TORNADO
INFRASTRUCTURE EQUIPMENT

F-SERIES F3 | CITY F-SERIES F4 | RURAL F-SERIES F5 | REMOTE

# OPERATION & MAINTENANCE MANUAL


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- Improper installation or maintenance; or
- Operation inconsistent with the instructions provided in this manual.

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- Follow all safety instructions, hazard warnings, and procedural guidance provided.
- Use only manufacturer-approved parts, components, and attachments.
- Maintain the equipment in proper working condition.
- Comply with all applicable federal, state/provincial, and local laws and regulations, as well as relevant industry practices and guidelines.

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- Use of the equipment in unsafe or non-compliant environments.

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# 1 Introduction

## 1.1 Intended Use

Thank you for choosing Tornado as your hydrovac equipment provider. We recognize that you have a range of options in the market, and we appreciate the opportunity to support your operations with our equipment.

Each Tornado hydrovac truck is built with a focus on quality, precision, and durability. When maintained properly, your unit is engineered to provide reliable performance over many years of service.

This manual is intended to guide operators and maintenance personnel in the proper use, servicing, and care of Tornado hydrovac trucks. It includes troubleshooting information and preventive maintenance recommendations to help address common operational challenges. Because operating conditions can vary by region, some procedures may need to be adapted to local climates or terrain. For assistance with region-specific procedures or extreme operating conditions beyond standard temperatures of 0°F to 115°F (-18°C to 46°C), please contact Tornado support.

This equipment is designed to be operated, serviced, and repaired only by trained, qualified, and competent personnel who are familiar with its specific characteristics and who follow all relevant safety procedures. Use of the truck outside of the instructions in this manual, or beyond its intended operating limits, is not supported and may lead to unsafe conditions or equipment damage.

## 1.2 Contact Tornado

Tornado Infrastructure Equipment (North America) Inc.
4100 77 Street
Red Deer, AB
T4P 3P7
Canada

Phone: .....+1 (403) 742-6121
Toll Free (Canada only): .....+1 (877) 340-8141

Parts information: ..... parts@tghl.ca
Product service: ..... service@tghl.ca
Warranty information or claims: ..... warranty@tghl.ca

## 1.3 How to Use This Manual

This operator's manual is provided to support the safe and effective use of the F3, F4, and F5 hydrovac trucks. All personnel who operate, maintain, or work near these trucks should review the entire manual and ensure they are familiar with its contents before working with the equipment.

The manual is organized into four chapters, with appendices that provide supplemental information on topics such as optional equipment. Each chapter addresses a specific area of use and care:

- **Chapter 1 – Introduction**
  Provides information on how to use the manual, contact information for support, and a basic overview of the hydrovac and its systems.
- **Chapter 2 – Safety Information**
  Provides crucial information for safe operation of the hydrovac equipment.
- **Chapter 3 – Controls & Operations**
  Describes the hydrovac's controls and indicators and explains procedures for operating the equipment.
- **Chapter 4 – Maintenance**
  Provides a maintenance schedule and the associated procedures for properly maintaining the hydrovac equipment.
- **Appendix A – Hydrovac Options**
  Provides information related to optional equipment available on hydrovac trucks.
- **Appendix B – Legacy Information**
  Provides information on legacy decals used on previous generations of hydrovac trucks.

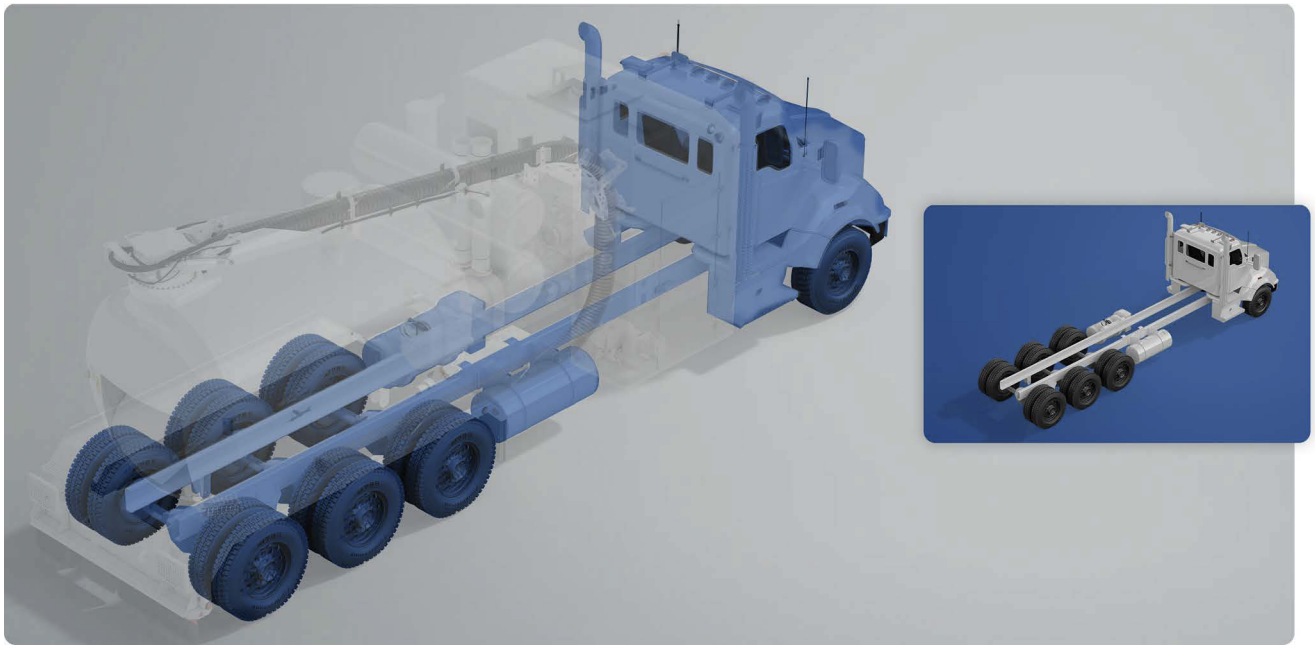
It is important to understand that both this manual and hands-on training are essential for proper preparation to operate or maintain this equipment.

## 1.4 Major Components

The following figures illustrate the major components of the hydrovac truck.

- The diesel truck chassis supports and powers the hydrovac equipment. Refer to the chassis owner's manual for information on operation and maintenance of the chassis.

***Figure 1-1.*** *Major Components - Truck Chassis*



- The transfer case is installed in a split-shaft configuration on the truck driveshaft. Outputs of the transfer case drive the hydraulics and the blower.

**Figure 1-2.** *Major Components - Transfer Case*



- The water heater is located in the van body and provides hot water for excavation operations in cold weather. The water heater draws diesel from the truck's fuel tank.

**Figure 1-3.** *Major Components - Water Heater*



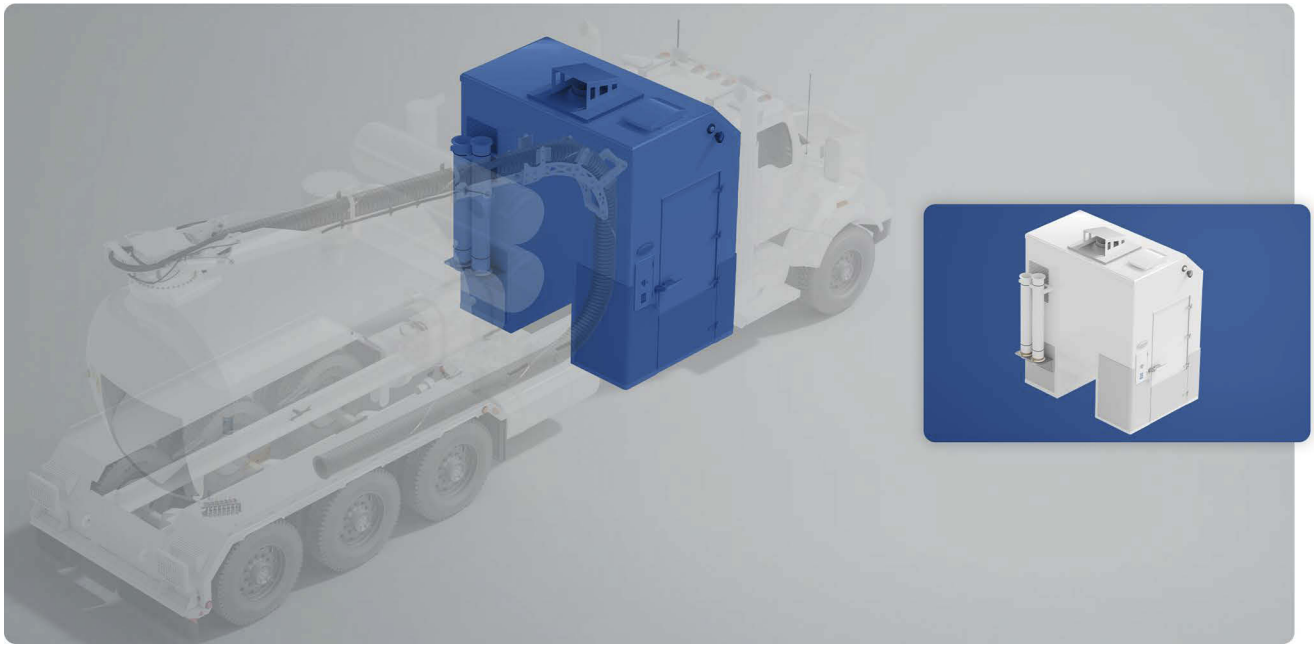
- The water pump provides pressurized water at up to 2800-psi for excavation operations. It is driven by a hydraulic motor.

