump Drain Valve for 30 seconds then close the valve.
- 8. Open the Boiler Drain Valve inside the hose reel cabinet and wait for the hose to be purged of water.
- 9. Take off the cap and remove the Y-Strainer screen from the Water Pump Y-Strainer.
- 10. Turn off the Air Purge Valve.
- 11. Open the Water Pump Shut-off Valve.
- 12. Open all of the drain valves and leave open while the unit is not being used.





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

- Open the ball valve at the end of the hose on the hose reel to depressurize the system and remove the valve assembly.
- 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.
- 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

- 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.



AWARNING

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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OPERATION

- 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.





TIPPING AND CRUSHING HAZARD

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

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

512887B r0

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.

DUMPING SAFETY OPERATION

AWARNING



Crushing hazard.

Serious injury or death can result from falling debris body.

Never go under a raised debris body without the safety prop(s) in place. Debris body must be clean and empty for service work.

On firm level ground raise the body above the height of the props. Tilt the prop(s) in place. Lower debris body until it just rests on the prop(s). Use all props.

Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.

Refer to manual for details.

AWARNING



Crushing hazard.

Serious injury or death can result from falling rear door. Never go under the rear door when open. Use door prop(s) or safety pin(s) to secure door before entering body, working under or around the

Open the rear door to just clear the prop(s) and lower door until it just rests on the prop(s). On units that use a safety pin(s) open the door until the pin holes are aligned and insert pin. Use all props or pins.

Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.

AWARNING



Electrocution hazard.

Serious injury or death can result from electrocution.

Check for overhead wires and obstructions before raising debris body, opening rear door or raising optional equipment. Never leave debris body, rear door or optional equipment raised or partly raised while vehicle is unattended. Never move vehicle with debris body, rear door or optional equipment raised.

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

1800128 rE

AWARNING



Electrocution hazard

Serious injury or death can result from electrocution.

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

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

Refer to SAFETY section in manual.



SAFETY INSTRUCTIONS

Best Practices for Dumping

Position unit on level, stable ground.

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

Vibrator (if equipped)

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

A WARNING

Crushing Hazard

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

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

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

Note: If truck is equipped with air ride suspension, dump air suspension so that the rear of the truck is at its lowest point before dumping.

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

Functionality

Park Brake Set

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

Park Brake Released

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





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.







The 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 fan by removing material from the air stream before it reaches the fan.

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.

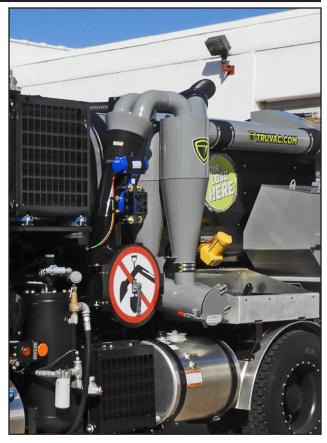


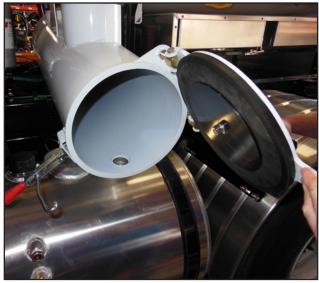
Biological hazard Always stand to the side when opening the clean out door.

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. Using the reach pole slightly raise up and pull out the body prop.
- 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. Push the prop to the stored position.
- C. The door can now be closed.









Rear Door Can Be Damaged

Remove safety support(s) before closing door to avoid damage. Open rear door before raising the debris body.

Make sure rear door attachments clear the bumper and ground when raising the debris body.

89384CA rev



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, 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. Using the supplied handle rotate the safety prop towards the prop rest.
- 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

- Raise the debris body just enough to clear the safety prop, rotate the prop back to the stored position.
- 2. The debris body can now be lowered.
- 3. Remove and store the debris body prop handle.

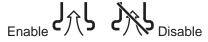




Overview

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

Vacuum reliefs are normally labeled enable/disable.



Application on PD blower vacuum trucks

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

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

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

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

Application on sewer cleaner vacuum systems

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

PD versus Fan vacuum relief operation

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

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

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

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

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



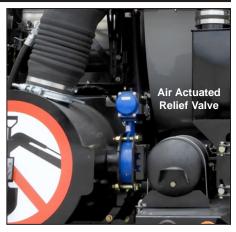
Use proper hearing protection when in the vicinity of this device which emits a loud, sharp sound. Follow safety precautions to prevent injury from high velocity flow of materials.

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

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

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

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





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.
- 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.

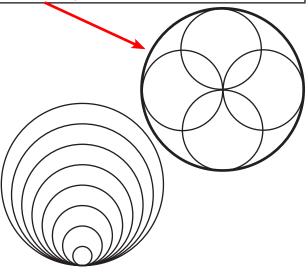




Shown is an example of a good vacuum hose run. The hose is the same size from the truck to the hose end. The Safety tee is located for good operator access and a hose end is being used.

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:

- 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.
- Maintain an MSDS/SDS for all materials the units is used for.
- 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.

AWARNING



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.

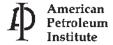
Serious injury or death may result if cleaning procedures are not followed.

Safe Operation of Vacuum Trucks in Petroleum Service

API RECOMMENDED PRACTICE 2219

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Available from the WJTA:

Recommended Practices for the Use of Industrial Vacuum Equipment.



St Louis Missouri 6200 USA - www.WUTA org - with dwits and

Vactor

Unit			
Work	performed by		Date
Note	s		
Area	s NOT decontamina	ated	
1			
2			
3			
4			
5			
Last	material in unit		
MSDS/SDS attached		Yes - No	
Cleaning agents used			Yes - No
MS	SDS/SDS attached		Yes - No
Othe	r		
1	Unit fully winterize	ed?	Yes - No
2	Water tanks draine	ed and flushed?	Yes - No
3	All filters, strainer	s, filter bags cleaned or replaced?	Yes - No
4	Exterior of unit cle	eaned?	Yes - No
5	Debris body, cyclo	one(s), bag house(s), dump tube(s) clear	red? Yes - No
6	All other areas ma	terial 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.



Biological hazards

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

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

NOTICE



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

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

Note: A printable checklist is in the Maintenance section.

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



Check all lights including brake and running.



Check tire pressure and condition.



Check brakes, driving and parking.



Fill diesel exhaust fluid tank if equipped.



Wheel chocks should be available on the unit.



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



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

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

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

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

Note: A printable checklist is in the Maintenance section.

Check all hydraulic and electrical functions for proper operation.



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



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



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



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



Check filters if equipped.

Replace any that have excessive build up.



Check all microstrainers and strainer baskets as equipped.



Verify ground bonding cable.





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

To comply changes in engines have been made that include:

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

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



NOTICE

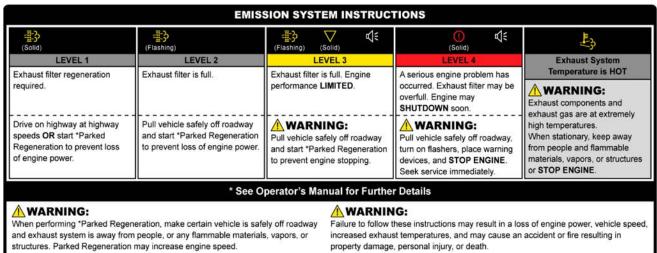
Consult OEM chassis and engine operation and maintenance manuals for complete details on operation.

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

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

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

Typical cab instruction decal (IH shown)



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

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

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

External Alert System

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

Consult chassis operator's manual for service details.

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

Note

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

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

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

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

http://articles.directorym.net/Crack Down on Idle Time-a878668.html

NOTICE



Jump Starting Or Welding Can Damage Electrical System

To avoid damage:

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

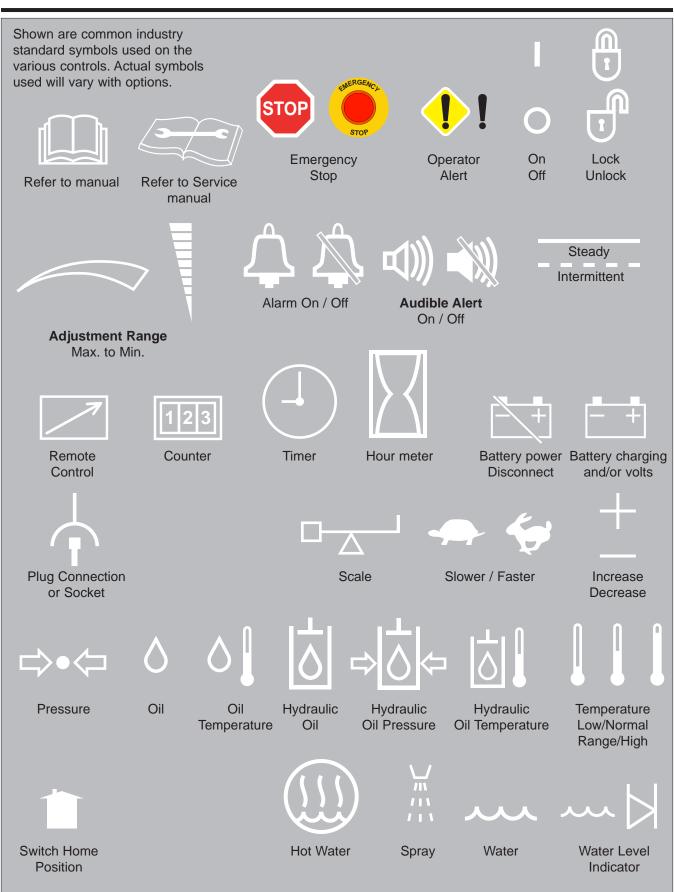
NOTICE



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

This manual is available at: www.vactor.com

Symbols Operation



Symbols Operation



Symbols **OPERATION**

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

n/min











Blower or Compressor RPM

Blower or Compressor

Rotary Compressor, Liquid Ring or Vacuum 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).

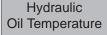


Red indicator light - activated when a condition requires immediate attention or the function has been activated.





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







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

Oil **Temperature**



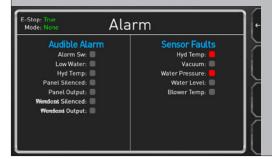
Vacuum ENABLE / DISABLE



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.

STATIC ELECTRICITY OPERATION

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.

Safe Operation of Vacuum Trucks Handling Flammable and Combustible Liquids in Petroleum Service API RECOMMENDED PRACTICE 2219

Additional copies available from API Publications and Distribution: (202) 682-8375

Information about API Publications, Programs and Services is available on the World Wide Web at: http://www.api.org



1220 L Street, Northwest Washington, D.C. 20005-4070 202-682-8000



Typical static cable and clamp

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

•	Training/Workshops	Ph: Fax:	202-682-8490 202-682-8222
•	Inspector Certification Programs	Ph: Fax:	202-682-8161 202-962-4739
•	American Petroleum Institute Quality Registrar	Ph: Fax:	202-682-8130 202-682-8070
•	Monogram Program	Ph: Fax:	202-962-4791 202-682-8070
•	Engine Oil Licensing and Certification System	Ph: Fax:	202-682-8233 202-962-4739
•	Petroleum Test Laboratory	Ph:	202-682-8129

In addition, petroleum industry technical, patent, and business information is available online through API EnCompass™. Call 1-888-604-1880 (toll-free) or 212-366-4040, or fax 212-366-4298 to discover more.

To obtain a free copy of the API Publications, Programs, and Services Catalog, call 202-682-8375 or fax your request to 202-962-4776. Or see the online interactive version of the catalog on our web site at www.api.org/cat.



American Petroleum Institute

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.

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Avoiding Static Ignition Hazards in Chemical Operations

A CCPS CONCEPT BOOK

LAURENCE G. BRITTON





CENTER FOR CHEMICAL PROCESS SAFETY of the

American Institute of Chemical Engineers 3 Park Avenue, New York, New York 10016-5901 USA If use of Vactor equipment results in exposure to potentially hazardous dust, employers and users should consult any applicable SDS as well as OSHA regulations, guidelines, and information to ensure safety of operators. Under these circumstances, users should pay particular attention to possible increased exposure when dumping debris hoppers and changing bag filters. Wearing appropriate respirator during dumping operations and wetting down filter bags before service or removal may reduce exposure to certain dusts such as silica dust. To reduce exposure in presence of potentially hazardous dusts, employers should consider use of upgraded filters, broken bag detectors, and ensure that any leaking gaskets and seals are promptly serviced. Employers should monitor exposure of operators and ensure compliance with applicable OSHA regulations and standards.

Some common practices to reduce exposure include:

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

Combustible dusts

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

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

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

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

- 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.
- 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.
- 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.
- Never use any non-conductive materials in any part of the vacuum line (PVC Pipe or Plastic Hose).
- Never use bare copper wire inside or outside of the vacuum line as a jumper across nonconductive 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.

Dust - Resources Operation

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

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

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

General Information

- FM Global, "Prevention and Mitigation of Combustible Dust Explosions and Fire", Data Sheet No. 7-76, January 2005.
- Eckhoff, Rolf K. "Dust Explosions in the Process Industries," 3rd Edition, Gulf Professional Publishing, 2003.
- Bartknecht, W. "Dust Explosions: Course, Prevention, and Protection," Springer- Verlag, 1989.