**Figure 1-4.** *Major Components - Water Pump*



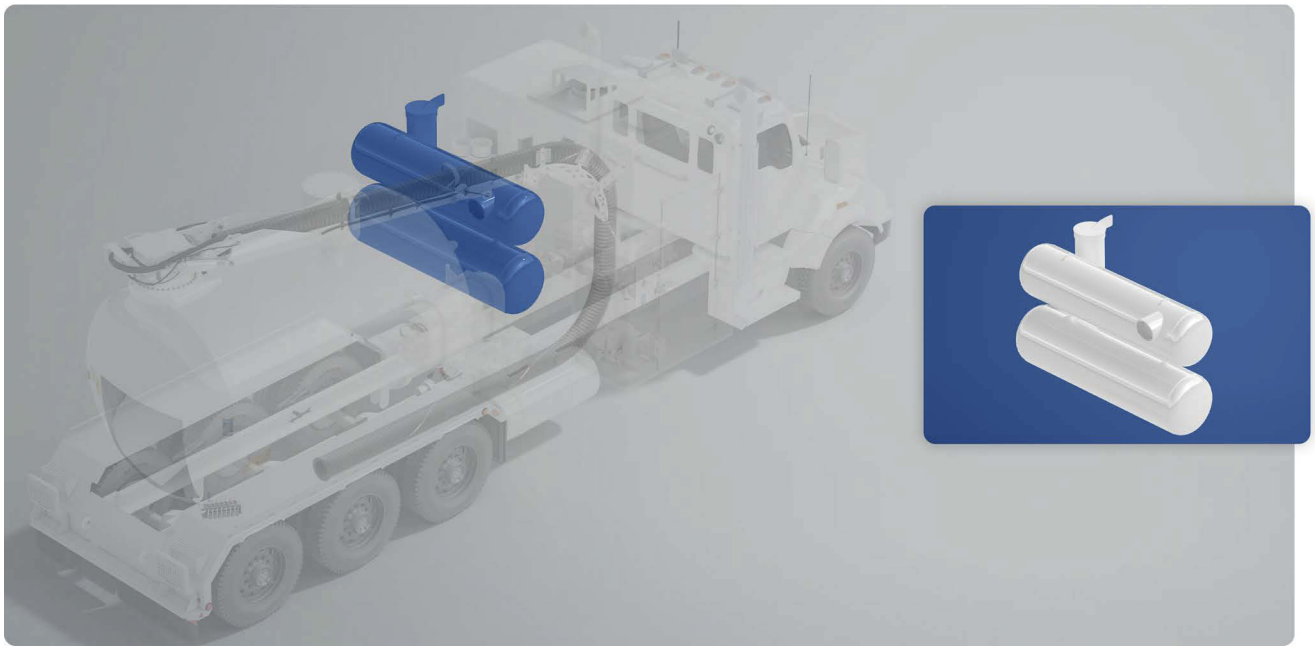
- The van body encloses and protects key equipment, including the main control panel, water heater, and water pump, and provides storage for tools and accessories. It allows operators easy access for use and monitoring.

**Figure 1-5.** *Major Components - Van Body*



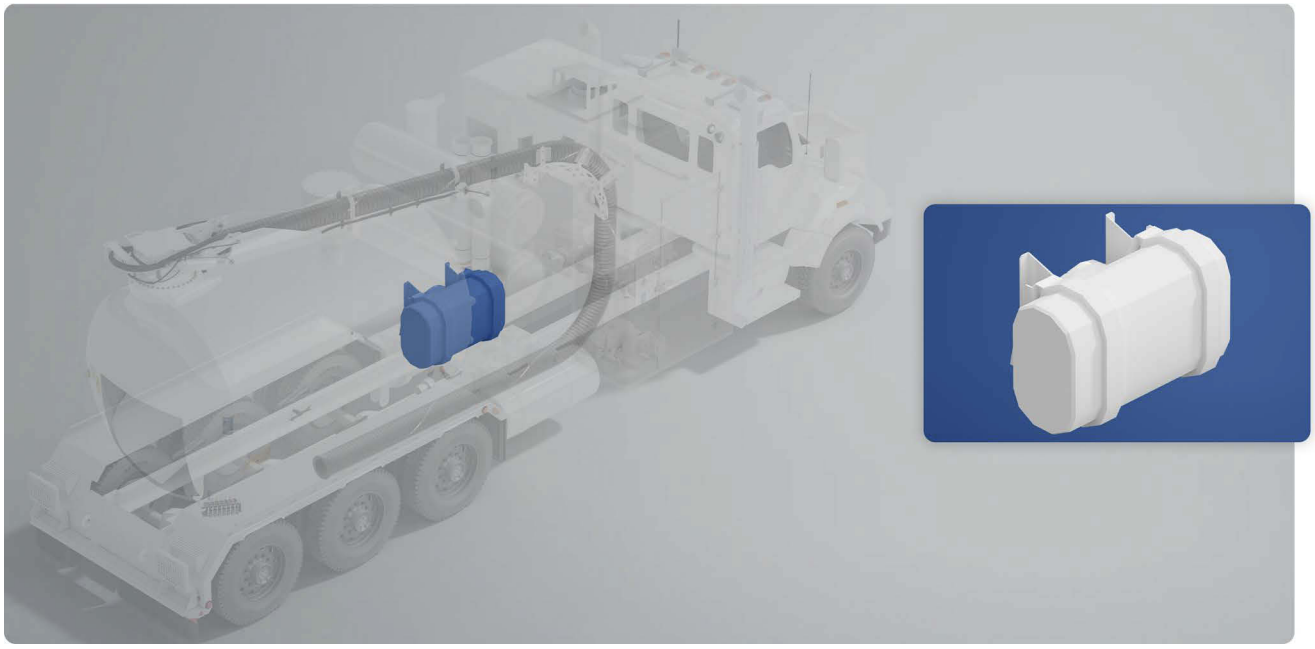
- There are two silencers on the hydrovac—a cooling silencer that channels intake air upstream of the blower and a discharge silencer that directs air flow downstream of the blower. These devices minimize environmental noise levels.

***Figure 1-6.*** *Major Components - Silencers*



- The blower creates the primary air movement creating suction through the boom. The blower is driven by the transfer case.

***Figure 1-7.*** *Major Components - Blower*



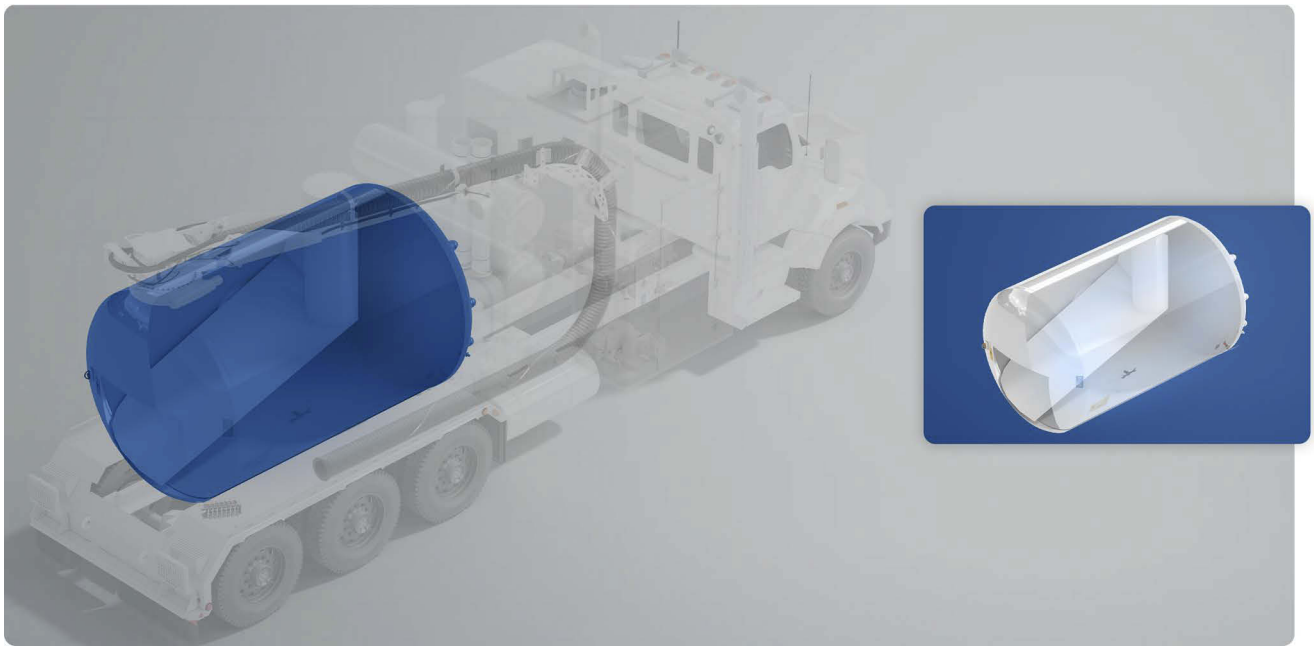
- The air filter is a pleated element capable of 10-µm (ten micron) filtration, removing dust from the air flow before it is vented out of the system.

**Figure 1-8.** *Major Components - Air Filter*



- The water and debris tank is a single vessel that is internally divided, with clean water on the bottom of the tank and debris on the top.

**Figure 1-9.** *Major Components - Water and Debris Tank*



- A hydraulically operated boom is used to vacuum dirt, water, and debris during excavation operations. The boom is controlled either manually or via a remote controller. Multiple dig tubes are provided to extend the reach of the boom during excavation.

**Figure 1-10.** *Major Components - Boom*



- Manual control levers for the boom, dump door, and other functions are located on the passenger side near the rear of the truck.

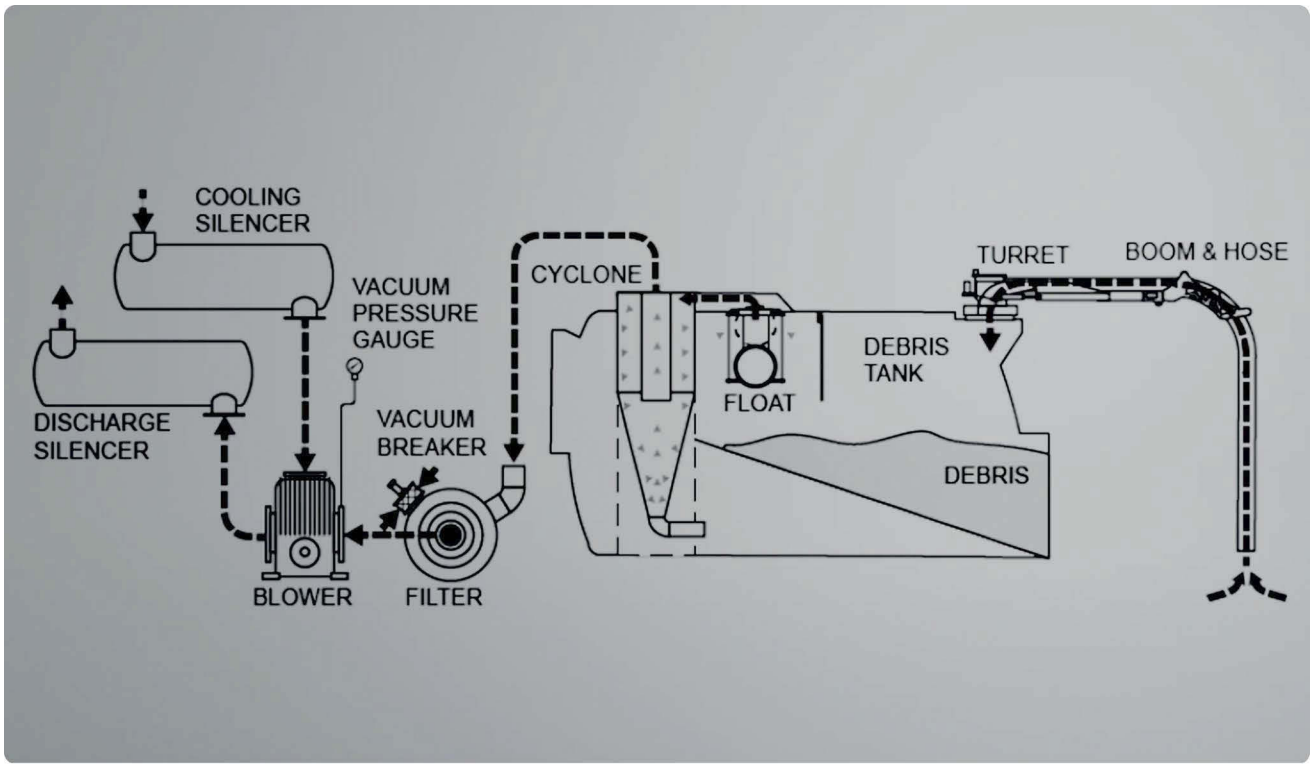
**Figure 1-11.** *Major Components - Valve Block*