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

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

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

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

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

Code of Federal Regulations (CFR) [Standards]

U.S. Government Printing Office

732 N. Capitol Street, NW Washington, DC 20401

Telephone: 1-866-512-1800 (toll-free)

OSHA Standards, Interpretations, and Publications

U.S. Department of Labor/OSHA OSHA Publications Office

200 Constitution Ave., NW, N-3101

Washington, DC 20210 Telephone: (202) 693-1888 or by Fax: (202) 693-2498

Related OSHA standards found in 29 CFR:

1910.22 - General Requirements: Housekeeping

1910.94 - Ventilation

1910.107 - Spray Finishing Using Flammable and Combustible Materials

http://www.dustexplosion.info/



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

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

Dust - Resources Operation

National Fire Protection Association (NFPA)

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

Related NFPA Standards:

NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities

NFPA 68, Guide for Venting of Deflagrations

NFPA 69, Standard on Explosion Prevention Systems

NFPA 70, National Electrical Code 2014 Edition

NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids

NFPA 120, Standard for Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities

NFPA 432, Code for the Storage of Organic Peroxide Formulations

NFPA 480, Standard for the Storage, Handling, and Processing of Magnesium Solids and Powders

NFPA 481, Standard for the Production, Processing, Handling, and Storage of Titanium

NFPA 482, Standard for the Production, Processing, Handling, and Storage of Zirconium

NFPA 484, Standard for Combustible Metals, Metal Powders, and Metal Dusts

NFPA 485, Standard for the Storage, Handling, Processing, and Use of Lithium Metal

NFPA 495, Explosive Materials Code

NFPA 499, Recommended Practice for the Classification of Combustible
Dusts and of Hazardous (Classified) Locations for Electrical Installations
in Chemical Process Areas

NFPA 505, Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation

NFPA 560, Standard for the Storage, Handling, and Use of Ethylene Oxide for Sterilization and Fumigat

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

NFPA 655, Standard for Prevention of Sulfur Fires and Explosions

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

NFPA 1124, Code for the Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnic Articles

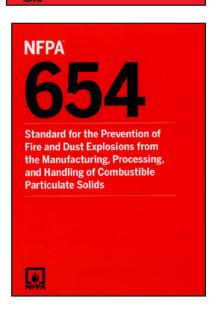
NFPA 1125, Code for the Manufacture of Model Rocket and High Power Rocket Motors

NFPA 68

Standard on Explosion Protection by Deflagration Venting



Recommended Practice on Static Electricity
2019



OSHA Fact Sheet

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

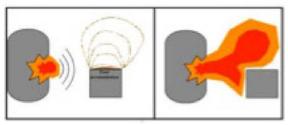
In addition to the familiar fire triangle of oxygen, heat, and fuel (the dust), dispersion of dust particles in sufficient quantity and concentration can cause rapid combustion known as a deflagration. If the event is confined by an enclosure such as a building, room, vessel, or process equipment, the 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.



Secondary Explosion





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 - Resources Operation

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.



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

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DSG FS-3791 05/2015

OSHA Fact Sheet



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

	Forincesing and	Respi Prote and Mi Assi Prote	uired iratory ection inimum igned ection ir (APF)		
Equipment/ Task	Engineering and Work Practice Control Methods	≤ 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 SILICA DUST OPERATION

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

Alternative Exposure Control Methods

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

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

What Else Does the Standard Require?

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

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

- wear a respirator for 30 or more days per year;
- Train workers on the health effects of silica exposure, workplace tasks that can expose them to silica, and ways to limit exposure; and
- Keep records of workers' silica exposure and medical exams.

Additional Information

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



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

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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Occupational
Safety and Health
Administration

DSG FS-3681 12/2017

Options

Options

HXX ParaDIGm

BACKFILL HOPPER OPTIONS

The backfill hopper is normally vacuum filled with sand, dirt, etc. to be dumped into a pothole to replace the spoils removed while digging.

Filling

The backfill hopper is vacuum filled by attaching a vacuum hose to the backfill hopper vacuum inlet port.

- Attach a vacuum hose to the backfill hopper vacuum inlet port.
- 2. Engage the blower.
- 3. Open the vacuum outlet valve.
- 4. Use the inlet hose to vacuum up the fill material.
- 5. Stop vacuuming when the hopper is full.
- 6. Close the vacuum outlet valve.
- 7. Remove and store the inlet hose.

Note: Use only the minimal amount of vacuum to load the backfill hopper. The backfill hopper is intended for smaller material like sand or dirt. Stringy material like mulch will plug the ports.

Operation

Normal operation requires that the unit be positioned with the backfill hopper dump chute over the hole to be filled. Use the hopper chute valve to meter out the require backfill material. Use the vibrator to free up any sticking material when backfilling. Activate the vibrator intermittently. Only use short vibrating blasts. Do NOT use long or continuous blasts.

The backfill hopper should be emptied and cleaned and the end of the work day. Material should not be stored in the backfill hopper.





The water heater is designed to control the temperature of the water. The heater output temperature is controlled by an adjustable thermostat control.

A water heater with an electronic temperature control will allow the water heater to heat different volumes of water without overheating and going into steam. The electric temperature control has a microprocessor in it that senses a rapid heat rise and shows the accent of the heat. The primary controls are designed with a safety system that shuts down after about 13 seconds if no flame is detected.

Routine Maintenance

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



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

Hour Meter - Hours unit burner switch is on.

Power indicator light - indicates there is power at the primary control.

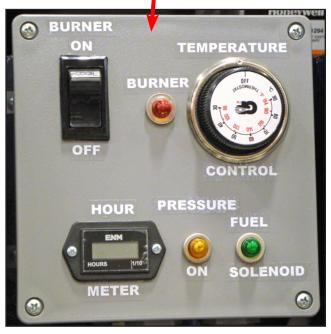
Fuel Solenoid indicator light - indicates that the fuel solenoid is active.

Temperature Control - Turn to adjust to desired water temperature. The burner will not operate in the OFF setting.

Pressure indicator light - indicates that the minimum flow and pressure of water is moving through the system. This light is triggered by the pressure switch located inside the water pump cabinet (may also be located in heater cabinet). To achieve the minimum hydraulic pressure to activate the flow switch requires proper water nozzle selection.







High Temperature Relief Valve

This valve will relieve the system to a drain hose when the system overheats or reaches 5000psi. This is a fail safe type of valve and must be replaced if activated.



WATERHEATER - ALKOTA - GENERAL OPERATION

- Check to make sure fuel tanks have at least a 1/4 tank of fuel. Heater will not ignite if fuel falls below this level.
- 2. Ensure water tank has water in it.
- 3. Open door on heater cabinet, this must remain open during operation to provide adequate air flow to the burner and to prevent overheating of the system.
- 4. Turn burner power switch to the "ON" position.
- 5. Set desired water temperature. Do not exceed 180° F.
- Turn on water pump and begin digging. 6.
- 7. The green flow indicator light will light when proper water flow/pressure is sensed by the pressure switch. Proper nozzle selection is required to produce needed flow.
- 8. When green indicator light is on the burner will receive the signal to ignite.
- Burner will turn on/off automatically to keep 9. water temperature within the set range.

If for any reason the water heater does not fire after 15 seconds, the fuel solenoid will lock out due to no flame. This can be reset by turning the burner power switch "off" and waiting 10 seconds. Return the burner power switch to the "on" position. If after 3 consecutive attempts and the burner does not ignite, discontinue use, start trouble shooting the water heater (refer to water heater troubleshooting section). The fuel solenoid indicator light will be on when the fuel solenoid is powered.

- 10. At lower water volumes the burner will cycle on/off as much as 4 to 5 times per minute. At higher volumes the burner will run continuously.
- It is recommended the water heater be turned off and allowed to cool with water flowing through the coil. This will decrease the amount of scale build-up in the coil.

It is recommended to change the fuel nozzle after every 1000 hours of operation.

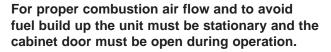
Some locations do not require heat for operation due to higher temperatures or soft materials being vacuumed. It is recommended to start your burner and let it run for 10-15 minutes once per month to ensure proper operation and prevent fuel from draining back to tank or debris from accumulating on the coils.



NOTICE

Fire hazard

Do not use water heater when unit is in motion.



Notes:

- Enabled when water pump is ON in stationary mode (does not work in road mode)
- Does NOT run in recirculation mode
- Disabled if water tank temperature is at least 100° F and water return line temperature is at least 120° F. (Does not apply to 2100 Plus CB units)



HXX Paradigm

WATERHEATER - ALKOTA - PERFORMANCE

OPTIONS

Burner performance is not affected until the elevation is over 2000 ft. As elevation increases above sea level, the ambient air contains less oxygen. Because there is less available oxygen per Cubic foot of air, the burner must deliver a higher volume flow (cfm) of air to provide the proper amount of oxygen for the amount of oil being burned. This is the reason that an increase in the burner air setting or a fuel nozzle downsize may be required as elevation increases. For every 1000 ft. above sea level there is a 1.84% rate reduction in the burner.

During normal operation there should not be any visible smoke. If smoke is observed shut down and correct the burner setup. If not corrected the heat exchanger will be covered in soot and efficiency will be reduced.

The water flow determines the on/off cycle rate of the burner and the resulting temperature rise.

All burner nozzles sizes are in gallons per hour at 100psi fuel pressure.

This flow indicator light is triggered by the pressure switch located inside the water pump cabinet (may also be located in heater cabinet). To achieve the minimum hydraulic pressure to activate the flow switch requires proper water nozzle selection. The pressure switch is actually triggered off the hydraulic motor for the water pump.

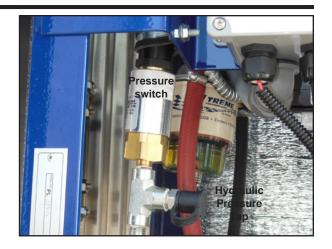
This procedure sets up a replacement pressure switch:

- Attach the hose ball valve to the water lance hose. The water will be discharged to the ground during the test.
- 2. Locate the pressure switch. If it has one set screw, it controls the burner, fuel light and flow light. If two, one is for the burner/fuel light and the other turns on the flow light.
- Install a tee and pressure tap in the 1/4 inch line going to the switch (if one is not installed).
 Connect a suitable pressure gauge.
- 4. Run the throttle at a moderate speed with multiflow to maximum.
- 5. Slowly close the ball valve until the pressure gauge reads 1200 psi. At this point turn the switch adjuster screw(s). When the flow light just turns on, lock the screw down. Turn the other screw, and the burner should fire. Lock that screw down by holding the screw in place with a screwdriver and snugging up the lock nut. The heater controller takes a few seconds to react to the signal from the switch. Turn the adjusting screws slowly, even pausing to ensure the switch point is at 1200 psi.
- 6. Verify the adjustments by operating normally with the gun. When you squeeze the trigger, the flow light, the burner and the fuel light should come on after a few seconds. Release the handle. The burner and flow light should go off. Repeat to ensure proper operation.

45277D-30 pressure switch

This switch is normally set to 1200psi. Always verify settings with the schematics for the unit.

To adjust set point: Loosen the adjusting collar screw, then turn CW to increase and CCW to decrease set point.



Vactor HXX

AIR EXCAVATION OPTIONS

Air excavation is similar to hydro-excavation in operation.

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

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

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

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



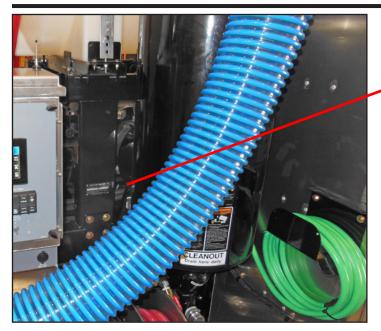
Maintenance

Maintenance

VACTOR®
www.vactor.com

This product may be covered by one or more United States Patents and/or pending patent applications. See: www.vactor.com/patents SUBSIDIARY OF FEDERAL SIGNAL CORP.

Oak Brook, Illinois U.S.A. 49873 rl



General location is same on all versions.

Perform these items in addition to all other service and lubrication requirements.

	New Unit First Time Service & Lubrication Checklist					
	ITEM	When	Performed By	Date		
1	Service chassis (consult manufacturer's manual)					
2	Inspect all door seals	1st week				
3	Inspect all vacuum hoses	1st week				
4	Wash and clean entire truck	1st week				
5	Inspect all safety equipment, guards, etc.	1st week				
6	Drain air tanks	1st week				
7	All grease zerks (unless otherwise noted)	1st week				
8	Lift cylinder	1st week				
9	Debris body hinges	1st week				
10	Rear door hinges	1st week				
11	All clamp and lid screws	1st week				
12	Change blower oil if equipped	100 hours				
13	Change hydraulic oil filter	100 hours				
14	Driveline joints	1st week				
15	Grease boom	1st week				
16	Inspect / repair leaks	1st week				
17	Change oil & lube water pump	50 hours				
18	Change hydraulic oil filter(s)	100 hours				
19	Air compressor (see manufacturer's manual)					



Confined Space Hazard

Entering a confined space without proper precautions can lead to death or serious injury. Before entering the debris body, watertank or filter housing comply with all work rules and applicable federal, state, and local regulations.

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SERVICE CHECKLIST MAINTENANCE

The system should be serviced according to the following schedule. Proper service of the system includes proper lubrication. Consult the lubrication checklist in conjunction with the service checklist. The following time intervals are based

upon a normal eight hour working day. Frequency of maintenance may have to be increased if the system is placed into operation for longer periods of time.