## 1.5 Airflow Diagram

Airflow within the system is generated by a twin rotary lobe blower, which is powered by the transfer case and ultimately driven by the truck's driveshaft. This blower creates suction that draws air, along with water and debris, through the boom and into the debris tank. Once separated from solids and liquids, the air continues through the filtration system and is discharged back into the atmosphere. The steps outlined below provide a detailed overview of the airflow path within the F-Series unit. Figure 1-12 shows a simplified diagram for reference.

***Figure 1-12.** Airflow Diagram*




1. **Material pickup –** The boom hose draws in air, water, and debris from the excavation area. The boom supports the hose, allowing the operator to raise, lower, extend, retract, or rotate it as needed.
2. **Debris tank entry –** Air and debris pass through the turret and into the debris tank. The float ball in the tank is designed to cut off airflow from the debris tank to the blower when the tank is full.
3. **Cyclonic separation –** The air stream then moves through a crossover into the cyclone. Centrifugal force removes heavier particles from the air stream, which fall into a particulate trap at the bottom of the cyclone.
4. **Air filtration –** A pleated air filter rated for ten micron filtration captures any remaining particles traveling in the air stream. From here, the cleaned air is routed to the blower.
5. **Blower intake –** The blower ducting draws air from two sources: the air filter and additional cooling air from the cooling silencer, which also helps reduce noise levels.
6. **Discharge –** The blower exhausts air through a high-efficiency discharge silencer, returning it to the atmosphere while minimizing noise.

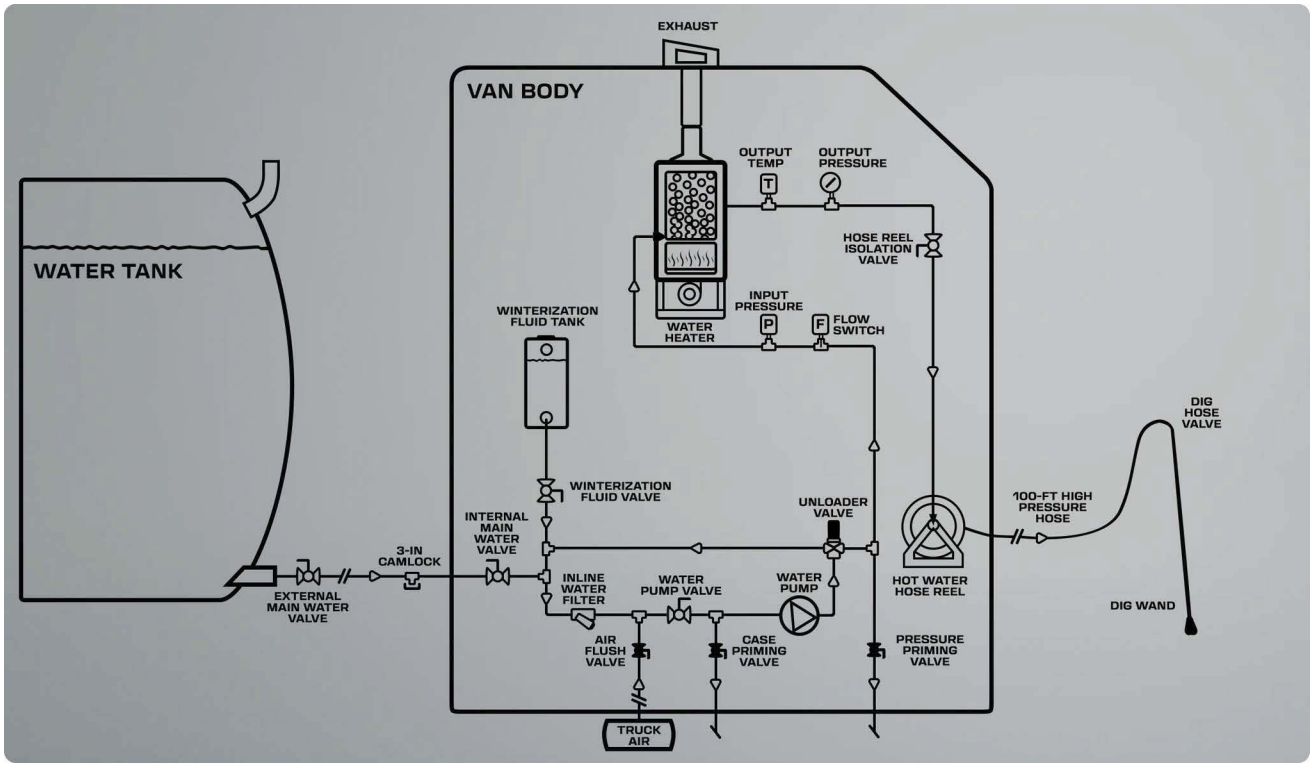
7. **Vacuum breaker –** The vacuum breaker can be activated using either the valve block or the remote controller to intentionally stop suction at the end of the boom hose. This allows the operator to dislodge the hose if it becomes sealed against a surface and can potentially relieve a system blockage. Activating the vacuum breaker diverts the intake to the atmosphere, ending the vacuum upstream of the air filter without shutting down the blower. The vacuum breaker is also opened when the machine stop button is pressed.

## 1.6 Water Flow Diagram

The hydrovac truck includes a clean water tank that occupies the front lower portion of the debris tank. This water supplies the hose reel and is used for excavation or cleaning, depending on the attachment connected to the dig hose. Figure 1-13 shows a simplified diagram of the water flow through the hydrovac.

> ***NOTE:*** *See "Water Tank Filling" on page 64 for details on filling the water tank.*

***Figure 1-13. Water Flow Diagram***




1. **Water supply –** Clean water is stored in the water tank and flows through a shutoff valve to a hydraulically driven water pump.
2. **Pump to water heater –** From the pump, water passes through an unloader valve and enters the supply line leading to the water heater. The water heater is used only when hot water is needed, such as during excavation in cold weather.
3. **Heating and monitoring –** Water exiting the water heater flows through temperature and pressure gauges before traveling to the control valve located upstream of the hose reel.
4. **Flow control –** The isolation valve directs water to the hose reel. The dig hose ends with a hand valve, which must be opened to allow water to exit the system, typically through a dig wand.

5. **Bypass operation –** To reduce pump wear caused by pressure surges when flow is stopped, a bypass line returns water to the pump feed line at the unloader. The bypass is triggered if the operator closes a downstream valve or releases the trigger on an attached washout gun while the pump is running.

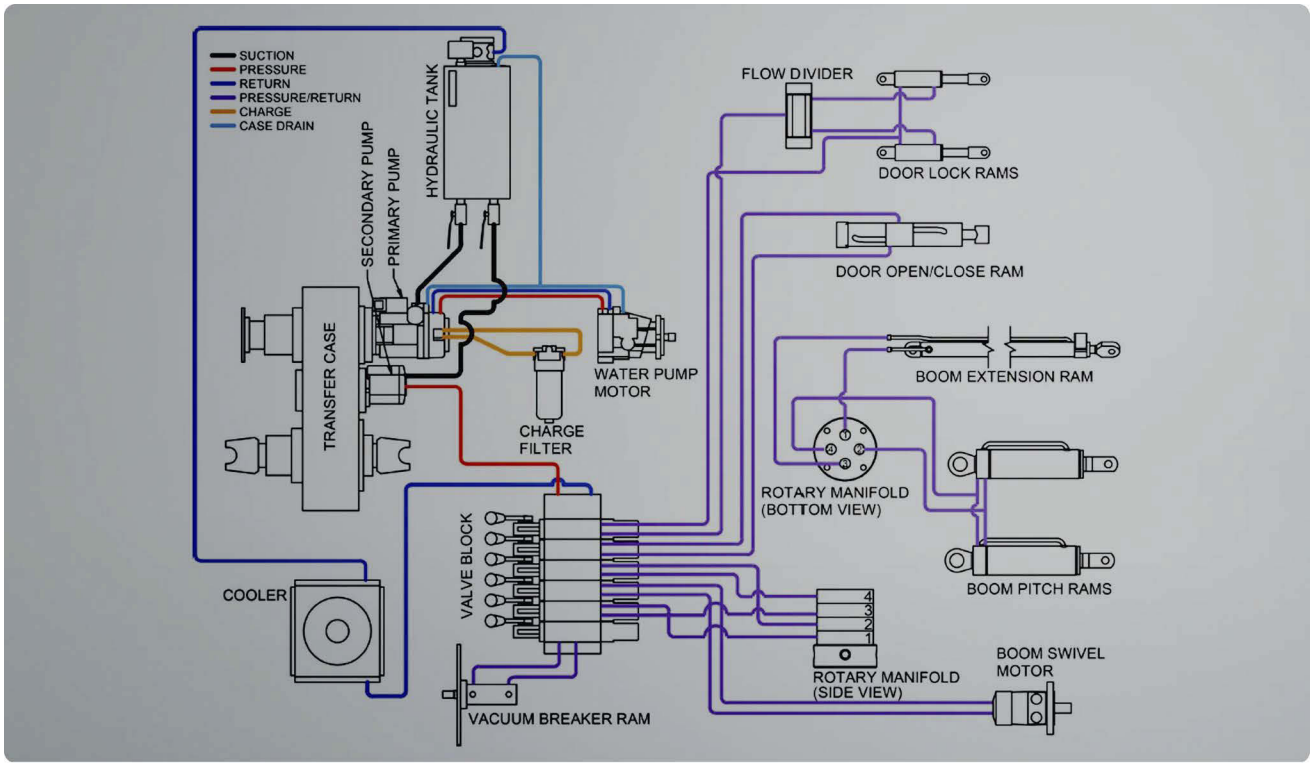
## 1.7 Hydraulic System Diagram

There are two independent hydraulic circuits on the hydrovac, and they share a common hydraulic tank (also referred to as the hydraulic reservoir). The two circuits are:

- **Water pump (primary) circuit –** Powers the water pump in the van body.
- **Valve block (secondary) circuit –** Powers hydraulic rams and other components that are not part of the water pump circuit. These components are controlled by the valve block.