	Service Checklist					
	ITEM	8 Hrs. or each shift	25 Hrs. or Weekly	100 Hrs. or Monthly	500 Hrs. or Every 6 Months	1000 Hrs. or Every 12 Months
1	Check blower oil level	х				
2	Check hydraulic oil level	х				
3	Service chassis (consult manufacturer's manual)	Х	Х	х	х	Х
4	Inspect all door seals		Х			
5	Inspect all vacuum hoses	х				
6	Wash and clean entire truck		х			
7	Inspect all safety equipment, guards, etc.	Х	Х			
8	Inspect, drain and clean blower micro strainer	Х				
9	Inspect all warning labels		Х			
10	Inspect proper functioning of vacuum relief valves	Х				
11	Inspect and clean debris body screens	Х				
12	Inspect make/break seals	Х				
13	Drain air tank(s)	х				
14	Drain silencer(s)	Х				
15	Inspect and clean cyclone & dust box	Х				
16	Check transfer case oil level if equipped	Х				
17	Check water Y-strainer Filter Screen	Х				
18	Check Body/Boom Seals for Leakage & Condition		Х			
19	Check all chassis fluid levels	х				
20	Flush high pressure water pump		х			
21	Inspect and rotate vacuum suction hose			х		
22	Inspect water heater for leaks, damage, etc		Х			
23	Inspect and clean water tank sensor probes				Х	
24	Inspect high pressure wand and hand gun for damage	Х				
25	Water pump oil and piston lube points	Х				
26	Run water heater for 15 minutes if equipped			Х		
27	Check Y-strainer screens	Х				
28	Check blower driveline	Х				
29	Inspect water & hydraulic hoses for wear or damage	х				
30	Inspect hoses and gaskets for leaks and wear	Х				
31	Inspect make/break and boom tube seals		х			
32	Check pressure limiting devices (hydraulic and water reliefs)		х			
33	Air compressor if equipped (see manufacturer's manual)	х	х	х	х	х
34	Service water pump (see manufacturer's manual)	Х	Х	Х	Х	х
35	Check water pump coupling for movement/loose			х		
36	Check blower coupling for movement/loose			Х		

SERVICE CHECKLIST MAINTENANCE

All units are equipped with this general purpose decal, normally located on the passenger side, to assist operators.



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.





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

Stay clear of the suction hose inlet end. Turn vacuum off before attaching hose, pipe or accessories

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

Refer to SAFETY manual for details.





Cancer and Reproductive Harm

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

NOTICE

Boom Can Be Damaged

The boom should only be used for its published, intended and rated use. Do not overload. To avoid damage do not use as a lifting device.

Blower Oil Service



Check blower oil daily or the start of each shift.

All vacuum blowers are equipped with at least one sight glass at each end of the blower. Depending on blower configuration the sight glasses may be located on either side or the end of the blower at each end, and there may also be upper and lower sight glasses. The oil level must be checked at both ends of the blower while the unit is off and on

Refer to the maintenance section in the manual and the blower manufacturer's manual

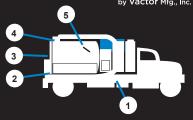
General Operation

- Consult the OPERATOR'S manual for complete details on SAFETY and proper OPERATION of this
- Call 811 before all digging operations to locate and mark off all known utilities
- Verify all equipment is in safe working order and suitable for the work to be performed.
- Never operate without manual, automatic and safety vacuum reliefs installed and properly operating.
- Work as team with second operator
- Wear protective clothes and equipment Set up vacuum hose with the in-line vacuum relief valve and nozzle at the hose working end.
- The working end of the vacuum tube should be soft and non-conductive
- Follow site procedures for static electricity and ground truck
- Do not use excessive water pressure or temperature
- Cold weather operation drain as required

Daily Service Check List

- Inspect all safety equipment, guards, etc.
- Check blower oil level
- Check hydraulic oil level
- Check transfer case oil level (if equipped)
- Service chassis (consult manufacturer's manual)
- Inspect all vacuum hoses
- Drain, inspect and clean micro strainer (if equipped)
- Drain, inspect and clean all air/water filters and Y-strainers
- Inspect for proper functioning of vacuum relief valves
- Inspect inlet head and inlet boot seals
- Inspect all high pressure hoses for excessive wear, damage or improper assembly of fittings
- Inspect hoses and gaskets
- Inspect and clean all door seals before closing doors
- Drain air tanks and silencers
- Inspect cyclones for excess material (if equipped)
- Inspect all safety equipment, guards, etc.





WEEKLY (25HRS) GREASE POINT

	WEEKET (2311K3) GREAGE FORMTS			
1	ALL DRIVELINE JOINTS			
2	DEBRIS BODY MOUNTING HINGE - Monthly			
3	REAR DOOR LOCKS			
4	BOOM PIVOT			
5	LEVEL INDICATOR (location varies)			
-	ALL SMALL DOOR HINGES			

Wireless Operation Wireless ON

- Set engine to idle
- Engage the emergency stop on the remote
- Press and release the Power switch on the remote Disengage the emergency stop on the remote
- Set to wireless remote at control panel
- Wireless will now be engaged and duplicate controls will be disabled

Wireless OFF

- Set engine to idle
 Remote control switch to OFF
- Engage emergency stop on the remote

Technical Service Hotline - 877-342-5374



Scan the QR Code with your mobile device or visit: http://www.fsesgsafety.com for the latest FSESG product and application safety information.



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LUBRICATION MAINTENANCE

	Lubrication Checklist					
	ITEM	8 Hrs. or each shift	25 Hrs. or Weekly	100 Hrs. or Monthly	500 Hrs. or Every 6 Months	1000 Hrs. or Every 12 Months
1	All grease zerks (unless otherwise noted)		х			
2	Lift cylinder		Х			
3	Box hinges			х		
4	Rear door hinges			Х		
5	All clamp and lid screws		х			
6	Change blower oil			First	Х	
7	Change hydraulic oil and filter					Х
8	Driveline joints		Х			
9	Check the tightness of the blower oil case plugs			х		
10	Grease boom swivel bearing (2)		Х			
11	Grease boom sleeve (3)			Х		
12	Grease boom lift Cylinder (1)			Х		
13	Grease boom hinge pin (1)			Х		
14	Grease boom pivot pin			Х		
15	Grease Debris Body Hoist Cylinder (2)			Х		
16	Grease Debris Body Hinge (2)			Х		
17	Grease Debris Body Door Hinge (4)			Х		
18	Grease Debris Body Rear Door/Hyd. Locks (4)		Х			
19	Grease Debris Body Fill Indicator (1)		Х			
20	Place 3 drops of oil in each oil hole on Cat water pump			х		
21	Grease hyd pump front drive shaft (3) and PTO shaft (3)		Х			
22	Air compressor if equipped (see manufacturer's manual)			grease	oil	
22	Water pump (see manufacturer's manual)	500 hrs or 3 months				

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

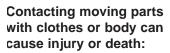
Note: Keep grease fittings clean, accessible, and free from damage. Grease fittings should be checked every week. Examine for broken fittings and replace broken fittings.

All clamp and lid screws should be lubed with an anti-sieze compound.

Chassis service - refer to the chassis manual



Entanglement Hazard

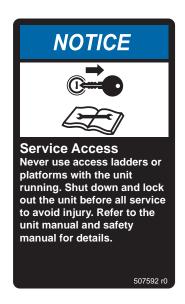




- Never go underneath the vehicle with the engine running.
- Never work near a rotating drive shaft.
- Never attempt to engage or disengage the pump or other driven equipment from underneath the vehicle with the engine running.
- Never attempt to engage or disengage any driven equipment from any position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

NOTICE

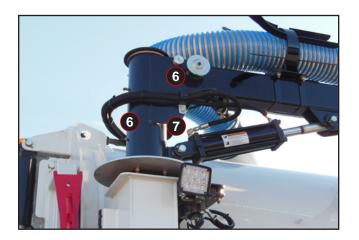
Keep grease fittings clean, accessible, and free from damage. Grease fittings should be checked every week. Examine and replace broken fittings.



GREASE POINTS MAINTENANCE

1	Rear Door Hinges (2)
2	Rear Door Locks (3)
3	Debris body Hinges (2)
4	Level Indicator
5	Debris body Lift Cylinder (not shown)
6	Boom Hinge Pin and column
7	Boom Lift Cylinder (2)
8	Top Rear Blower Bearing if equipped
9	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.

Paradigm

Hydraulic Oil Maintenance

The hydraulic system leaves the factory filled with Castrol Hydraulic Dual Range 32 oil. This purple fluid is recommended for all normal operation conditions from -20° to 95° (F) ambient. For continuous operation above 95° (F) ambient Castrol Hydraulic Plus Blue 68 is recommended. For continuous operation below -20° (F) ambient grade 22 oil is recommended.

Other hydraulic oils, if used, should be a quality product carefully selected with assistance from a credible supplier. The oil should include thermal stability, sheer stability, low-temperature fluidity, anti-wear, anti-corrosion, anti-foaming and seal conditioning characteristics. Consult the factory for oil other than the recommended products.

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 1000 hours or twelve months after that (or when the filter gauge indicates). Filters should be changed whenever indicated by the filter gauge. Contaminants allowed to remain in the circuit not removed by the filters will cause excessive wear and malfunctions.

The oil tank will normally feel hot to the touch.

Two sight eyes are installed to determine the oil level are mounted on the side of the oil reservoir tank Proper oil level should not be less than 1/2 as viewed in the lower sight eye and not above 1/2 in the upper sight eye. The debris body should be down, rear door closed, boom stored, hose reel retracted and system off when checking level. Check the oil level every eight hours. If the oil level is low, add proper grade hydraulic oil.

-	Anti-Wear Hydraulic Oils						
	GRADE	32	46	68			
1	Gravity, API D 1298	32.2	29.3	28.5			
2	Flash, COC, °F D 92.	410	440	460			
3	Viscosity cSt at 40° C D 445	32	46	68			
4	Viscosity cSt at 100° C	5.4	6.8	8.7			
5	Viscosity SUS at 100° F	165	237	352			
6	Viscosity SUS at 210° F	44.4	49	55.5			
7	Viscosity Index D 2270	102	102	99			
8	Emulsion at 130° F D-1401	Pass	Pass	Pass			
9	Turbine Oil Stability Test D 943 Hours	5000+	5000+	5000+			
10	Rust Test, SSW D 665B	Pass	Pass	Pass			



The oil filters supplied by Vactor/Guzzler are equipped with a high efficiency absolute filtering media. Many common filters only give approximately thirty percent filtration of the particles in the hydraulic oil. These filters are referred to as nominal filters. Absolute filtering can give as much as ninety eight percent filtration of the particles in the hydraulic oil. Vactor/Guzzler uses and recommends only the use of absolute filters.

The hydraulic oil filter is normally located on the driver side 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

1/2 Yellow & 1/2 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.

- Shut down the system and relieve pressure in the filter line.
- 2. Remove the housing.
- 3. Install the new element.
- 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
- 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 50 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.

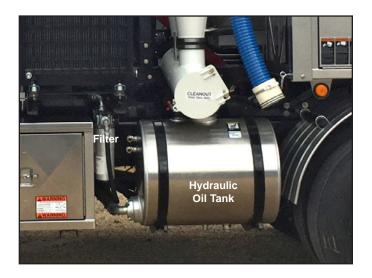
Change the Hydraulic Oil and Clean the Strainer

- Place a suitable container below the hydraulic reservoir and remove the drain plug from the lower front of the reservoir.
- 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.
- 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.
- Fill the hydraulic reservoir using the oil specified in the chart entitled A/W Hydraulic Oils.

A WARNING

High Pressure Air

When using compressed air, always use eye and face protection, protective clothing and adjust air pressure to 30 PSI or less. Never point the air nozzle at a person. Compressed air can penetrate the skin and cause serious injury or death.



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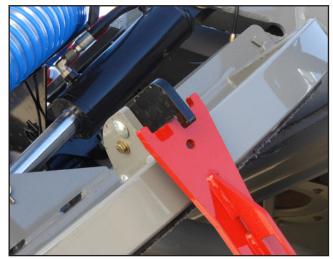
SAFETY PROPS MAINTENANCE

Each Vactor 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.

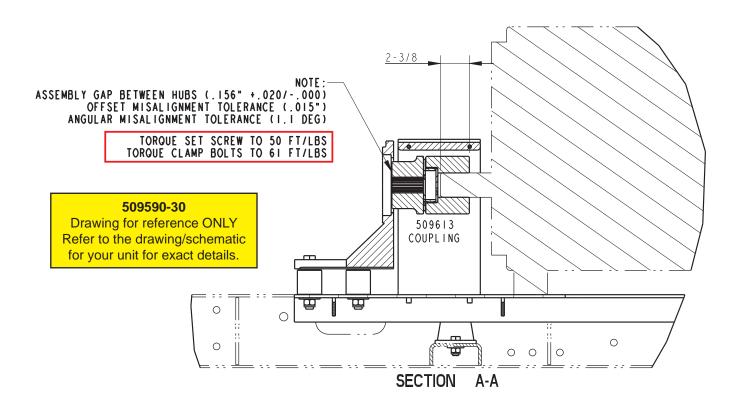
Debris body Prop



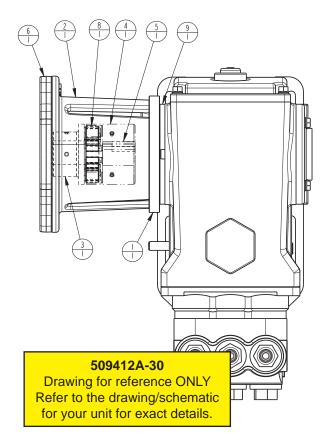
Debris body prop correctly locked in maintenance position.

BLOWER COUPLING MAINTENANCE

The blower coupling requires proper alignment and coupling torque for proper operation. Monthly visual inspections of the coupling is required to assure the condition and position of the coupling. It should be visually checked for any signs of movement or of being loose. If required clean, reassemble and torque as noted here.



The water pump coupling requires proper alignment and coupling torque for proper operation. Monthly visual inspections of the coupling is required to assure the condition and position of the coupling. It should be visually checked for any signs of movement or of being loose. If required clean, reassemble and torque as noted here.



NOTES:

I) SEAL/VALVE KIT QUANTITIES LISTED ARE SUFFICIENT FOR FULL REPLACEMENT OF RESPECTIVE COMPONENTS

2) APPLY LOCKTITE 242 TO COUPLING CROSS CLAMP SCREWS, TORQUE TO 7 FT/LBS.

3) INDIVIDUAL PARTS ARE FOR SERVICE ONLY. P/N 509412A COMES COMPLETE WITH ALL COMPONENTS SHOWN

MAXIMUM ALLOWABLE DISPLACEMENT	
COUPLING SIZE	28
MAXIMUM ANGULAR MISALIGNMENT	1° 30′
MAXIMUM PARALLEL MISALIGNMENT	.009
MAXIMUM AXIAL DISPLACEMENT	.060

LTEM	PART NO	DESCRIPTION	QTY	REF
- 1	511213	ADAPTER, CAT (76557)	I	REF
2	511212	BELL HOUSING, CAT (76554)	I	REF
3	48564	COUPLER HALF, MOTOR, CAT(38297)	I	REF
4	509792	COUPLER HALF, PUMP, CAT 38291	I	REF
5	48047LAA	KEY(M8X7.5X25),CAT660	1	REF
6	510698	MOTOR FLANGE, CAT (76544)	I	REF
7	509889	PUMP, 8.0 GPM, CAT 56	1	REF
8	48047MC	SPIDER ELEMENT	I	REF
9	511211	WATER PUMP MNT FLANGE, CAT (76323)	I	REF
-	509893	SEAL KIT, CAT 30799	3	REF NOT SHOWN
-	509894	VALVE KIT, CAT 33820	6	REF NOT SHOWN
-	4644ID	UNLOADER VALVE, CAT 660 PUMP, (7542)	I	REF NOT SHOWN
-	46441K	RELIEF VALVE, CAT 56 PUMP, 7694.AVM	I	REF NOT SHOWN

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.



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.



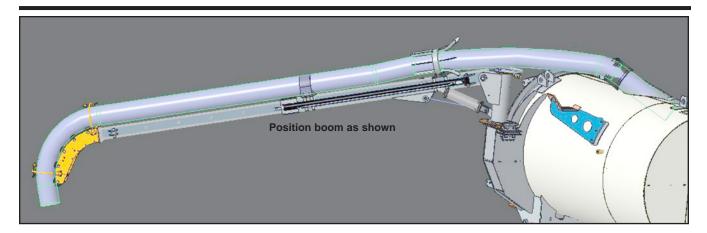
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OUTLET SEAL ADJUSTMENT

MAINTENANCE

The outlet seal can be adjusted by moving the rubber seal. The rubber cone can be raised or lowered to get a good seal by loosening the band clamp to adjust.



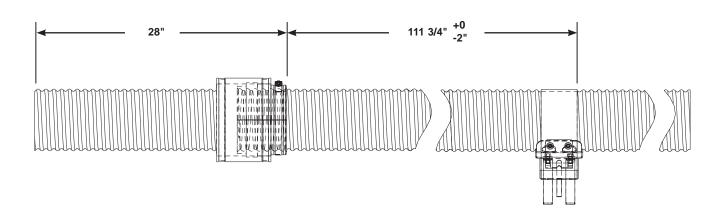


Replacement of the boom hose is made by rotating the boom out towards the rear of the unit so that the boom is aligned/straight with the debris body inlet. Drop the boom down so the hose goes across the boom pivot. This is the longest distance the hose has to make. After removing the old hose verify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

Utilize only the OEM hose (part # 511815-30). Failure to utilize this hose may result in kinking at the bend radius.

Before installing locate the collar as shown. Then measure out to 111-3/4" and mark with tape. Install the hose and locate the boom clamp to the 111-3/4" mark. This insures the hose is fully extended.

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 drain plug is provided at the bottom of the silencer housing which is used to drain any excess moisture that has collected in the silencer during operations. It must be plugged during normal operations. The plug must be removed at the end of each day and the water drained out. Leave plugs out until next use to allow residual water to drain.

Verify the rain cap works correctly to assure rain and water cannot enter.



BLOWER MAINTENANCE

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.

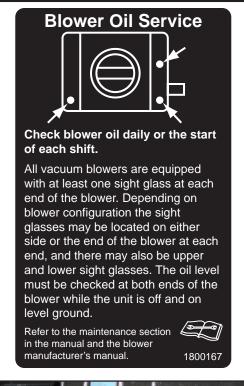
Oil Level

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.





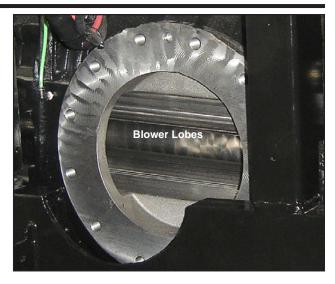


BLOWER - STORAGE MAINTENANCE

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.





MATERIAL FLOW MAINTENANCE

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.



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.

	Pro	e-Job/D	aily Che	cklist	
	Engine Off, Engine Cool			Engine ON	
Check	Item	Date	Check	Item	Date
	Radiator Coolant			Engine Sound and Exhaust	
	Battery Water			Foot Brakes	
	Hydrometer			Emergency Brake	
	Drive Belts			Power Steering	
	Fan			Cab Lights	
	Alternator			Headlights	
	Crankcase Oil			Taillights	
	Fuel Tank			Turn Signals, Rear	
	Transmission Fluid			Turn Signals, Front	
	Brake Function			Clearance Lamps, Front	
	Brake Fluid			Clearance Lamps, Rear	
	Instrument Gauges		1	Marker Lamps, Front	
	Windshield Wipers			Marker Lamps, Rear	
	Windshield Washers			Instrument Panel Lamps	
	Mirrors			Instrument Panel Gauges	
	Tire Wear			Horn	
	Tire Damage			Heating and Ventilating	
	Tire Inflation			Air Conditioning	
	Hoses			Mirrors	
	Frame			Test Drive	
		_			
	Engine Off			Engine On, Park Brake Set	
Check	Item	Date	Check	Item	Date
	Hydraulic Pump Oil Level			Open Rear Door	
	Blower Oil Level			Install Rear Door Safety Prop	
	Vacuum Relief Valves			Inspect Vacuum Float Balls	
	Water Pump Oil Level			Inspect, Clean Rear Door Seal	
	Access Door Secured			Store Rear Door Safety Prop	İ
	Hoses, Tubing, and Loose Items Secured			Close Rear Door	
				Hydraulic Pump ON when PTO is Engaged	
				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.

DRIVELINE SERVICE MAINTENANCE

Driveline components installed by Vactor all require these bolt, nut and torque specifications.

Chassis manufacturers may use other bolt, nut and torque configurations in the chassis drivelines. Some transfer cases are installed by the chassis manufacturer. Follow chassis manufacturer specifications for bolt, nut and torque when provided.

Vactor standard practice is to replace any yoke strap that is removed with a new strap and bolts. All Vactor installed driveline bolts are marked with *TORQUE SEAL* (508727-30) to verify the bolts were properly torqued and to detect vibration loosening.

Use only recommended and approved components and torque specified here or by the chassis manufacturer for service work. Alterations, substitutions, or use of additional components must have Vactor engineering approval.





Series	Strap & Bolt Kit P/N	Bolt Torque (Ft-Lbs)
1710	48332D-30	115-135
1760	48332D-30	115-135
1810	48332D-30	115-135
SPL250	48332F-30	115-135



Note: Use Loctite 242 or equivalent on all bolt threads. If the seal on the bolts is broken at any point reapply the thread locker.

	Driveli	ne Bolt a	ınd Torque Sp	pecifications	
Driveline Series	Diameter, Thread, Length	Grade	Vactor Bolt	Vactor Nylock Nut	Torque (Ft-Lbs) ±5% Lubed w/Loctite 242 or Equiv.
1280-1310	3/8"-24 X 1"	8	1210648-30	43042A-30	35
1610	3/8"-24 X 1-3/16"	8	1210008-30	43042A-30	35
1710	3/8"-24 X 1-1/4"	8	16337N-30	43042A-30	35
1610*	3/8"-24 X 1-9/16"	8	48400B-30	43042A-30	35
1710*	3/8"-24 X 1-11/16"	8	1210701-30	43042A-30	35
1350/1410	7/16"-20 x 1-3/16"	8	1210650-30	49751-30	60
1760	7/16"-20 x 1-3/4"	8	47635C-30	49751-30	60
1810	7/16"-20 x 1-3/8"	8	1210010-30	49751-30	60
1350/1410*	7/16"-20 x 1-5/8"	8	1210913-30	49751-30	60
1810*	7/16"-20 x 1-3/4"	8	47635C-30	49751-30	60
SPL140	3/8"-24 x 1-11/16"	8	1210701-30	43042A-30	35
SPL170	7/16"-20 x 1-3/4"	8	47635C-30	49751-30	60
SPL250	7/16"-20 x 1-3/4"	8	47635C-30	49751-30	60
* Tru Stop Brake Applications					

The automatic relief valves protect the blower if the vacuum hose, debris body or inlet filter become plugged or restricted. These valves are on all units with 15-18 in-hg systems. The valves open at a preset vacuum level and allow the blower to draw air through the valve openings. Proper operation should be verified daily by temporarily blocking off the vacuum hose and observing that the valve whistles at the unit's rated vacuum level.

The relief valve, when operating, will emit a loud, sharp whistle. This will occur when the vacuum hose is plugged or when the floatball shutoff stops the airflow, indicating the debris body is full.

The blower is cooled internally by the air moving through it. As the vacuum levels increase, the airflow decreases; therefore less cooling air is available which causes the blower to heat up.

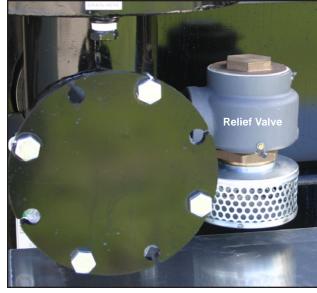
The relief valve opens at a preset level to admit extra air into the blower. The valve will whistle when this happens. Steps should be taken to reduce the vacuum.

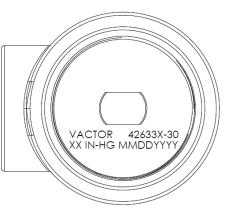
Mid-2020 Vactor started using a second supplier for vacuum relief valves. Both are supplied using the same part numbers for the 15, 16 and 18 IN-HG applications. The new valves can be identified by the stamping shown. The new valves are not user adjustable and must be replaced.

Note: The new valves have a set pressure tolerance of -0/+2 IN-HG. Always install a second known good vacuum pressure gauge to verify correct operation when troubleshooting.



- 1. To adjust, start the blower.
- 2. Then block off the intake pipe to about 80 percent.
- 3. Slowly raise the RPM and watch the vacuum level rise.
- 4. The relief valve should start to open at 1-1/2" HG less than the blower rating and be open fully at the rated inches of HG.
- 5. Reduce the engine RPM to idle and remove the intake pipe block.









NEVER adjust the valves with vacuum on the system.

- Loosen the set screws on the top of the valve and, with a large pipe wrench, screw the top of the valve in or out to adjust the level at which the relief valve opens.
- 7. Start back at step 1 and repeat as required.
- 8. These valves can also be disassembled, cleaned and reset.

Replace the Relief Valve

A safety-relief valve should begin opening 1-1/2 to 2-inches hg below maximum hg and be fully open at maximum hg. To check relief valve operation, leave vacuum tube attached to bumper mount and watch vacuum gauge, located on control panel. Briefly increase truck RPM to normal operating pressure. If relief valve does not open, increase RPM until it opens or vacuum gauge shows 15 hg. Replace or service the relief valve if it opens before system pressure reaches normal level or after 15-inches hg on the vacuum gauge.

To replace the relief valve, do the following:

- Remove screen from bottom of relief valve.
 Then remove the relief valve.
- Before installing a new safety-relief valve, use a pipe tap to ensure clean-cut uniform threads are in the opening for normal hand-tight installation.

Note: Use pipe compound sparingly to prevent excess from entering valve and causing leakage.

- 3. Thoroughly clean and flush system of all dirt and debris, which can scratch seals and cause erosion and leaking.
- On relief valve, leave female pipe threads and the first thread of the male pipe free of pipe compound; apply a moderate amount to remaining male pipe threads.
- 5. Install relief valve hand-tight followed by one half to one full turn.

Note: Avoid over-tightening which will distort safetyrelief valve seals. As the vessel and valve are heated, the heat causes an explosion, which grasps the valve more firmly.

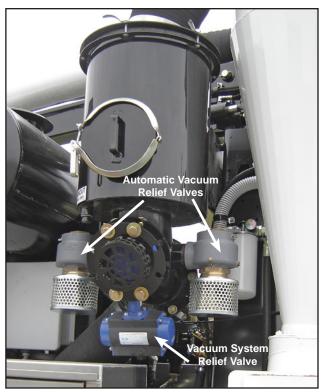
- 6. Apply a moderate amount of pipe compound to the male pipe threads on the relief valve.
- Install the screen (hand-tight) followed by onehalf to one full turn.

NOTICE

Safety / relief valves should be operated only to assure that they are in good working condition. Opening can cause leakage of trapped foreign material.

Never break lead and wire seals or tamper with safety / relief valve. Never reset relief valves to higher vacuum settings. Damage to the blower can occur.





Kunkle brand vacuum relief valves (Automatic Valves) are preset at the factory to the setting suitable for the particular unit. If it becomes necessary to service them it is very necessary that the valves be reset to the correct setting before putting them back in service. Below is the service and resetting procedure for these valves. Vactor Manufacturing Inc. accepts no responsibility for damage caused by improper or unauthorized resetting of the valves. Over a period of time, especially if the valves operate frequently they may suck in some dirt which might either clog them and prevent their function or wear them out causing damage to the seats and cause leaks.

To service the valves, remove them from the unit and work on a clean work bench. Clamp the valve in a vise using soft jaws to prevent damage to the cast shell. Do not over tighten the vise as the valves might distort causing difficult dismantling and damage to the threads. Remove the two screws holding the identification plate and the plate and save them. Using a suitable tool, scrape off the silicone bead around the cap. Slowly loosen the cap and remove it.

Remove the spring and the seat. Check the seat for deep scoring or pitting marks at the seating surfaces. Check for burrs, wear marks or cracks. Check for spring deformity or rust/ corrosion on coils. Check for damaged threads or cracks of the valve body. Replace if any component is observed to be damaged. Clean all components in parts washing solution and air dry. Assembly is reverse of disassembly. Do not lubricate any part as it might attract dirt and cause unnecessary wear.