Hydraulic fluid flows through both circuits while the hydraulics are engaged using the cab controls.

***Figure 1-14. Hydraulic System Diagram***




### 1.7.1 Water Pump Circuit

The water pump circuit is a closed loop circuit. In addition to the shared hydraulic tank, it consists of:

- **Suction line shutoff valve –** Located on the underside of the hydraulic tank.
- **Primary hydraulic pump –** Mounted to the top pump pad of the transfer case. The primary pump is a variable displacement axial piston pump.
- **Water pump motor –** Mounted to the water pump inside the van body. The water pump motor is a fixed displacement axial piston motor.
- **Charge filter –** Mounted to the rear exterior wall of the van body and connected to the remote charge filtration ports of the primary hydraulic pump.

The working fluid travels in a loop between the pump and the motor; the motor's speed is set by varying the amount of fluid that the pump outputs per revolution. Fluid in the loop is constantly exchanged with the hydraulic tank at a low rate, with fluid entering the loop via the suction port on the pump and returning to the tank via the shared drain line connected to the motor and pump's case drain ports.

### 1.7.2 Valve Block Circuit

The valve block circuit is an open loop circuit. In addition to the shared hydraulic tank, it consists of:

- **Suction line shutoff valve –** Located on the underside of the hydraulic tank.
- **Secondary hydraulic pump –** Mounted to the middle pump pad of the transfer case. Also called the gear pump.
- **Valve block –** Located at the rear passenger side of the truck. Controls power to each of the following items:
  - Boom swivel motor
  - Boom pitch cylinders
  - Boom extension/retraction cylinder
  - Dump door open/close cylinder
  - Dump door lock/unlock cylinders
  - Vacuum breaker cylinder(s) (one on the Robuschi RB-DV 125 blower, two on the Robuschi RB-DV 145 blower)
- **Cooler fan –** Located on the rear exterior wall of the van body. This heat exchanger cools the hydraulic fluid.
- **In-tank return filter –** Located on top of and extending into the hydraulic tank.

---

***NOTE:*** *The valve block may also have levers that control the optional debris dozer and the sludge pump motor if equipped with these options.*

---

The working fluid is pumped from the hydraulic tank to the valve block, returning to the tank through the heat exchanger and return filter. Hydraulic fluid is circulated through this circuit regardless of whether the functions on the valve block are in use in order for the hydraulic fluid in the tank to be constantly cooled and filtered.

## 1.8 F3 City Specifications

The Tornado F3 City Hydrovac is designed to navigate worksites ranging from industrial parks to suburban alleyways.

***Figure 1-15.*** *F3 Truck Configuration*




| SPECIFICATIONS - F3 CONFIGURATION | |
|---|---|
| **Item** | **Description** |
| **Blower Suction** | RB-DV 125: 3800-CFM at 27-inHg |
| **Water Pump** | 20-GPM at 2800-psi |
| **Water Heater** | 690,000-BTU |
| **Boom Hose Diameter** | 8-in |
| **Boom Reach** | 26-ft |
| **Boom Rotation** | 342-deg |
| **Dump Door Size** | 48-in x 52-in |
| **Van Body Size Options** | 42-in or 48-in |
| **Control System** | Vortex 1.0 |
| **Chassis Specifications** | Tandem axle |

## 1.9 F4 Rural Specifications

The Tornado F4 Rural Hydrovac optimizes hauling capacity while maintaining great highway fuel economy. Requiring fewer loads to get the job done, the F4 meets country jobs head on, accomplishing large payload hauls between townships.

***Figure 1-16.*** *F4 Truck Configuration*




| SPECIFICATIONS - F4 CONFIGURATION | |
|---|---|
| **Item** | **Description** |
| **Blower Suction** | RB-DV 125: 3500-CFM at 27-inHg<br>RB-DV 145: 6100-CFM at 27-inHg |
| **Water Pump** | 20-GPM at 2800-psi |
| **Water Heater** | 690,000-BTU |
| **Boom Hose Diameter** | 8-in |
| **Boom Reach** | 26-ft |
| **Boom Rotation** | 342-deg |
| **Dump Door Size** | 48-in x 52-in |
| **Van Body Size Options** | 60-in or 70-in |
| **Control System** | Vortex 1.0 |
| **Chassis Specifications** | Tandem with pusher axle<br>Tridem axle<br>Tridem with pusher axle |

## 1.10 F5 Remote Specifications

The Tornado F5 Remote Hydrovac maximizes payload capacity while remaining compliant with commercial transport regulations. If remote worksites are commonplace in your operation, the F5 will see the job completed with the fewest number of loads possible.

***Figure 1-17. F5 Truck Configuration***




| SPECIFICATIONS - F5 CONFIGURATION | |
|---|---|
| **Item** | **Description** |
| **Blower Suction** | RB-DV 125: 3500-CFM at 27-inHg<br>RB-DV 145: 6100-CFM at 27-inHg |
| **Water Pump** | 20-GPM at 2800-psi |
| **Water Heater** | 690,000-BTU |
| **Boom Hose Diameter** | 8-in |
| **Boom Reach** | 26-ft |
| **Boom Rotation** | 342-deg |
| **Dump Door Size** | 48-in x 52-in |
| **Van Body Size Options** | 60-in or 70-in |
| **Control System** | Vortex 1.0 |
| **Chassis Specifications** | Tridem axle<br>Tridem with pusher axle |

# 2 Safety Information

This chapter outlines essential safety information specific to Tornado F3, F4, and F5 hydrovac trucks. It is critical that all operators, technicians, and service personnel read and understand the safety information provided in this chapter and throughout the rest of this manual prior to operating, maintaining, or working around the equipment.

Safe operation of this equipment requires more than just adherence to this manual. Operators must also receive proper training and comply with their employer's safety policies, site-specific requirements, and all applicable federal, state/provincial, and local regulations. The hydrovac equipment should always be operated by two operators.

## 2.1 Safety Alerts

This manual uses standardized safety alert symbols and terminology to identify hazards and prevent injury. The following alert levels are used:

**⚠ WARNING!**

A WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

**CAUTION**

A CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

***NOTE:*** *A note indicates information considered important, but not hazard-related (e.g., messages relating to property damage or operating tips).*

## 2.2 Emergency Procedures Overview

Hydrovac operators face a wide range of potential emergencies, each requiring a specific and rapid response to minimize harm to workers and prevent further damage to equipment or infrastructure. While this manual includes general and hazard-specific guidance, it cannot account for every possible emergency scenario. Operators must develop and follow site-specific emergency response plans in coordination with their company policies, local regulations, and worksite requirements. The emergency response guidelines and procedures in this manual are intended to provide general principles that can support those plans.

**⚠ WARNING!**

Failure to act quickly and correctly during an emergency can result in serious injury, permanent disability, or death. All operators must be familiar with emergency shutdown procedures, evacuation protocols, and site-specific response plans prior to starting work.

### 2.2.1 Emergency Preparedness

- Conduct regular safety meetings and tailgate talks to reinforce emergency procedures.
- Know the location of muster points and evacuation routes.
- Verify that emergency response equipment is present, accessible, and suitable for the potential hazards, including, at minimum:
  - First aid kit – should include all standard first aid supplies, as well as burn dressings, tourniquets, and wound care materials.
  - Eye wash station – must provide a clean, sterile, and reliable flow of a solution suitable for flushing contaminants from the eyes in case of exposure.
  - Fire extinguisher – suitable for both oil and electrical fires and compliant with local transport authority regulations (e.g., DOT or CTA).
  - Emergency contact list and site-specific response procedures.
- Ensure that equipment is properly maintained and in good condition. Verify the proper function of all machine stop buttons daily prior to starting work.

***NOTE:*** *There is a 5-lb fire extinguisher in the cab of every chassis upon delivery. It is recommended to keep a 25-lb type-ABC fire extinguisher in the van body that can be placed at a suitable location during equipment operation for easy access. This optional fire extinguisher should be securely stored during travel.*

### 2.2.2 General Emergency Guidelines

- Immediately stop work if any situation arises that poses an immediate danger to health or safety.
- If it can be done safely and quickly, shut off the truck or press one of the machine stop buttons (see “Machine Stop Buttons” on page 37).
- Evacuate the area, keeping a safe distance from equipment and potential hazards.
- Notify emergency response services and follow the site-specific emergency response plan.

Hydrovac operations often take place around high-risk utilities, including gas, electrical, water, and communication lines. While the required emergency response will vary depending on the type of utility involved and the specific circumstances of the incident, all utility strikes must be treated as safety-critical events.

Operators must immediately stop work, secure the site, and escalate the incident according to jurisdictional, company, and site-specific requirements. They must also be trained to recognize utility types and understand the appropriate response procedures for each.

### 2.2.3 Electric Line Strike Guidelines

- Cease all operations and release controls immediately.
- Do not touch any part of the hydrovac truck or any other objects or personnel that could be energized.
- If inside the truck cab or van body, remain inside until cleared by emergency personnel unless another more immediate hazard requires you to evacuate.
- Warn all personnel to stay clear of the truck.
- If bailing from the equipment is required, avoid contact with metal wherever possible and jump clear from the equipment in one motion: keep both feet together, do not touch the truck and the ground at the same time, and aim to land balanced with your feet together.
- Evacuate to a safe distance from the truck and other energized hazards by shuffling with both feet on the ground and close together.
- Notify emergency responders and contact the utility owner to shut off the power.
- Follow site-specific emergency protocols.
- Do not return to the equipment or allow others into the area until the utility owner confirms the site is safe and power is isolated.