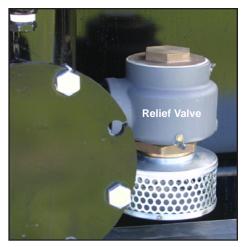
Press down firmly on the cap after seating the spring and start the threads. Do not tighten the cap more than two or three turns as the valve still has to be set. Do not install the identification plate or its screws yet. Apply liquid or paste Teflon on the male threads of the nipple welded on the micro-strainer or the blower hat or the blower box as the case might be and screw on the female side of the automatic valve by hand. Tighten the valve on the nipple no more than one turn with a wrench. Point the opening of the valve downwards or between 4 o'clock and 8 o'clock positions, never upwards.

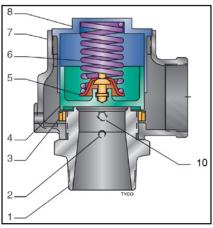


Flying Parts



The valve is spring loaded. Use care while dismantling the valve. Always wear safety glasses and protective gloves while working with the valves.





	Automatic Vacuum Relief Valve
Item	Description
1	NOZZLE
2	SET SCREW
3	REGULATOR DISC
4	DISC
5	SPRING STEP
6	SPRING
7	BODY
8	COMPRESSION SCREW
9	STEM
10	REGULATOR RING SET SCREW

Setting The Valve

Attach an accurate vacuum gauge (+/- 2% accuracy) to the tee provided at the blower inlet. (One side of this tee is already attached to the vacuum gauge in the control panel, the other is plugged, remove this plug to attach the test vacuum gauge). Make sure that all doors and ports on the truck are shut except for the vacuuming port farthest from the blower (rear port hole or the boom vacuuming port).

Cap off all Automatic valves except the one that is to be set. If more than one are to be set, set them one at a time, capping off all but one. Have a thick board, large enough to cover the vacuum port and strong enough to resist a strong vacuum, handy. Start engine and engage the blower following the normal blower engaging procedure. Increase the RPM with the throttle at the control panel to about 1500. Place the board on the port covering it about 3/4th of the opening. Gradually increase blocking of the opening till the valve just begins to open (you will hear a whistling sound and if you put a thin sheet of metal at the valve opening you can feel it suck in). At this point, note the vacuum reading on the test vacuum gauge. Tighten the cap to increase the setting and loosen it to reduce the setting. Tighten or loosen the cap in small increments and repeat the procedure till the valve just opens at the recommended vacuum. (Check your blower manual for vacuum capabilities/settings of your unit).

Note: Do not set the Automatic valve(s) at a higher vacuum than it/they was/were originally set at. Doing so will not only void any warranties but also seriously harm the blower.

After setting the relief valve, cross check it once more and then install the identification plate and its screws. These screws hold the cap in place and prevent it from vibrating loose and so prevent the setting of the valve from changing. Run a bead of silicone caulk at the join of the cap to the valve body to prevent any vacuum leakage at that point. Do not operate the machine till the silicone is dry or it will get sucked in and defeat its purpose.







The air operated vacuum relief valve is used to relieve the system if the vacuum hose, debris body or inlet filter become plugged or restricted. These valves are on all blower units. The valves are normally operated from the master control panel, pendant or optional wireless remote. Proper operation should be verified daily by verifying under vacuum. Actual location size and configuration of the valve varies by the model and options. Typical location is in the inlet piping of the blower.

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



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

Note: Keep foreign material from entering the valve. Do not paint, oil, or otherwise cover any interior or working parts of any safety valve; safety valves do not require any lubrication or protective coating to work properly.

Note: Test all vacuum relief valves to ensure proper valve operation. See the section "Vacuum Relief Valves" in the Operations section.

The vacuum relief valve is actuated by a switch located on the main control panel or a switch located on the pendant control. The switch controls an air valve which sends air pressure to the valve either opening or closing, whichever is needed. The vacuum relief valve needs to be open for normal vacuuming using the boom and debris hose. When the vacuum relief valve is closed, air flow is blocked to the boom and debris hose.









Whether it is manually or automatically operated, a switch energizes an electric over air solenoid valve. This allows pressurized air to fill a chamber on the actuator for the butterfly valve which opens or closes depending on whether the 'on' or the 'off' solenoid is actuated.

As with any other electrical system in Vactor products, the master switch in the main control panel has to be in the ON position. If the valve fails to function, the problem could lie in the electrical or the pneumatic system. It is in very rare cases that there is a mechanical reason for the failure of the valve. To trouble-shoot, first ascertain whether the problem is mechanical, electrical or pneumatic. To do this, start the engine, build up air pressure to the maximum and follow the procedure to obtain power to the control panel and turn on the master switch. Trace back the two air lines at the valve actuator to the double air solenoid. This may be located very close to the valve itself or may be somewhere at the underbelly of the debris body. Remove one air line at a time on the "out" side of the solenoid. If there is pressure at one of the ports, the problem is not pneumatic.

Now, operate the switch. If the air pressure switches to the other port, there is no electrical malfunction either. Now that the problem has been categorized, we can proceed to rectify the defect.

Pneumatic

If there is no air pressure at the "out" side of the air solenoid, remove the incoming air line to the solenoid. Does that have air pressure? If yes, you have a faulty solenoid. Open, clean and reassemble or replace the solenoid assembly. If there is no pressure in the incoming line, trace the incoming line to its origin, checking for kinks or blockages. Pull out the air line coming out of the air dryer/tank at the air protection valve. Check for air in the reservoir. Check if air protection valve functions properly, if not, replace.



Electrical

Is the master switch in the control panel turned on? Check for loose connections at the mating plugs. Open the control panel door and check for blown fuses, loose connections or damaged wiring. Repair as required. Unplug the wiring harness at the solenoid and check for voltage at the harness connectors with the switches in both, the open and closed positions. If no power, go back to the pendant switch and open it. Check incoming voltage to the switch, corroded, worn or otherwise damaged contacts or loose or damaged wiring. Repair as required.

If there is voltage at the wiring harness connectors at the solenoid valve, press the solenoid over ride rubber buttons, one on each of the solenoid assembly. If that operates the valve, the solenoids are faulty. Replace the faulty solenoids).

Mechanical

If air is being supplied to the valve actuators and the valve still does not work, the valve could be binding. Remove the strainer basket and try to free the valve by squirting some penetrating oil at the shaft bushings. Remove the air lines going to the actuators and lubricate the ports with air tool oil or penetrating oil. It may be that the screws of the valve to shaft or the actuator coupling have come loose or the shaft is broken. Rectify as necessary.

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.

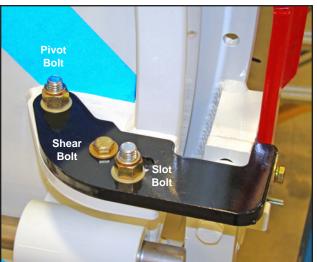
The pivot bolt and slot bolt are installed with belleville washers. Tighten the fibre locknuts down until the belleville washer just becomes flat and no more. Do not overtighten.

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).





REAR DOOR – SEAL MAINTENANCE

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:



Serious injury or death can result from falling debris body.

Never go under a raised debris body without the safety prop(s) in place. Debris body must be clean and empty for service work.

On firm level ground raise the body above the height of the props. Tilt the prop(s) in place. Lower debris body until it just rests on the prop(s). Use all props.

Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.

Refer to manual for details.



Crushing hazard.

Serious injury or death can result from falling rear door. Never go under the rear door when open.
Use door prop(s) or safety pin(s) to secure door before entering body, working under or around the door.

Open the rear door to just clear the prop(s) and lower door until it just rests on the prop(s). On units that use a safety pin(s) open the door until the pin holes are aligned and insert pin. Use all props or pins.

Shut down and lock out the entire system and chassis before servicing. Unload any items stored in debris body before using machine.





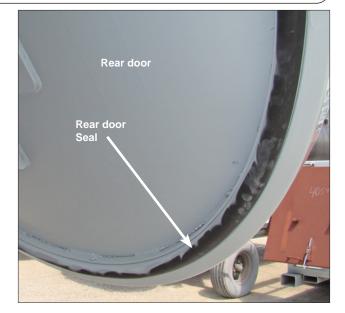
Electrocution hazard.

Serious injury or death can result from electrocution.

Check for overhead wires and obstructions before raising debris body, opening rear door or raising optional equipment. Never leave debris body, rear door or optional equipment raised or partly raised while vehicle is unattended. Never move vehicle with debris body, rear door or optional equipment raised.

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

4000400 -



- 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.



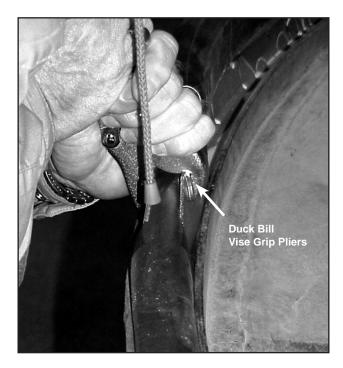
 Make sure the end of the seal is cut squarely for a proper seal at the end of the procedure. A hacksaw works well.



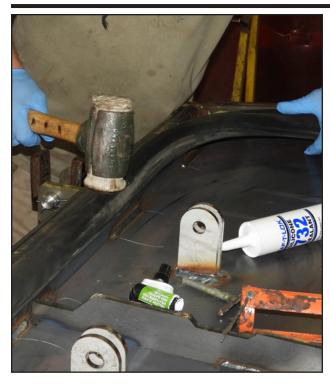
4. Starting at the top of the door, place the flat surface of the new seal into the seal channel.



- 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.



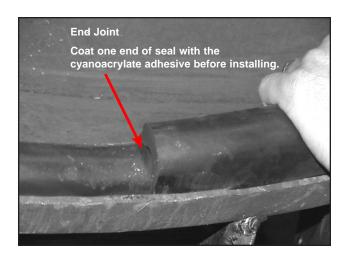
Rear door seals_r1



- 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.

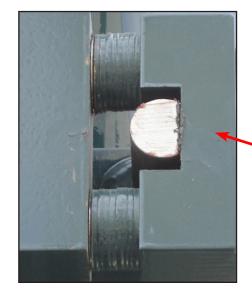


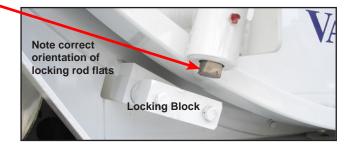
The rear door will need adjustment to compensate for seal wear. There are two adjustments available. The locking blocks are attached to the debris body and are used to set an even spacing for the door seal. These will not normally need to be adjusted.

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.
- 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.



- 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.
- 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.*

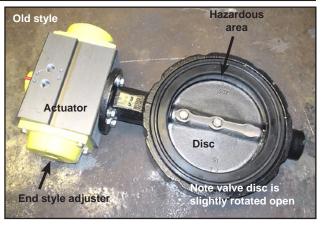
Butterfly pneumatic actuators are designed to allow adjustment without the removal of the actuator end caps. Typically there is a jam nut located on each end of the actuator in the center of the end cap. Newer style butterfly valves have the adjuster bolt on the side of the actuator. One adjuster controls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

With the valve in the CLOSED position:

- Determine which adjuster screw is for the closed position. It will be the one that moves the disc.
- 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.
- 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







AIR SYSTEM MAINTENANCE

All units use compressed air to operate various valves and cylinders. The air is normally supplied by the chassis air system. Depending on options, unit or chassis configuration there will normally be one or more air tanks, filters or dryers located on the unit in varying locations.

Maintenance

If equipped all air tank filters should be checked daily and cleaned if necessary. If upon a visual inspection, the filter is dirty or clogged, it should be replaced.

Note: the chassis air tank should be drained daily and the unit air filter checked and cleaned if necessary every 48 hours. Cold or very humid weather may require more frequent draining of the chassis air tanks.

When air is compressed the water vapor in the air is put into the vehicle's air system. The liquid accumulates and affects system performance by washing away lubricants, accelerating corrosion and blocking air system components by freezing. High humidity, high air consumption and cold temperatures increase the water vapor collected in the air system. Two common methods are used to address this issue are automatic drains and desiccant-type air dryers. Manual drains may also be found.

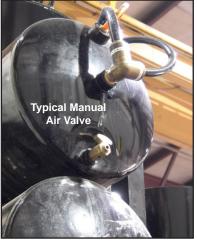
Note: Alcohol injection systems are sometimes used by others. They are very specialized and should not be used as the alcohol can damage seals and plastic parts in an air system.

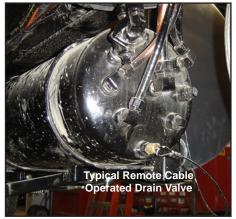
Freezing conditions can create situations where the frozen water can slow down or stop the proper operation of the various components in an air system. This can include chassis brakes, air valves and air cylinders that operate safety systems such as vacuum reliefs. When operating under these conditions proper operation of the air systems should be routinely verified. The frequency will vary with the conditions.

When the conditions exist for air system water problems Vactor Manufacturing and most chassis manufacturers recommend draining all system air reservoirs every 2-3 hours of operation.

Desiccant-type air dryers require routine replacement of the desiccant element. Refer to the chassis service manual.

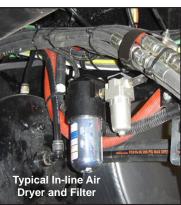
Consult the Vactor Manufacturing Service Group for recommendations and systems suited to your applications.







In-line dryers and filters are normally used on units with blowers and transfer cases for the air shift.



Typical desiccant style air dryer with replaceable filter element.



Y-Strainer Maintenance

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.





2" Y-strainer at water fill - Assembled





3" Y-strainer on water pump - Disassembled



2" Y-strainer at water fill - Disassembled

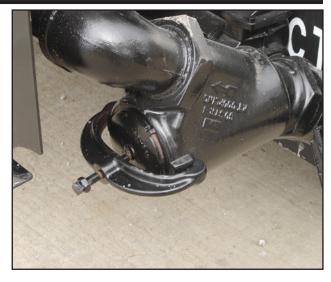


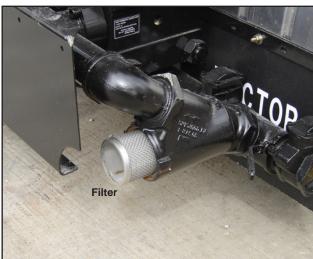
Y-Strainer Maintenance

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

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

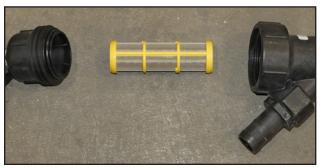
The second gasket seals the cover to the filter screen. If this gasket is missing, debris can bypass the filter screen and get into the water tank and eventually into the water pump causing damage to the pump. Both gaskets must be intact and in place. Replace any damaged or missing gasket.





Typical composite Y Strainer. Cap unscrews to remove filter.







Machines can often sit at a work site for months while work creeps along. For long term storage beyond one year consult Vactor-Guzzler Service. Refer to the unit's manual for specific details. Storage protection plans should look like the following for a northern, dry climate:

Rotation - Rotate all compressors, pumps, fans and blowers every two weeks.

Visual Inspection - When rotating exposed machined surfaces, check shafts and couplings to see that a protective coating has been applied and has not been removed. Reapply if needed.

Miscellaneous - Lubricate miscellaneous equipment as applicable per normal maintenance schedule.

Drains - Leave all drain plugs out to prevent the buildup of moisture.

Other Considerations

In a warm, high-precipitation climate it is wise to look for alternate solutions to the problem of field storage during construction and prior to start-up.

For engines refer to the manufacturer's manual for procedures.

Vacuum System

Any time the unit will sit after use, the blower should be run 3-5 minutes with the vacuum relief open to dry out the vacuum system.

If the unit is not in operation, or will be parked for an extended period of time, the rear door can be opened slightly to drain and vent the debris body. This allows airflow into the body which reduces rusting and allows the rear door seal to relax, preventing it from training to a flat state. To ensure no entry to the debris body, or operation of the unit while the door is open, the door must only be cracked enough to relax the seal and a lockout/tagout procedure must be performed.

Air Systems

Drain all moisture traps and tanks. Replace all filters and all desiccant.

Freezing Weather

Any time the unit will sit after use during freezing weather the blower should be run 3-5 minutes with the vacuum relief open to dry out the vacuum system.

Oil & Grease

The unit should be on level ground and off. Before

storage all oil should be changed and filled to the center of the sight glass(s) or fill mark. **DO NOT OVERFILL.** When the blower will not be used for any time beyond a few days there is risk the close fitting surfaces inside the blower will rust and increase blower lobe wear on startup. Refer to the blower manufacturer's manual for details on long term storage. Grease the unit per the manual's schedule.

Sound Suppression Systems

Leave the drain plugs out when not in use to prevent rain water from building up in the silencers. Verify the rain cap works correctly to assure rain and water cannot enter.

Water Systems

Drain and purge all the water components. When completed open all ball valves, put Y-strainers, cap, clamp and drain plugs in a tool box if the unit will sit overnight or longer. This will allow any residual water to drain.

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

Putting the unit back in service

- Close the rear door if left open.
- Verify all fluids are at correct levels.
- Install all drain plugs and Y-strainers and close all drain valves.
- Operate engine(s) at low RPM's until warm.
- Engage and cycle all functions to verify operation.





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.

	TORQUE IN POUND FOOT (LB-FT)	
NOM. DIA. INCH	GRADE 5	GRADE 8
1/4250	9	12
5/16312	18	25
3/8375	30	45
7/16438	50	70
1/2500	75	110
9/16562	110	155
5/8625	155	215
3/4750	270	385
7/8875	435	620
1 - 1.000	660	930

	TORQU NEWTON (N	METER
NOM. DIA. INCH	GRADE 5	GRADE 8
1/4250	12.2	16.3
5/16312	24.4	33.9
3/8375	40.7	61.0
7/16438	68	95
1/2500	101	149
9/16562	150	210
5/8625	210	290
3/4750	365	520
7/8875	590	840
1 - 1.000	895	1260

BOLT HEAD MARKING



GRADE 5



*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 FASTENERS SUCH AS BOLTS, NUTS, CAP SCREWS, USED IN STEEL AND CAST IRON PARTS.

APPLICATION: THIS STANDARD IS INTENDED FOR FASTENERS OF GASKETED OR NON-GASKETED JOINTS, WITH OR WITHOUT STEEL WASHERS, AND WITH COARSE OR FINE THREADS. ALL SPECIAL CONDITIONS WHICH WILL SERIOUSLY AFFECT THE RELATIONSHIP BETWEEN TORQUE AND TENSION OF THE FASTENER, SUCH AS SPECIAL SURFACE FINISHES, LEAD WASHERS, AND FASTENERS SCREWED INTO MATERIAL OTHER THAN STEEL OR CAST IRON, WILL REQUIRE SEPARATE TORQUE VALUES TO BE INCLUDED IN THE APPLICABLE SPECIFICATION. THIS SPECIFICATION DOES NOT APPLY TO TORQUING OF HYDRAULIC CONNECTIONS

MEAN OR BASIC RECOMMENDED TIGHTENING TORQUE FOR METRIC FASTENER REQUIRING $\pm 20\%$ ACCURACY*. TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS.

	TORQUE IN POUND FOOT (LB-FT)		
SIZE	GRADE 8.8	GRADE 10.9	GRADE 12.9
МЗ	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
MB	18	30	33
M1O	35	50	63
M12	65	95	110
M14	105	150	177
M16	160	235	277
M20	320	460	542
M24	550	790	937

	NEWTON METER (Nm)		
SIZE	GRADE 8.8	GRADE 10.9	GRADE 12.9
EM	0.5	1.8	2.0
M4	3.0	4.5	5.0
M5	6	9	10
M6	10	15	18
MB	25	35	45
M1O	50	70	85
M12	90	125	150
M14	140	200	240
M16	225	310	375
M20	435	610	735
M24	750	1050	1270

TODOLIE IN

BOLT HEAD MARKING







*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

Troubleshooting

Trouble	Probable Cause	Remedy
	Plugged hose, elbow, horizontal connection hose.	Material has plugged tubing at some point. Most likely blockage is at the truck elbow or the horizontal hose connection location. Remove hose and inspect for blockage. Use the vacuum enhancer if equipped.
	Hose has flattened or collapsed.	Check hose for flattening or collapse. Blockage will be immediately ahead of such an area.
Air volume (suction) at hose pickup point drops.	Leaking seals.	Check rear door, cyclone and microstrainer housing for proper sealing. Clean and/or repair, as required.
	Blower is faulty (blower lobe wear or timing problems).	Normal vacuum is inadequate; the blower is not functioning properly. Refer to the Blower manual for repair information or contact factor service for repair assistance.
	Debris body is full.	Empty debris body at the dump site.
	Microstrainer is plugged.	Remove and clean microstrainer.
	Inner liner of hose has collapsed.	Remove and discard hose. Replace with a new hose section.
	Inlet seal is damaged or missing.	Repair or replace the faulty inlet seal.
	Plugged hose from heavy material being vacuumed.	Mix air and heavy material evenly to avoid sluggish in-hose transport.
	Frozen water and debris in hose	Spray warm water into boom or bring unit inside to warm up.
	Float ball screens plugged	Clean ball seals and screens
	Material is too bot for plastic	Switch to rubber hose or steel pipe.
Hoses soften or melt.	Material is too hot for plastic hoses.	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.

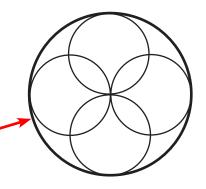
NOTICE

Machine Can Be Damaged

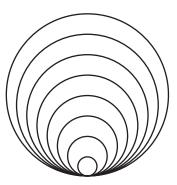
If ice builds up in the boom, shut down the vacuum system. Use hot water to heat the boom tubes or move the vehicle to a warm place. Slowly retract the boom when the tubes have warmed up. Do not retract the boom with ice build up in the vacuum tube. Damage to the boom and/or seal can occur. If hot water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

Probable Cause	Remedy
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.
Hose blockage.	Examine hose for blockage; clear blockage, repair, or replace hose.
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.
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.
	Worn hose or pipe. Damp material clogging hose or pipe. Hose has split or come apart at a joint. Hose blockage. Material too heavy or lumpy. Blockage at porthole

Multiple Hose Runs
Multiple lines should all be the same length.
Three 2" hoses = 4" hose run
Nine 2" hoses = 6" hose run
Four 3" hoses equals 6" hose run
Two 4" hoses equals 6" hose run
Sixteen 2" hoses = 8" hose run
Seven 3" hoses = 8" hose run
Four 4" hoses equals 8" hose run



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



What should I look for when there is little or no suction at the end of the vacuum hose.

There are several reasons that could singly or in combination cause loss of suction at the end of a vacuum hose. By following these logical steps you can identify and easily rectify the problem by the process of elimination.

Are all vacuum enable valves closed?

If not, close them, never tape any relief, pressure or safety valves shut. To do so will jeopardize safety and serious bodily harm or even death might occur. Faulty valves need to be repaired, not bypassed or forcibly shut.

 Did you reduce the size of the hose/tube or tube somewhere down the run?

Reduction of the hose/tube size midway down the run can cause material to build up in the hose/tube around the area where the hose/tube size changes. As the hose/tube size changes, the speed of air flowing through the hose/tube drops and some material falls off the airstream and begins to collect in that area. Over a short period, the accumulation grows into an obstruction which clogs the hose, resulting in loss of suction at the hose/tube inlet. The idea is to keep a constant air velocity from the point of material pick up to the entrance to the debris body. A velocity just high enough to transport the material to the body.

What Do I do to remedy the situation?

Uncouple the hose/tube at the point of the size change and operate the blower. If the clog is not very bad, it will clear itself otherwise manual cleaning of the hose/tube or removal of the clogged section of the hose/tube may be required. To avoid the situation, if a smaller hose/tube is all that will work, run that size hose/tube right from the truck but remember a 50% diameter reduction reduces the effective area to 1/4th the original size. Therefore the job will take much longer and also blower cooling will be reduced. To get the job done more efficiently always use the recommended hose/tube size.

Is the debris body full?

In a liquid filled debris body, the float ball will get sucked closed resulting in a drop of suction at the hose/tube inlet.

In case of solids, an over full body, debris might partially block the passageway, translating to a loss of suction at the hose/tube end. If continued, debris will get carried over to the cyclone (if equipped) chamber, choking the filter. Any blockage of the air path or a considerable reduction of airflow will not supply enough cooling to the blower and it will over heat. The blower is a positive displacement pump and has to have a certain amount of air flowing through it to work efficiently. It is similar to failure of the water pump in an engine cooling system, if cooler water is not allowed to flow through the engine block, it will overheat rapidly and damage.

How to correct

Stop vacuuming, empty the debris body and clean it thoroughly.

 Leaky gaskets, damaged or blocked hoses, damaged debris body. Leaky or damaged gaskets will cause air to be sucked in through the leaky area which will translate into loss of suction at the hose/tube inlet. Same will be the result of a leaky hose/tube or connections.

Repair or replace the damaged hose. Replace a leaky gasket as soon as possible and repair any other sources of leaks.

Regulating the vacuuming speed. It is a misconception that higher the blower RPM the faster the job will be completed, especially where light weight material is vacuumed.

Note: When needed an optional water ring can be used to cool and wet the incoming material.

A faster blower speed generates a high velocity airflow and increases the production of flying dust. As it is, light weight dust is difficult to separate from the airstream and a high velocity airstream makes it even harder. As a result, with higher RPM than required, more dust carries over into the cyclone chamber and the microstrainer housing. All the dust that enters the housing tries to pass through the filter, exposing it to faster choking. This ingress can be reduced by reducing the operating blower speed. As a rule of thumb, keep the blower speed just high enough to easily convey the debris to the debris body and no faster. This will depend on the type of material handled and the distance through which it has to travel to the body. Start with a low RPM and if it does not do the job, increase it gradually until material starts flowing easily into the suction hose. A lower RPM will reduce the carryover into the cyclone and microstrainer housing.

Is the silencer blocked?

Any dust that is small enough to pass through the system also passes through the blower and through the silencer. Although most of this is emitted in the atmosphere, some of the minute particles cling to the insides of the silencer. Over a period of time, the

silencer will get choked. This will not allow all the air from the blower to readily exhaust out of the blower, effectively creating a back pressure in the blower. This reduces its efficiency as it has to use some of its power to overcome this back-pressure, resulting in loss of airflow through it.

The remedy is to clean or replace the silencer.

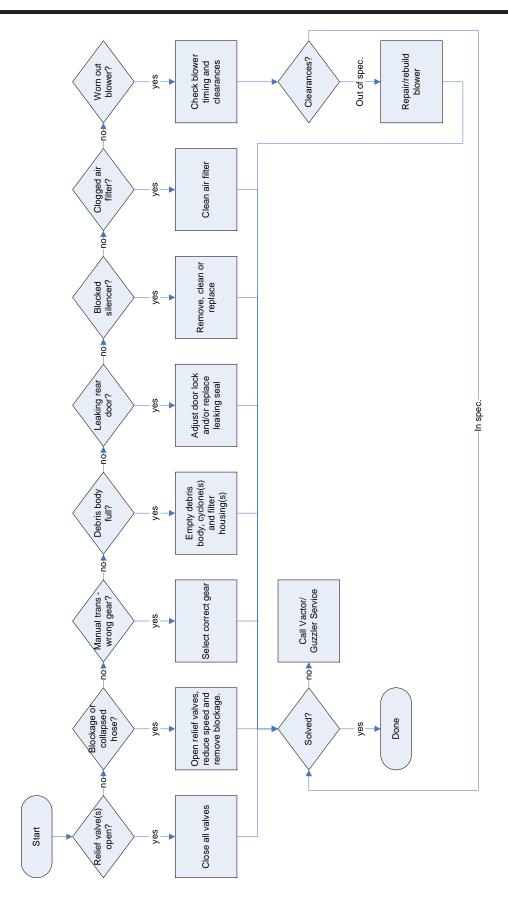
Is the blower worn out?