### 2.2.4 Gas Line Strike Guidelines

- Cease all operations immediately.
- If it can be done safely and quickly, shut off the truck or press one of the machine stop buttons, then remove or disable any potential ignition sources.
- Warn all personnel in the area that a gas line has been struck. Evacuate the area immediately, upwind or crosswind if safe to do so.
- Notify emergency responders and contact the utility owner.
- Follow site-specific emergency protocols for gas leaks.
- Do not return to the equipment or allow others into the area until the utility owner confirms the site is safe.

### 2.2.5 Communication Line Strike Guidelines

- Cease all operations immediately.
- Assess for additional hazards, but never look into the cut ends of a fiber optic or unidentified cable as vision damage can occur.
- Notify the utility owner.
- Follow any site-specific reporting requirements.

## 2.3 Safety and Informational Decals

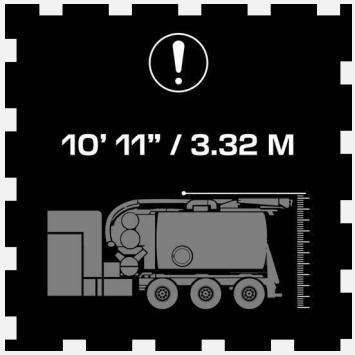
Hydrovac trucks are equipped with safety decals placed at key locations to warn operators and maintenance personnel of potential hazards. These decals provide immediate visual alerts and are essential for safe operation. Each decal corresponds to a specific hazard and is located near the relevant equipment or risk zone. Operators must become familiar with the meaning of each decal and always follow the related safety precautions. Personnel must never remove, obscure, or deface safety decals. If a decal becomes unreadable or damaged, it must be reported and replaced immediately.

Other decals are not safety-related but convey information that is important for the operator to know.

**⚠ WARNING!**

Safety decals serve as critical reminders and immediate hazard alerts. Do not rely on them as a substitute for reading and understanding the full safety guidance in this manual.

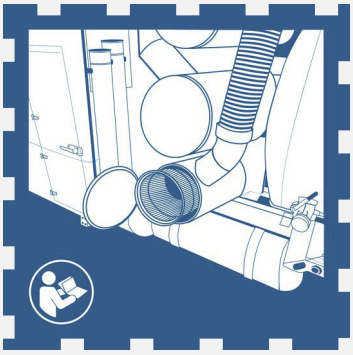
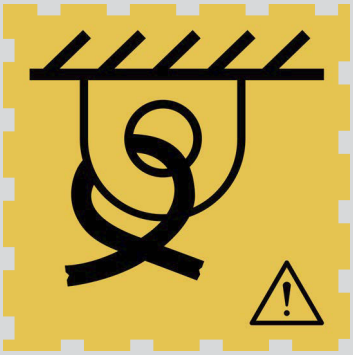
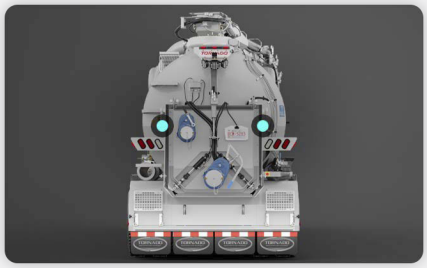
**SAFETY AND INFORMATIONAL DECALS**

| Decal | Location | Description |
|---|---|---|
|  |  | **Hydrovac Height:** Indicates the height of the hydrovac truck. Exact heights of individual trucks will vary. Refer to the decal in your chassis cab to determine the height of your equipment. |
|  |  | **Consult Operations Manual:** Indicates that special procedures must be followed to safely operate the component. For more information, refer to:<br>• "Blower Diesel Flush" on page 81<br>• "Cleaning Cyclone" on page 100<br>• "Vacuum-Assisted Water Filling Operations" on page 65 |

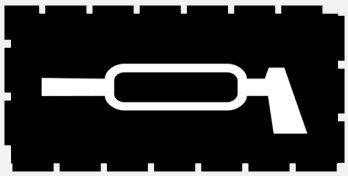
## SAFETY AND INFORMATIONAL DECALS

| | | |
|---|---|---|
|  |  | **Hot Surface:** Indicates the surface temperature may be hot. |
|  |  | **All PPE Required:** Indicates that all PPE is required within a 6-meter perimeter. See “Personal Protective Equipment (PPE) Requirements” on page 26. |
|  |  | **DANGER – Spinning Shaft:** Indicates to keep clear of the spinning shaft.<br>• Keep arms, legs, and clothing away.<br>• Any loose and/or dangling objects on person may get caught in shaft and cause severe injury or death. |
|  |  | **No Step:** Indicates that the blower driveshaft cover is not a step. |

## SAFETY AND INFORMATIONAL DECALS

| | | |
|---|---|---|
|  |  | **Air Filter Maintenance:** Indicates that the air filter should be cleaned or changed according to the operations manual. See “Clean or Change Hydrovac Air Filter” on page 97. |
|  |  | **ALERT – Tie Off Required:** Indicates that operators must be properly tied off when working on top of the truck. See “Fall Protection” on page 33. |
|  |  | **ALERT – Dump Door Locking Pins:** Indicates that both safety pins must be used to secure the door in the open position and must be removed prior to closing the dump door. |
|  |  | **DANGER – Pinch Point:** Indicates that operators should keep clear of the pinch point. |

## SAFETY AND INFORMATIONAL DECALS

| | | |
|---|---|---|
|  |  | **Grease Point:** Indicates a grease point. See “Greasing Hydrovac System Components” on page 99. |
|  |  | **ALERT – Keep Clear When Dumping:** Indicates that operators should keep clear of the rear of the truck when dumping. |
|  |  | **ALERT – Do Not Operate Debris Dozer When Icy:** Indicates that the debris dozer equipment should not be used with ice or frozen debris in the tank. Doing so can potentially damage the sweep assembly. See “Debris Dozer” on page 117. This decal is only present if this optional equipment is installed. |
|  |  | **Consult Operations Manual for Boom Grease Manifold Chart:** Indicates that the boom manifold grease chart should be followed weekly. See “Greasing Boom Components” on page 99. |

## SAFETY AND INFORMATIONAL DECALS

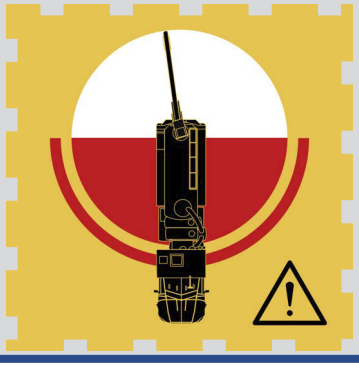




**DANGER – Avoid Overhead Power Line:** Indicates that overhead power lines pose an electrocution hazard and should be avoided.

- 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 vehicle or any obstruction.
- Be aware of the vehicle's surroundings before operating any of the hydraulic functions to prevent death, injury, or equipment damage.
- If unsure of power line voltage, maintain the largest required safe clearance distance from power lines, or contact the local utility owner to determine clearance requirement.

See "Overhead Power Line Contact Risks" on page 29.





**DANGER – Boom Safe Operation Zone:** Indicates the safe operation zone for the boom. Operation of the boom in the **CAUTION ZONE** may cause damage to the tank and/or other equipment, and excavating within this zone may create a hazard for operators and equipment.

## SAFETY AND INFORMATIONAL DECALS





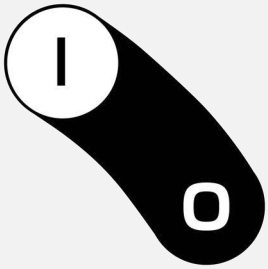
**WARNING – Boom Use:** This indicates that the boom should not be used as a lifting device or crane.

- The boom on the hydrovac was not designed in accordance with any of the crate standards.
- Misuse of the boom can result in personal injury or death.
- Misuse of the boom may result in damage to any or all parts of the boom, which can lead to failure of the boom and its infrastructure.



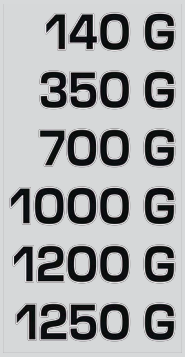



**Debris Tank Fill Levels:** These indicate the fill level of the debris tank: full, half full, or empty.






**Valve Positions for Vacuum Water Filling:** Indicates whether the valve is open or closed. The valve is fully open when in the vertical (upright) position and fully closed when in the horizontal position.

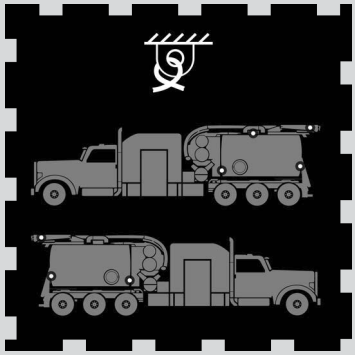





**Sight Glass Volumes:** Indicates the volume of water for each sight glass.

- **F3:** 140 G, 350 G, 700 G, 1000 G, 1200 G, 1250 G
- **F4:** 250 G, 475 G, 900 G, 1275 G, 1500 G, 1550 G
- **F5:** 270 G, 540 G, 1015 G, 1500 G, 1825 G, 1950 G

## SAFETY AND INFORMATIONAL DECALS

| | | |
|---|---|---|
|  |  | **Fire Extinguisher Inside:** Indicates that a fire extinguisher is installed inside the van body. This decal is only present if this optional equipment is installed. |
|  |  | **CAUTION – Fall Protection Tie-Off Points:** This indicates the locations of the approved fall protection anchor points. See “Fall Protection” on page 33 and “Working on Debris Tank” on page 86. |
|  |  | **Clean Out Daily:** This indicates that the inline water filter should be inspected and cleaned out daily following the guidelines in the operations manual. See “Inline Water Filter Cleaning” on page 108. |

## 2.4 General Safety Principles

This section outlines fundamental safety principles that apply to various aspects of hydrovac truck operation, maintenance, and transport. These principles are not a substitute for detailed procedures but serve as foundational expectations that must be consistently followed to reduce the risk of injury or equipment damage. These principles must be observed in combination with company safety programs and jurisdictional regulations. Operators are expected to stop work and seek clarification whenever a task or condition appears unsafe.

### 2.4.1 Training and Authorization

- Only trained and authorized personnel may operate, maintain, or inspect the hydrovac unit.
- Operators must be familiar with all controls, emergency shutdown procedures, and safety systems before use.
- New operators should receive hands-on orientation and competent supervision.

### 2.4.2 Personal Protective Equipment (PPE)

- Always wear the required PPE when performing hydrovac operations. See “Personal Protective Equipment (PPE) Requirements” on page 26 for detailed PPE requirements.
- Additional PPE or enhanced safety measures may be necessary depending on specific tasks, environmental conditions, or site-specific hazards.