Any dust particle that passes through the system, however small it may be, at the high speed it is traveling sand blasts the internals of the blower and eventually wear it out. The tolerances between the moving and stationary parts in a blower are very minute and they get even smaller as the metals expand when the blower achieves its working temperature. This helps in creating a seal to trap air and pump it out. As the blower wears, the clearances get larger and the sealing gets weaker, the pumping performance reduces, creating less and less airflow. Eventually it needs to be taken out of service and rebuilt.

The blower's condition can be checked by the following method:

- Find and repair all vacuum system leaks. This includes all door seals, debris body inlet seal, etc.
- 2. Cap the boom hose end to close it off.
- 3. Set the vacuum to disable.
- 4. Start the engine, engage the blower.
- 5. Increase the blower speed to about 1500rpm.
- 6. Set the vacuum to enable.
- 7. Note the rise in the vacuum gauge reading.
- 8. Observe the blower as vacuum builds and the automatic vacuum relief valves (Kunkle valves) open up at the specified vacuum for the blower, or in case of a high vacuum blower, the gauge climbs up without an appreciable loss in blower speed.

The blower should raise the vacuum to at least 75% of the blower's rated vacuum or the automatic vacuum relief valves should open. If the blower achieves the required vacuum, the blower is in good shape. Refer to competent repair facilities (factory service can assist), or refer to blower manufacturer's maintenance manual. If it fails to achieve the rated vacuum, the blower may need attention. If the engine bogs down and begins to stall, the engine is not building enough power to run the blower to full load. It could also translate to a choked silencer and excessive back pressure.



BLOWER TROUBLESHOOTING

Trouble	Probable Cause	Remedy
	Low oil.	Check sight gauge and add oil.
	Bearings bad.	Disassemble and replace.
Noisy.	Timing out	Place transfer case in neutral and with engine OFF manually rotate the blower. If interference is felt call service.
	Low RPM	Operate blower at 900rpm or blower
	Too much or too little oil.	Check sight gauge and service as needed.
Runs hot.	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.
	Too much or too little oil.	Check sight gauge and service as needed.
Bearing cover paint discolored.	Bearings bad.	Disassemble and replace.
Boaring cover paint discolored.	Submerged or blocked vacuum hose/tube limiting air flow	Clear hose/tube and verify air flow
	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.
Low vacuum at pick up nozzle.	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.
	Doors not sealed.	Secure locks, check for debris; replace seals if worn.
	Clamps on joints not sealed	Check for proper attachment.
No vacuum	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

BLOWER TROUBLESHOOTING

Trouble	Probable Cause	Remedy
Protective strainer plugged	Screen assemblies plugged	Dump debris, open body, lower safety props, clean screens.
(float ball cages)	Float balls stuck.	Remove and flush with water or air.
	Engine speed too low.	Verify engine operation
No air flow.	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.
	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.
Low capacity.	Connection leaks.	Check connections for air leaks.
	Rear door leak.	Check for leaking seal at rear door.
	Expansion joint leak.	Check for air leaks at rubber seal connection at the make/break.
	Blower lobe wear or timing problem.	Refer to competent repair facilities (factory service can assist), or refer to blower manufacturer's maintenance manual.
	Vacuum relief valves	Check for leaks and proper operation.



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.

BLOWER TROUBLESHOOTING

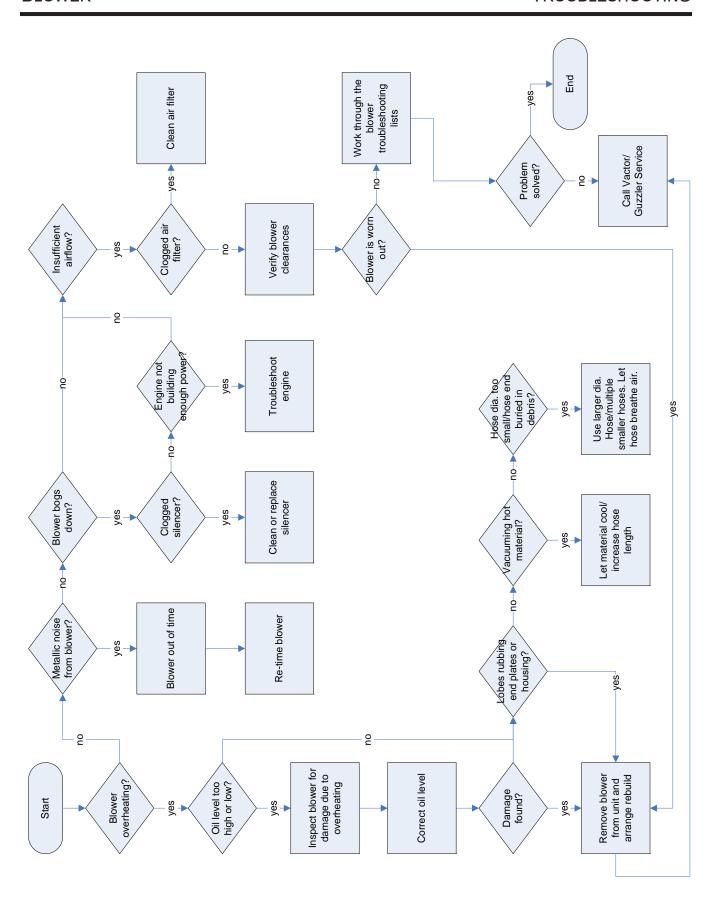
Trouble	Probable Cause	Remedy
	Dry material	Water rings are available to wet and cool material.
	Excessive blower speed for job requirement creates dust carry-over through exhaust.	Reduce engine speed to optimize vacuum operations.
Dust plume through blower	Over loaded cyclone section resulting in excessive carry over. Filter overloaded.	Dump the vacuum system and thoroughly inspect for material buildup. Clean vacuum system, as required.
(silencer) exhaust.	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.
	Speed too high.	Never operate above rated RPM of blower.
	Pressure too high.	See item "Low capacity."
Excessive power (chassis)	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.
	Inadequate lubrication	Restore correct oil levels in main oil sumps.
Overheading of headings are	Excessive lubrication	Check oil level. If incorrect, drain and refill with clean oil of recommended grade.
Overheating of bearings or gears.	Excessive pressure	See item "Low capacity."
	Not enough air flow	Do not submerge the end of the hose or vacuum tube. There must be adequate airflow to cool the blower.

NOTICE

Machine Can Be Damaged

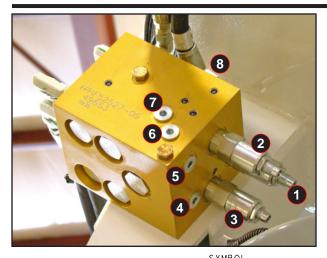
To avoid damage to the blower/fan and drive train immediately shut down the unit when any vibrations or material discharge at the exhaust is noticed. Immediately stop operations and correct problem.

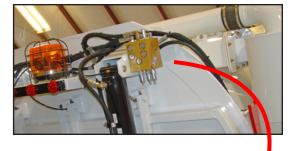
Trouble	Probable Cause	Remedy
	Driver of blower loose.	Tighten mounting bolts securely.
	Driveline bearings	Check and replace as needed both UPPER and LOWER driveline bearings.
	Misalignment.	See item "Overheating of bearings or gears."
	Impellers rubbing.	See item "Excessive power."
Vibration	Worn bearings/gears.	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.
	Silencer or muffler defects.	Check for holes and/or leaks.
Noisy blower.		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.

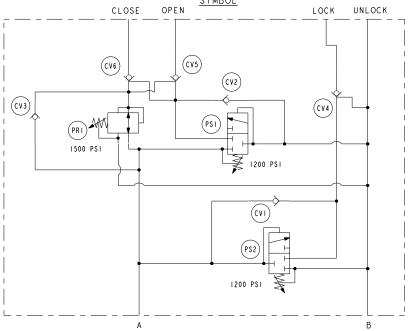


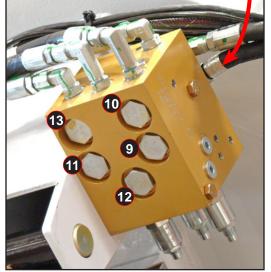
REAR DOOR TROUBLESHOOTING

Trouble	Probable Cause	Remedy
	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.
Rear door will not operate.		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	Leaking rear door seals.	Seal is not holding. After dumping, clean off seal and inspect gasket for cuts.
site.		Replace door seal.
		Adjust door locks









	Function	Setting
1	Sequence valve - close/lock	1200psi
2	Sequence valve - unlock/open	1200psi
3	Pressure reducer valve - limit rear door closing force	1500psi
4	Hole plug	NA
5	Hole plug	NA
6	Hole plug	NA
7	Hole plug	NA
8	Check valve - proper sequencing of open/close	NA
9	Check valve - proper sequencing of lock/unlock	NA
10	Check valve - holds door locks when hydraulic power is removed	NA
11	Check valve - proper sequencing of open/close	NA
12	Check valve - holds door closed when hydraulic power is removed	NA
13	Check valve - holds door open when hydraulic power is removed	NA

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.

 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.

- 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.
- 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

A DANGER

Entanglement Hazard

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



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

A 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.

Paradigm

Hydraulics Troubleshooting

Trouble	Probable Cause	Remedy	
		An insufficient oil flow to the hydraulic pump will cause what is called "Starving the Pump". First check the reservoir.	
Noisy hydraulic pump.	Insufficient flow of hydraulic fluid.	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.	
	Hydraulic leakage.	Check for leaks in hydraulic lines.	
Insufficient lifting of debris body.	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.	
	Center of gravity of body and debris misaligned.	Never attempt any repair. Consult factory.	
Body is up and will not come down	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.	



Crushing hazard

NEVER go under a raised loaded debris body. To avoid injury or death:



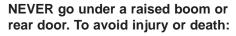
- Empty debris body before service work.
- Always use the body prop when the debris body is raised for service.
- NEVER disconnect check valve with the debris body in raised position. Debris body will fall.
- NEVER remove the bleeder screw (if equipped) from cylinder with pressure on the cylinder. Debris 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.
1,445,545	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.

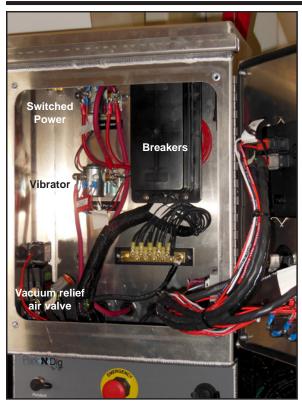


Crushing hazard





- 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.



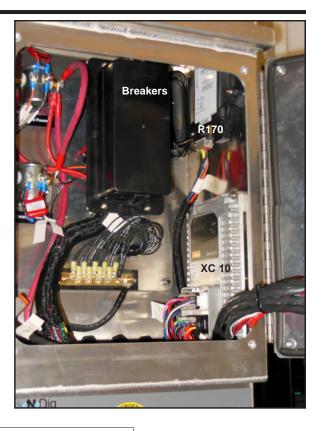
No power to Master Control Panel

All power for the master control panel is controlled by a large relay in the master control panel.

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.

Note - Diode on main power relay is flyback protection (surge protection) for master switch indicator light. The LED lights in the switches will be damaged if this diode is removed.





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.

506485 rD

Breakers Troubleshooting

Rear-fed Fuse and Relay Module, Power Distribution Module (PDM)

This panel has the fuses and most relays to operate the Vactor components on the HXX Units.

This new panel has two vertical rows of fuses, one down each side of the panel, and one row of relay down the middle of the panel. The left side row of fuses is Battery Powered. The right row of fuses is Switch Powered.

There are two cable studs on the lower back side of the fuse and relay PDM. One for the Battery Power Supply for the left fuse bank and one for the Switched Power Supply for the right fuse bank.

There is a Max of 100 amps per side of the RFRM. 100A on the Battery Fuse side and 100A on the Switched Fuse side.

Each wire going to this Fuse and Relay PDM is inserted into the back to the panel with a terminal and seal crimped to it. There are two sizes of terminal used in this application. They are both a Metri-Pack 280 Female terminal:

Wire Size	Terminal	Seal
12ga	49452A-30	45851-30
14ga	49452A-30	45850-30
16ga	49452-30	45849-30
18ga	49452-30	45849-30

There is no wiring inside the Fuse and Relay PDM. There is only a metal strip on each side of the panel to power up each of the fuses. Each of the relays is wired normally into the circuit from the back of this panel.

Parts used with this new Fuse and Relay PDM:

- Cover, 44594EA-30
- Stud End Cap, 44594EB-30
- 44594F-30, SPDT Relay Micro 280
- 44596F-30, 5A Circuit Breaker Micro 280
- 44596G-30, 10A Circuit Breaker Micro 280
- 44596K-30, 20A Circuit Breaker Micro 280



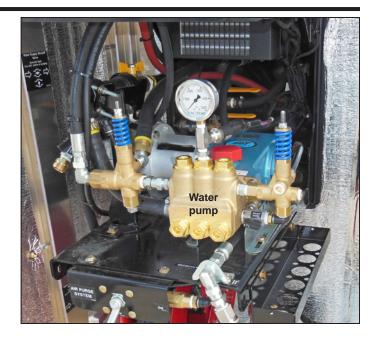
SWITCHED	RELAY	BATTERY
F20 -	R10 - Spare	- F40
F19 -		- F39
F18 -	R9 - Spare	- F38
F17 -		- F37
F16 - Limit Switch	R8 - Additional	- F36
F15 - Valve Block	cabinet heater	- F35
F14 - Sensor	R7 - Cab	IQAN - F34
F13 - Compressor	Heater	- F33
F12 - Panel SW	R6 - Spare	Outlet 2 - F32
F11 - Boom WL		Outlet 1 - F31
F10 - MD4	R5 - DOT	- F30
F9 - XC10	Beacons	Realy 2 - F29
F8 - Hopper Vib	R4 - Beacons	Relay 3 - F28
F7 - OMNEX		Relay 4 - F27
F6 - Cabinet Lt	R3 - Spare	Relay 5 - F26
F5 - Rear WL		Relay 6 - F25
F4 - Pass WL	R2 - Spare	Relay 7 - F24
F3 - Driver WL		Relay 8 - F23
F2 - Panel Lt	R1 - E-Stop	Relay 9 - F22
F1 - Keypad		Relay 10 - F21
		506485G r0

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

- Water tank
- Water pump

Watertank

The water tank is located just in front of the debris body. The tank is normally filled through a Camloc fitting at piping to an air gap install with a 2.5" hydrant hose and Y-strainer in-line.











Paradigm

WATER SYSTEM - WATER PUMP

TROUBLESHOOTING

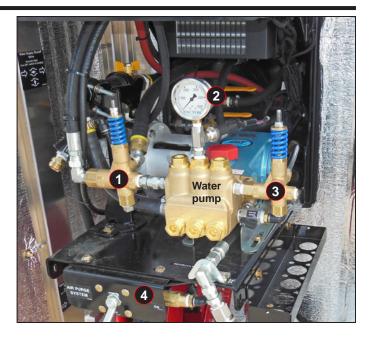
Located inside the water pump cabinet.

The water pump is rated at 8 gpm. However, the nozzle size at the end of the handgun will determine how much flow you actually have.

Once water leaves the tank through the shut-off valve, it travels to the water pump via 2" insulated hose.

A y-strainer is located inside the pump cabinet. Water flows through the strainer and is guided to the charge pump. The strainer must be kept clean.

- 1 Water pressure relief valve
- 2 Water pressure gauge
- 3 Water pressure regulator
- 4 Air purge valve



Five common questions to ask if the water pump is not making pressure or making low pressure.

- 1. Is the pump turned on correctly?
- a. Chassis ignition power to on.
- b. PTO engaged
- c. If the above conditions are met and the pump still does not work, there is an electrical or a hydraulic issue.
- 2. Is there a nozzle installed?
- a. Make sure that you have a nozzle installed on the end of the handgun or the digging wand
- Make sure the nozzle is clean of foreign debris which could create spikes allowing the unloader to cycle sporadically
- c. Make sure you have the correct nozzle size for the required flow
 - i. Nozzle to big-flow but low pressure
 - ii. Nozzle to small-creates excessive pressure can stall pump
- 3. Is there adequate inlet conditions?
- a. Identify the water level in the tank
- b. Check that the outlet valve from tank is open
- c. If still low flow/pressure
 - i. Close outlet valve
 - ii. Remove screen from y-strainer and inspect
 - 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
 - Pull charge pump line to the inlet head off and direct it away by holding it toward the ground
 - 3. Turn water pump on and observe stream intensity

- 4. If stream is intense and shoots out 20-25 feet inlet conditions are good
 - a. Hook line back to inlet head

Note: this can be checked with a pressure gauge plumbed in (10 psi or better)

- 5. If stream is weak
 - a. Replace charge pump
- 4. Is the pump producing enough flow? (water escaping)
- a. If the pump has adequate water supply and the pressure is still low
- b. Check to see that the pump is unloading by letting go of the handgun
 - If it is not unloading the unloader check valve may be sticking causing partial bypass
 - ii. You can pull the unloader apart and clean this out
 - iii. If corroded replace unloader
- c. Check the inlet and outlet valves on the inlet 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

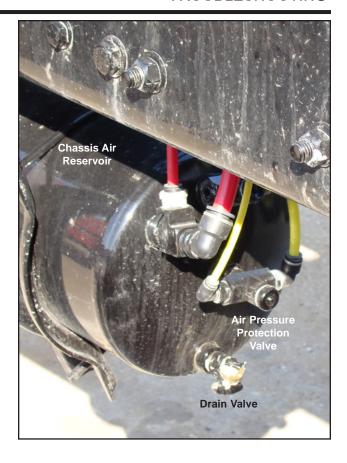
Setting the secondary relief and unloader valves

- 1. Attach handgun with the standard nozzle.
- 2. Unit needs to be running and water pump on.
- 3. With the handgun triggered tighten unloader valve (A) to 2700psi. At that point adjust the relief valve (B) so it just trickles.
- 4. With the handgun triggered adjust the unloader valve (A) to 2500psi.
- When the handgun trigger is released there should be about a 100psi spike to around 2600psi and then the gauge will go to zero. The pump should still be running.
- 6. Repeat step 5 to verify pressure is consistent.
- 7. Secure lock nuts on both valves.

All pneumatic controls added to the chassis by Vactor are fed from the chassis air reservoir through an air pressure protection valve. This valve acts like an electrical fuse by not allowing the reservoir air pressure to drop below about 70psi. When air pressure drops to about 75psi the valve closes and shuts off the Vactor systems. Normal chassis operating air pressure is about 120psi. By limiting the available air pressure to a minimum of 75psi the chassis will still have functional brakes and other needed systems.

The valve typically fails due to debris in the air system and corrosion. The valve may work intermittently or fail either open or closed. If the valve fails open, an air leak may deplete the chassis air system if there is a significant system failure on the Vactor side. If the valve fails closed no air will be supplied to the Vactor systems. Either can be verified by putting an air gauge in the system. The valve is not user serviceable and must be replaced.

Note: There are a variety of these valves in service. Some are supplied by the chassis manufacturers. Appearance will vary.



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

Prodigy

SERVICE PARTS PARTS

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

Part Number	Description	Frequency (hours)	PD units	Fan units
46938JF-30	Remtron plastic carry bag	As Needed	•	•
48611-30	Spindle Box Lube, Shell Omala RL 68	500	•	•
48209A-30	Filter Element for 48208A Hydraulic Filter	500		•
42431B-30	Filter Element for 62643B Hydraulic Filter	500		•
42431-30	Filter Element for 62643 Hydraulic Filter	500	•	
48749A-30	Kit, Seal Cat 3560	1500	•	•
48567-30	Kit, Seal Cat 660	1500	•	•
48749B-30	Kit, Valve Cat 3560	2000	•	•
48556-30	Kit, Valve Cat 660 (2 required)	2000	•	•
48565-30	Spider for motor coupling Cat 660	As Needed	•	•
48047MC-30	Spider for motor coupling Cat 3560	As Needed	•	•
46441D-30	Unloader Valve Cat 660 (pump# 48947L / 10gpm)	As Needed	•	•
46441E-30	Relief Valve Cat 660	As Needed	•	•
46441EA-30	Seal Kit, Buna-N for 46441E Relief Valve	As needed	•	•
46441EB-30	Seal Kit, Viton for 46441E Relief Valve	As needed	•	•
46441G-30	Unloader Valve Cat 3560 (pump# 48047N / 20gpm)	As Needed	•	•
46441H-30	Relief Valve Cat 3560	As Needed	•	•
39893-30	Boom Turret Cover Gasket	As Needed	•	•
70404M-30	Debris Hose, Red 8" x 34"	As Needed	•	•
43958A-30	Debris Hose, Red 8" x 136" (Ext.Boom)	As Needed	•	•
46564D-30	Debris Hose, Red 8" x 60" (Tel. Boom)	As Needed	•	•
70404M-30	Debris Hose, Red, Gum Lined 8" x 36"	As Needed	•	•
1140363A-30	Air Filter, Final Filter 19.6OD x 14ID x 28.5 tall (round style for HXX PD)	As Needed	•	
1140363B-30	Air Filter, Final Filter 19.6OD x 14ID x 21.5 tall (round style for Prodigy)	As Needed	•	
1140467D-30	Air Filter, Final Filter 20 x 30 x 3.5 (old square style for HXX PD)	As Needed	•	
35096-30	8" to 6" Reducer Flange	As Needed	•	•
34141-30	6" to 4" Reducer Flange	As Needed	•	•
46471A-30	Quick Clamp 4"	As Needed	•	•
32087-30	Quick Clamp 6"	As Needed	•	•
16584-30	Quick Clamp 8"	As Needed	•	•
51770-30	Band Lock, 8" FLG to 6" MBL	As Needed	•	•
50271-30	Bank Lock, 8" FLG to 6" FMBL	As Needed	•	•
51188-30	Band Lock, 8" FLG to 8" FMBL	As Needed	•	•
1280043-30	Band Lock, 8" FLG to 6" FMBL	As Needed	•	•
42577-30	Band Lock Assembly 4"	As Needed	•	•
42578-30	Band Lock Assembly 6"	As Needed	•	•
42579-30	Band Lock Assembly 8"	As Needed	•	•
42580-30	Band Lock, Female 4"	As Needed	•	•
42581-30	Band Lock, Female 6"	As Needed	•	•
42582-30	Band Lock, Female 8"	As Needed	•	•

Prodigy

SERVICE PARTS PARTS

		Frequency	PD	Fan
Part Number	Description	(hours)	units	units
42583-30	Band Lock, Male 4"	As Needed	•	•
42584-30	Band Lock, Male 6"	As Needed	•	•
42585-30	Band Lock, Male 8"	As Needed	•	•
42589-30	Band Lock, Gasket 4"	As Needed	•	•
42590-30	Band Lock, Gasket 6"	As Needed	•	•
42591-30	Band Lock, Gasket 8"	As Needed	•	•
42586-30	Band Lock, Clamps 4"	As Needed	•	•
42587-30	Band Lock, Clamps 6"	As Needed	•	•
42588-30	Band Lock, Clamps 8"	As Needed	•	•
43322-30	PVC Flex Hose Bulk 4"	As Needed	•	•
43323-30	PVC Flex Hose Bulk 6"	As Needed	•	•
43716-30	PVC Flex Hose Buk 8"	As Needed	•	•
25637D-30	Aluminum Pipe 8" x 72"	As Needed	•	•
25637E-30	Aluminum Pipe 8" x 90"	As Needed	•	•
25637G-30	Aluminum Pipe 8" x 120"	As Needed	•	•
25262-30	Aluminum Pipe Handle 8"	As Needed	•	•
29314-30	Water Ring 8"	As Needed	•	•
20188M-30	Quick Disconnect (Water) 1/2" Male	As Needed	•	•
20188L-30	Quick Disconnect (Water) 1/2" Female	As Needed	•	•
40589-30	Quick Disconnect 1/2" to 1/2" NPT	As Needed	•	•
27771K-30	Ceramic Lined Elbow 8"	As Needed	•	•
89444-30	Digging Lance Fiberglass	As Needed	•	•
500619A-30	Digging Lance Pipe Assy. 83"	As Needed	•	•
500619B-30	Digging Lance Pipe Assy. 108"	As Needed	•	•
500619C-30	Digging Lance Pipe Assy. 48"	As Needed	•	•
500619E-30	Digging Lance Pipe Assy. 83" w/nozzle	As Needed	•	•
500619F-30	Safety Shutoff Valve Assy.	As Needed	•	•
89714-30	Nozzle Guard Assembly, 3.2 GPM	As Needed	•	•
89714A-30	Nozzle Guard Assembly, 4.8 GPM	As Needed	•	•
89714B-30	Nozzle Guard Assembly, 9.6 GPM	As Needed	•	•
89714C-30	Nozzle Guard Assembly, 16.5 GPM	As Needed	•	•
89714D-30	Nozzle Guard Assembly, 6.4 GPM	As Needed	•	•
86230-30	Nozzle, 3 Insert with out Guard (Inline)	As Needed	•	•
86230D-30	Nozzle, 2 Insert with out Guard	As Needed	•	•
89714A-30	Nozzle, 3 Insert with out Guard	As Needed	•	•
89713-30	Nozzle Tube, Guard (plastic)	As Needed	•	•
47390KJ-30	Heating Coil for 47390K (400K BTU unit)	As Needed	•	•
47390LD-30	Heating Coil for 47390L (940K BTU unit)	As Needed	•	•

Prodigy

SERVICE PARTS PARTS

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

Part Number	Description	Frequency (hours)	PD units	Fan units
49209-30	Air Spade			
49209-30	AIR EXCAVATION KIT, PREMIUM	As Needed	•	•
49209A-30	AIR-SPADE SERIES 2000 TOOL	As Needed	•	•
49209B-30	AIR-SPADE 3FT EXTENSION POLE	As Needed	•	•
49209C-30	AIR-SPADE 10FT LIGHTWEIGHT HOS	As Needed	•	•
49209D-30	AIR-SPADE 45* ANGLED ADAPTER	As Needed	•	•
49209E-30	AIR-SPADE HANDLE	As Needed	•	•
49209F-30	AIR-SPADE 4FT EXTENSION POLE	As Needed	•	•
49209G-30	AIR-SPADE NOZZLE, 150 CFM	As Needed	•	•
49209H-30	AIR-SPADE NOZZLE, 105 CFM	As Needed	•	•
49209J-30	AIR-SPADE HANDLE REBUILD KIT	As Needed	•	•
49209K-30	DIRT GUARD, AIR SPADE	As Needed	•	•
	3000 Series Air Spade			
49931-30	3000 SERIES AIR SPADE	As Needed	•	•
49931A-30	FLEX LEADER HOSE, 1" X 25FT.	As Needed	•	•
49931B-30	LANCE EXTENSION, 3' LG	As Needed	•	•
49931C-30	NOZZLE, 330 SCFM	As Needed	•	•
503054A-30	AIR EXCAVATION KIT, 330 SCFM	As Needed	•	•
	Fuses (normally located in the battery box)			
507865-30	80A MEGA FUSE	As Needed	•	•
507865A-30	150A MEGA FUSE	As Needed	•	•
507865B-30	350A MEGA FUSE	As Needed	•	•







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