### 2.4.3 Pre-Operational Checks

- Ensure all pre-use inspections and maintenance tasks are completed before operating the equipment.
- Do not operate the unit if any component is damaged or not functioning properly.
- Mark the proposed path of excavation with suitable paint and have underground utilities located by One Call services before starting work.
- See “Pre-Operations Checklist” on page 75 for a list of some essential pre-use actions.

### 2.4.4 Lockout/Tagout (LOTO)

- Always isolate and lock out energy sources before performing maintenance or inspection activities.
- Verify that systems are de-energized before beginning work.
- Always follow proper LOTO procedures for your company, site, and jurisdiction.

### 2.4.5 Situational Awareness

- Stay alert to surroundings, especially when operating near traffic, trenches, overhead obstructions, other workers, bystanders, or nearby structures.
- Be aware of boom and dump door movement, equipment blind spots, and other dynamic hazards.
- Maintain visual and verbal contact with co-workers at all times.
- Operate equipment in accordance with this manual. If abnormal sounds, movements, or conditions are observed, immediately stop operation and investigate the cause before resuming work.

### 2.4.6 Weather and Environmental Hazards

- Do not operate the truck during lightning storms, high winds, or other dangerous weather conditions.
- Use extreme caution in icy or wet conditions. Avoid climbing icy, wet, or snow-covered equipment.
- Only operate the hydrovac on firm, stable, and level ground. Avoid parking near steep slopes, on soft surfaces, or on uneven surfaces that could cause the unit to tip or shift unexpectedly.

### 2.4.7 Communication and Emergency Planning

- Maintain clear and consistent communication between all crew members.
- Ensure all workers are aware of site-specific emergency procedures, and know the locations of emergency shutoffs (see “Machine Stop Buttons” on page 37), fire extinguishers, and first aid kits.
- First aid kits and other emergency response equipment must be maintained and readily accessible at the job site.
- Confirm that all required safety documentation—including permits, hazard assessments, and emergency response plans—have been completed, reviewed, and fully understood by the crew.
- Ensure a reliable means of contacting emergency services is available on site, such as a two-way radio or mobile phone with adequate reception.

## 2.5 Personal Protective Equipment (PPE) Requirements

Proper personal protective equipment (PPE) is mandatory for all hydrovac operations and must be selected based on the type of task, the potential hazards involved, and any site-specific or regulatory requirements. All operators and personnel working with or near the hydrovac truck must wear PPE that meets or exceeds relevant safety standards. Personnel must also be trained to recognize when specialized PPE is required.

### 2.5.1 Minimum PPE Requirements

- **Eye protection –** Safety glasses or goggles that are meet the requirements of the latest version of the ANSI/ISEA Z87.1 (United States) or CSA Z94.3 (Canada) standards.
- **Foot protection –** Protective footwear with steel or composite toe protection and puncture-resistant soles that meets the requirements of the latest version of the ASTM F2413 (United States) or CSA Z195 (Canada) standards for your site conditions.
- **Hearing protection –** Double hearing protection—earplugs plus earmuffs—is required at all times, as sound levels from hydrovac equipment frequently exceed the protection limits of single hearing protection.
- **High-visibility clothing –** Garments or outerwear rated Class 2 or Class 3 that meets the requirements of the latest version of the ANSI/ISEA 107 (United States) or CSA Z96 (Canada) standards for your site conditions.
- **Flame-resistant (FR) clothing –** Garments or outerwear that meets applicable regulatory and site-specific requirements for fire protection in the operating jurisdiction.
- **Head protection –** Hard hat that meets the latest version of the ANSI Z89.1 (United States) or CSA Z94.1 (Canada) standards.

### 2.5.2 Task-Specific PPE Requirements

Depending on the tasks performed and site conditions, the following additional PPE may be required:

- **Face shield –** Required whenever there is the potential for exposure to high-pressure spray or flying debris during excavation.
- **Chemical-resistant and liquid penetration–resistant gloves –** Required where exposure to hazardous chemicals is possible or when working near pressurized water or hydraulic systems.
- **Chemical-resistant or waterproof outerwear –** Required where exposure to hazardous chemicals is possible; recommended in especially wet or cold conditions.
- **Fall protection –** Required when working at height, including on top of the truck (see “Fall Protection” on page 33).
- **Insulated gloves –** Required for handling components that may be hot during or after operation.

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***NOTE:*** *This is not a complete list of all PPE that may be required. Certain tasks, site-specific hazards, or regulatory requirements may necessitate additional PPE.*

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### 2.5.3 PPE Inspection and Maintenance

- Inspect PPE before each use. Do not use damaged, worn, or expired PPE.
- Clean and store PPE according to manufacturer instructions.
- Replace PPE immediately if compromised during use.

## 2.6 Mechanical and Thermal Hazards

Hydrovac trucks contain numerous moving and pressurized components that present serious mechanical hazards. Operators must be constantly aware of the potential for pinch points, crush zones, unexpected equipment movement, and exposure to hot surfaces.

### 2.6.1 Crush and Pinch Point Hazards

Operators and personnel must stay alert to potential pinch or crush points around moving equipment. Critical hazard areas include:

- **Boom assembly –** The rotating turret, telescoping segments, hydraulic cylinders, boom arm, and suction hose all pose potential mechanical hazards. These components can rotate, extend, lift, drop, or swing suddenly if control is lost or the system is activated unexpectedly.
- **Dump door assembly –** The hydraulically controlled dump door can open and close with great force. Injury risks are present from both the door movement and surrounding hydraulic rams, such as the door-locking mechanisms.
- **Hose reels –** This rotating equipment is powered by pneumatic control and can rewind rapidly if the valve’s lever is engaged. Because the reels are unguarded and rotate with force, they can catch loose clothing or limbs if approached too closely.

**⚠ WARNING!**

Never stand between moving parts, underneath raised equipment, or in the path of rotating, swinging, or descending components. Contact may cause serious injuries, amputations, or death.

Lockout/tagout (LOTO) procedures must be followed when performing inspections or servicing equipment near hazardous zones, including the engagement of any locking pins or manual supports. Confirm that systems are de-energized and that hydraulic and pneumatic pressure is relieved before entry or servicing.

### 2.6.2 Unexpected Movement and Hydraulic Failure

Sudden or unintended equipment movement—especially of the boom or dump door—can result from control failure, hydraulic leaks, or a loss of system pressure. These failures may occur abruptly and without warning.

- Always assume equipment is pressurized until verified otherwise.
- Never enter or position yourself beneath elevated booms or opened dump doors without verifying engineered lockout mechanisms are engaged.
- Use LOTO procedures during maintenance activities.
- Never tamper with hydraulic components and never adjust hydraulic hoses unless qualified to do so.

**⚠ WARNING!**

- Do not rely on hydraulics to support raised equipment—failure may cause sudden collapse or movement.
- Always treat hydraulic hoses and related components as pressurized unless proper LOTO has been performed by qualified personnel.
- High-pressure fluid injection injuries require immediate medical attention to prevent serious injuries or death.

Stable ground is also essential for safe operation—parking or working on uneven, soft, or unstable terrain increases the risk of tipping or unintended movement. Operators must assess ground conditions prior to work and continually during operations to ensure safe and stable footing for the equipment.

### 2.6.3 Hot Surfaces and Burn Risks

Several components may reach high temperatures during operation:

- **Blower housing –** Becomes extremely hot within minutes of operating.
- **Cabinet heaters –** Exterior surfaces heat up quickly and retain heat after shutdown.
- **Hydraulic fittings, hoses, and cylinders –** Can become hot after extended use.
- **Water pump casing –** May become hot after extended operation.
- **Water heater–heated plumbing –** Plumbing downstream of the water heater becomes hot after using the water heater.
- **Hot water discharge –** Water discharged from the hose or connected dig wand is hot when the water heater is used.

**CAUTION**

- Avoid contact with hot components to prevent burns. Allow time for equipment to cool completely before inspecting or servicing.
- In addition to those risks listed, components of the truck chassis such as the exhaust stacks may become very hot during operation.

### 2.6.4 Communication and Visual Markings

Maintain clear communication with team members when working around hazard zones or operating equipment. Always confirm equipment status (e.g., active, locked out, de-energized) before approaching or entering operational zones.

Hazard zones are often identified with decals or warning labels placed near the equipment (see “Safety and Informational Decals” on page 18). Always familiarize yourself with these decals or labels and ensure they remain visible and legible. Do not remove or obscure safety decals.

## 2.7 Electrical and Underground Utility Hazards

Hydrovac work is frequently performed near overhead power lines and buried utilities. Contact with electrical or underground services can result in electrocution, fire, explosion, environmental damage, or service disruption. Operators must remain vigilant and follow safe work procedures at all times. Follow all jurisdictional, company, and site-specific laws and other requirements for working around utilities.

### 2.7.1 Overhead Power Line Contact Risks

Hydrovac operators must understand that overhead electrical lines pose a serious hazard—not only through direct contact but also by arcing across air gaps or passing through the ground. Operators must be trained to recognize and respond to the signs of an electrical strike, such as arcing electricity, popping noises, smoke, power outages, or electrical strike alarms (see “Electric Line Strike Guidelines” on page 17).

**⚠ WARNING!**

Overhead power lines may cause fatal electrocution, fire, or explosion if contacted or approached too closely. Never position the boom above power lines and always maintain a safe clearance distance, treating lines as energized unless confirmed otherwise by the utility owner.

A minimum allowable clearance must be maintained at all times between equipment and overhead power lines based on the voltage class of the conductor. The data in the table below was obtained from 29 CFR 1926.1408(a)(2)(iii) and is provided for reference only. Operators must defer to the regulations and standards applicable to their jurisdiction, worksite, and company.

**POWER LINE MINIMUM CLEARANCE DISTANCES**

| Nominal AC Voltage | Minimum Clearance Required |
|---|---|
| **Less than 50-kV** | 15-ft |
| **50-kV to 200-kV** | 20-ft |
| **200-kV to 350-kV** | 25-ft |
| **350-kV to 500-kV** | 35-ft |
| **500-kV to 750-kV** | 45-ft |

Always identify the locations and heights of all overhead lines on the jobsite prior to starting work so that you can maintain safe clearance distances. The following are some additional precautions that should be taken:

- Use a designated spotter when operating the boom near power lines.
- Do not operate during high winds or when visibility is compromised.
- Follow utility owner permit and isolation procedures if working near energized conductors.
- Never enter the minimum allowable clearance zone or the area above the power lines unless one of the following conditions is met:
  - An authorized person has confirmed that electrical distribution and transmission lines have been de-energized and grounded at the point of work.
  - Insulating barriers have been installed by the utility company.

### 2.7.2 Buried Utility Contact Risks

Although hydrovac excavation is generally considered a “safe” daylighting method, high-pressure water jets can still damage buried utilities, especially if used improperly. See “Gas Line Strike Guidelines” on page 17 for appropriate response actions.

**⚠ WARNING!**

Damage to buried utilities can cause explosions, electrocution, fire, hazardous gas release, or environmental release that leads to death or serious injury.

The following precautions and preventive measures must be taken to avoid damaging buried infrastructure such as gas lines, underground power lines, fiber optics, and other piping or cables. Mark the proposed path of excavation with suitable paint (e.g., white) and have underground utilities located before working.

- Always acquire utility locates prior to starting any excavation:
  - In the United States, call 811 or 888-258-0808.
  - In Canada, refer to resources available at https://www.clickbeforeyoudig.com/.
  - Also contact any local utilities that do not participate in the above services.
- Inspect the worksite for signs of buried utilities, such as signage, gas or water meters, manhole covers, or other features that might indicate unidentified buried utilities.
- Always adjust water pressure to suit the material being excavated and soil conditions. Operators should always use the lowest water pressure suitable for their task.
- Always obtain authorization before working near underground utilities and ensure high-risk utilities—such as high-pressure gas and high-voltage power lines—are monitored by the utility owner.

If Common Ground Alliance standards are followed, the color coding of marked utilities is as follows:

| COMMON GROUND ALLIANCE COLOR CODES | |
|---|---|
| **Color** | **Utility** |
| **Red** | Electric |
| **Yellow** | Gas, oil, steam |
| **Orange** | Communication (e.g., fiber optic) |
| **Blue** | Potable water |
| **Green** | Sewer/drain |

## 2.8 Vacuum Hose and High-Pressure Fluid Hazards

Hydrovac equipment uses high-pressure water, hydraulic fluid, and powerful vacuum suction to excavate. These systems pose significant hazards if misused or approached carelessly.

### 2.8.1 Vacuum System Hazards

The vacuum system generates powerful suction, capable of drawing in loose objects, damaging debris, and even body parts if improperly handled. The suction hose opening is the most prominent hazard point in regular operations, but the vacuum breakers, the air filter, cyclones, and internal space of the debris tank are also subject to high vacuum pressure. Any time there is a problem, the operator should open the vacuum breaker to break the suction.

**⚠ WARNING!**

Exposure to high suction forces or extremely low pressures can cause serious injury or death. Never place your head, face, or any part of your body near a vacuum hazard, even briefly. Never direct the vacuum hose at someone else and never allow anyone to enter the debris tank while the blower is running.

Key precautions:

- Keep the vacuum hose inlet away from yourself and others during operation.
- Never attempt to retrieve items or to unclog a blocked hose by reaching into the suction hose inlet while the blower is running.

- Ensure only trained personnel operate the hydrovac equipment.
- Secure any loose clothing, tools, and other objects that could be otherwise drawn into the vacuum.

### 2.8.2 High-Pressure Fluid Hazards

Water pressure used for excavation could reach pressures up to 3100-psi and hydraulic fluids can reach pressures up to 2800-psi. Direct contact with high-pressure fluid jets may cause serious injuries, including injection injuries, lacerations, and severe damage to sensitive tissues, like eyes.

**⚠ WARNING!**

High-pressure injection injuries often appear small but are extremely dangerous and require emergency medical treatment. High-pressure water jets and hydraulic fluid sprays can easily penetrate skin and cause lacerations, infection, or permanent damage to sensitive organs. Avoid contact with high-pressure fluids and never direct pressurized water toward people or animals.

High-pressure water can also damage underground utilities. Always use an appropriate water pressure both for any utilities being exposed and for the soil conditions; using a higher pressure increases the risk of utility damage and increases the severity of potential injuries.

Additional precautions:

- Ensure only trained personnel operate the hydrovac equipment and that there are no bystanders near the excavation site.
- Never spray toward reflective surfaces or excavations where rebound towards yourself or others could occur.
- Reduce water pressure to suit any nearby or buried infrastructure and the soil conditions.
- Wear suitable PPE to protect against water injection injuries when using the dig wand or servicing hydraulic components.

Fluid injection injuries are medical emergencies. Surface wounds may appear minor while masking serious internal damage. If someone is sprayed with high-pressure water or hydraulic fluid, assume that an injection injury has occurred and perform the following actions:

- Cease all operations immediately.
- Do not delay medical care. Inform medical personnel that the injury involved a high-pressure water jet.
- Follow company-specific emergency procedures and documentation protocols.

### 2.8.3 Prevention Measures

High-pressure systems and vacuum suction offer powerful excavation capabilities, but demand strict control and respect for safety protocols at all times.

- Only use engineered nozzles.
- Inspect wands, hoses, and fittings before each use, replacing any damaged or worn components before use.
- Maintain constant communication between crew members.
- Keep excavation sites clear of other personnel and avoid the line of fire.

## 2.9 Fall Protection

Inspection and maintenance of hydrovac units periodically requires access to the top of the debris tank and tank platform. These elevated work areas lack guardrails and present a serious fall hazard, especially under wet or icy conditions. Follow all jurisdictional, company, and site-specific laws and other requirements for working at heights.

**⚠ WARNING!**

Falling from the top of the hydrovac unit can result in serious injury or death. Always wear fall protection equipment when working at height and follow safe access procedures.

### 2.9.1 Fall Protection Requirements

Key fall protection requirements:

- Fall protection is required at all times when accessing or working on top of the hydrovac unit.
- Only fall protection certified and authorized personnel may access the tank platform or other areas on top of the debris tank.
- Workers must use a complete fall-arrest system consisting of a full-body harness, connecting device, and engineered anchorage. The system must meet the applicable requirements of the latest versions of the ANSI/ASSP Z359 Fall Protection Code (United States) or the CSA Z259 Fall Protection series (Canada).
- A second crew member must be present during elevated work to assist or respond in case of emergency.

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***NOTE:*** *If workers will be tied off to one of the engineered anchor points (see the Fall Protection Tie-Off Points decal in "Safety and Informational Decals" on page 18) on top of the debris tank while also working on the debris tank, a suitable fall restraint lanyard must be used instead of a fall arrest lanyard. See "Working on Debris Tank" on page 86.*

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### 2.9.2 Safe Access Practices

- Disengage the hydraulic systems before anyone climbs or works on top of the tank. Never operate the boom, dump door, or any other hydraulic system while someone is on an elevated part of the hydrovac.
- Only use built-in ladders or approved mobile access platforms equipped with handrails to access the top of the tank.
- Maintain three points of contact when ascending or descending ladders.
- Never climb ladders with tools or equipment in hand. Use hands-free carrying options, tool lanyards, and/or taglines to move items.
- Do not access elevated surfaces during high winds, rain, snow, or icy conditions.
- Clear away any snow, ice, or obstructing debris before stepping onto that area of the platform or tank.
- Inspect anti-slip grip tape before stepping onto that area of the tank. Replace grip tape if missing or worn.

## 2.10 Confined Space Entry

The debris tank of the hydrovac unit is divided internally into a water tank side and a debris tank side. Both compartments are considered confined spaces due to limited access points, poor ventilation, and the potential for atmospheric hazards. Entry into either compartment requires specific authorization, procedures, and safety controls. Follow all jurisdictional, company, and site-specific laws and other requirements for confined space entry.

**⚠ WARNING!**

Entering the debris or water compartment of the tank without proper confined space entry procedures can result in suffocation, toxic exposure, or entrapment, potentially causing negative health effects or even death. Follow all confined space entry requirements before entering the debris or water compartments.

### 2.10.1 Tank Entry Requirements

Before entering either side of the debris tank, all of the following confined space safety requirements must be met:

- LOTO of the truck chassis. This includes installation of both dump door locking pins when working in or around the debris side of the tank.
- A confined space entry permit issued by an authorized person.
- Pre-entry and continuous atmospheric testing to verify acceptable levels for working within that environment.
- A trained rescue team and suitable rescue plan.
- A rescue harness and personal monitor must be worn.
- If necessary, suitable respiratory protective equipment or other PPE must be worn and engineered ventilation solutions applied.
- If necessary, intrinsically safe tools and equipment must be used.
- Adherence to all additional safety requirements and documentation for the company, jobsite, and jurisdiction.

### 2.10.2 Other Confined Spaces

Hydrovac operators may encounter other confined spaces during work, such as manholes, utility vaults, and excavated holes or trenches. While this manual focuses on the confined spaces of the truck itself, operators must also:

- Recognize the signs of confined spaces on site.
- Follow all site-specific protocols and regulatory requirements for accessing and working in these confined spaces.
- Avoid entry unless authorized, trained, and equipped to do so.

## 2.11 Regulatory Compliance

Operators and employers must comply with all applicable rules and regulations related to operating the equipment. While this manual incorporates safety best practices, it does not replace legal or regulatory requirements.

Key areas of regulatory compliance may include:

- **Occupational health and safety (OHS) –** Follow regional OHS legislation, including rules on confined space entry, PPE, fall protection, and working near utilities.
- **Environmental protection –** Adhere to environmental regulations regarding waste handling, water disposal, and emissions.
- **Transportation compliance –** Ensure compliance with regional transportation regulations concerning vehicle inspections, weight limits, securing loads, and licensing requirements.
- **Training and certification –** Ensure all operators are trained and competent in hydrovac operation, and that high-risk tasks are supervised by a qualified person.
- **Record keeping –** Maintain equipment logs, inspection records, and operator training documentation as required by law or company policy.

---

***NOTE:*** *Regulations vary by region. Operators must consult with their employer or designated safety representative to determine applicable regulations for each job.*

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# 3 Controls & Operations

## 3.1 Operator Preparation

1. Complete proper training and read this manual in its entirety before using equipment.
2. Always comply with applicable local laws and safety regulations. Ensure all appropriate documentation and safety measures are in place prior to starting work
3. Ensure that you are able to contact emergency services if necessary. Check for cellular phone service or verify radio function prior to starting work.
4. Ensure all required inspections and maintenance have been completed prior to using the equipment and that the equipment is in good working condition.
5. Use equipment only for intended purposes. Stop operation and investigate anything that does not look, sound, or feel right.

## 3.2 Emergency Procedures

**CAUTION**

All personnel should fully review “Chapter 2: Safety Information” on page 15 and be aware of the appropriate responses to different types of emergency situations.

In the event of an emergency and if safe to do so, operators should immediately either:

- Shut off the truck by turning the ignition switch off, or
- Press one of the three machine stops located around the truck.

***NOTE:*** *Turning off the truck using the ignition switch is preferred if both options are equally safe to pursue.*

### 3.2.1 Machine Stop Buttons

**CAUTION**

Engaging the machine stop does not shut down the equipment and does not disable all controls. To completely disable controls, the operator must shift the truck's transmission into neutral. If the blower is engaged, this should only be done in the case of emergencies, as shifting into neutral at high engine speed may cause the blower to spin in the wrong direction, causing serious equipment damage.

Fully pressing any of the three machine stops on the truck will reduce hydraulic pressure, release vacuum, turn off the water pump, and disable the remote control system, but does not turn off the truck. It should also be noted that the hydraulic and blower circuits are still operating, but at reduced speed. Pressing the red button on the handheld remote controller shuts off the water pump if it is on and disables all remote functions.

***Figure 3-1.** Machine Stop Button Locations*



### 3.2.2 Resetting Machine Stop Buttons

After an emergency situation has been resolved and it is safe to resume operation, reset the truck-mounted machine stop buttons by pulling them back out. The following will occur when the machine stop is reset:

- The E-Stop pop-up message on the HMI disappears.
- The water pump remains turned off, but the water pump speed remains at the last value set before engaging the machine stop. It is recommended to reduce the water pump setting to 20% or less before re-engaging the Water Pump Bypass button.
- The Aarcomm® receiver is re-enabled and all handheld remote controller functions will work again. If the controller was in operation at the time the machine stop button was pressed, it will continue operation as before upon reset.
- The Engine RPM Down and Vacuum Valve Open controls are released back to operator control.

---

***NOTE:*** *When the machine stop is first pressed, the Engine RPM Down and Vacuum Valve Open functions will start, but each takes several seconds to fully complete. Resetting the machine stop before these functions have fully transitioned will stop them at their current state. In other words, the engine speed holds at whatever it decreased to before resetting and the vacuum breaker will be positioned partially open.*

---

### 3.2.3 Fire Extinguishers

A fire extinguisher should be stored in the truck cab. If appropriate, place a fire extinguisher near the truck but away from possible sources of ignition when working. The fire extinguisher should always be classified for both oil and electric fires.

### 3.2.4 Coolant Isolation

The system has shutoff valves to isolate the hydrovac coolant loop from the truck engine's coolant system. The shutoff valves are located in the truck's engine bay or on some models underneath the passenger side of the van body inside of the truck frame rail.

**CAUTION**

Spilled coolant is an environmental and health hazard. Avoid contact with coolant fluid. Perform spill containment and remediation procedures in accordance with appropriate regulations if a leak occurs.

These valves serve two purposes:

1. The valves can be closed in warm weather to prevent coolant from flowing through the hydrovac system unnecessarily.
2. In the event of a leak in the hydrovac coolant loop, the valve can be closed to isolate the hydrovac coolant piping from the truck engine coolant loop so that the truck can be driven to a service shop if it is safe to do so.

*Figure 3-2. Coolant Isolation Valves*




## 3.3 Prohibited Debris

The F3, F4, and F5 hydrovac models must not be used to excavate hazardous or combustible materials, garbage, or other prohibited debris. Vacuuming prohibited debris could cause serious equipment damage or create a hazardous condition, such as fire or explosion. If you are unsure whether a specific type of debris material is compatible with your hydrovac model, contact Tornado for more information.

## 3.4 Stowed Positions

**⚠ WARNING!**

Failure to stow equipment properly can result in equipment striking obstacles and causing property damage, injury, or death.

Always return equipment to its proper stowed position before driving the hydrovac truck. Proper stowing prevents equipment damage, reduces the risk of road hazards, and ensures compliance with transport regulations. The stowed positions for equipment are outlined below:

1. **Boom and hose –** Boom retracted to red reflector position and returned to its cradle. Boom hose laid onto and secured on top of the passenger-side fender.
2. **Dig tubes –** All dig tubes securely stored at the rear driver side of the van body or on top of the driver-side fender.

3. **Dump door –** Dump door fully closed and locked with door lockout valve closed to prevent accidental operation.
4. **Dig wands –** All dig wands secured in their designated storage location inside the passenger side of the van body.
5. **Hose reel –** Hose fully reeled in using the air-actuated valve.

---

***NOTE:*** *For hydrovac trucks equipped with the optional boom alarm, see "Boom Alarm" on page 116 for details on its operation.*

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## 3.5 Cab Controls

The following sections describe the controls in the truck cab for operating the hydrovac equipment systems.

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***NOTE:*** *The truck cannot be driven while the hydraulics and blower are operating.*

---

### 3.5.1 Engaging Hydraulics

A list of generalized steps for engaging hydraulics are outlined below for automatic transmissions. However, the exact steps that must be followed vary based on engine size, transmission type, and hydrovac equipment options. Operators must always follow the engagement instructions for their specific equipment as detailed on the instruction plates included in their truck cab.

1. Ensure the truck is running at low idle speed, both tanks are aired up to above 100-psi, the truck is in neutral, and the parking brake is set.
2. Press and hold the brake pedal.
3. Press and hold the Hydraulics On/Off button for approximately 3 seconds.
4. Observe the 2x2 keypad and wait for the transfer case to engage (see "System Interlocks and Keypad Colors" on page 42).
5. Shift the transmission into direct drive, then release the brake pedal.
6. Verify that the Hydraulics On/Off button turns red, indicating that the driveshaft is spinning.
7. Set the engine to operating speed using the 2x6 keypad (see "2x6 Keypad" on page 46) or handheld remote controller (see "Remote Control" on page 73).

---

***NOTE:***

- ***Low idle*** *speed indicates the operator should reduce the truck's RPM all the way down when the truck is engaged. This will reduce the engine's speed to between 850- and 1000-RPM, depending on the engine.*
- ***Operating*** *speed/level indicates the operator should increase the truck's RPM all the way up. This will increase the engine's speed to between 1100- and 1550-RPM*

---

To disengage the hydraulics:

1. Reduce the engine speed to low idle using the 2x6 keypad or handheld remote controller.
2. Press and hold the brake pedal, then shift the transmission into neutral.
3. Observe the 2x2 keypad and wait for the driveshaft to stop spinning.
4. Press and hold the Hydraulics On/Off button for approximately 3 seconds.
5. Observe the 2x2 keypad and ensure it shows the hydraulics are not engaged.

### 3.5.2 Engaging Blower

A list of generalized steps for blower engagement are outlined below for automatic transmissions. However, the exact steps that must be followed vary based on engine size, transmission type, and hydrovac equipment options. Operators must always follow the engagement instructions for their specific equipment as detailed on the instruction plates included in their truck cab.

1. Ensure the truck is running at low idle speed, both tanks are aired up to above 100-psi, the truck is in neutral, and the parking brake is set.
2. Ensure the driveshaft is not spinning (see “System Interlocks and Keypad Colors” on page 42) and the boom hose opening is not blocked.
3. Press and hold the brake pedal.
4. Press and hold the Blower On/Off button for approximately 3 seconds.
5. Observe the 2x2 keypad and wait for the blower to engage.
6. Shift the transmission into direct drive, then release the brake pedal.
7. Verify that both the Hydraulics On/Off and Blower On/Off buttons turn red, indicating that the driveshaft is spinning.
8. Set the engine to operating speed using the 2x6 keypad or handheld remote controller.

**CAUTION**

- Never operate the blower without the filter in place and the filter housing door securely closed to prevent major equipment damage or injuries.
- If the blower is engaged, shifting into neutral at high engine speed may cause the blower to spin in the wrong direction, causing serious equipment damage. Except in the case of emergencies, always reduce engine speed before disengaging the blower.

To disengage the blower:

1. Reduce the engine speed to low idle and open the vacuum breaker.
2. Press and hold the brake pedal, then shift the transmission into neutral.
3. Observe the 2x2 keypad and wait for the driveshaft to stop spinning.
4. Press and hold the Blower On/Off button for approximately 3 seconds.
5. Observe the 2x2 keypad and ensure it shows the blower is not engaged.

### 3.5.3 System Interlocks and Keypad Colors

If the Blower On/Off button is pressed first without the hydraulics being engaged, the truck will engage both the hydraulics and blower at the same time. The blower cannot operate without the hydraulics engaged first. Likewise, disengaging the hydraulics will also disengage the blower if it is running.

The 2x2 keypad buttons will illuminate to provide feedback to the operator on safety interlocks and status information, as described in the following table:

| 2X2 KEYPAD COLOR CODES | |
|---|---|
| **Color** | **Description** |
| **Amber** | Not engaged, boom in storage cradle, road ready. |
| **Amber (Bright Flashing)** | Fault detected during transfer case engagement. |
| **Dark Blue** | Not engaged, boom lifted off cradle. |
| **Green** | Engaged, driveshaft not spinning, boom in cradle. |
| **Light Blue** | Engaged, driveshaft not spinning, boom not in cradle. |
| **Red** | Driveshaft spinning, do not engage or disengage. |

*Figure 3-3. 2x2 Keypad*



### 3.5.4 Work Lights

Press the Work Lights On/Off button to toggle the work lights on/off. The truck is equipped with work lights in the following locations:

- Driver side of the tank
- Passenger side of the tank
- Tank rear (3 work lights)
- Main boom arm (2–3 work lights)
- Boom extension

### 3.5.5 Control Beacon Light

Press the Beacon On/Off button to toggle the beacon light on/off. There are two beacon lights on top of the truck cab (driver side and passenger side) and one located on the rear of the tank.

---

***NOTE:*** *The optional arrow board will be located adjacent to the rear control beacon if equipped on the hydrovac (see “Arrow Board” on page 115).*

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### 3.5.6 Cameras

The truck is equipped with a rear view camera and a side view camera on the passenger side to improve visibility when reversing. A summary of key functions can be found below. Refer to the manufacturer's documentation for more details on functions and settings.

***Figure 3-4. Camera Controls***




| CAMERA CONTROLS | |
|---|---|
| **Item** | **Description** |
| **Power Button** | Toggles camera system on/off. |
| **Menu Button** | Displays settings menu or selects an item in the menu. |
| **View Selection Button** | Toggles between rear and side camera views. |
| **Arrow Down Button** | Navigates menu options and decreases value for selected items. |
| **Arrow Up Button** | Navigates menu options and increases value for selected items. |
| **Rotate Image/Back/Exit Button** | In normal operation, this button rotates the image. In settings mode, pressing it will take you back to the previous selection, or at the top level, it exits settings mode. |

## 3.6 Control Panel

The truck is equipped with a main control panel that is located inside the passenger side of the van body.

***Figure 3-5. Control Panel***

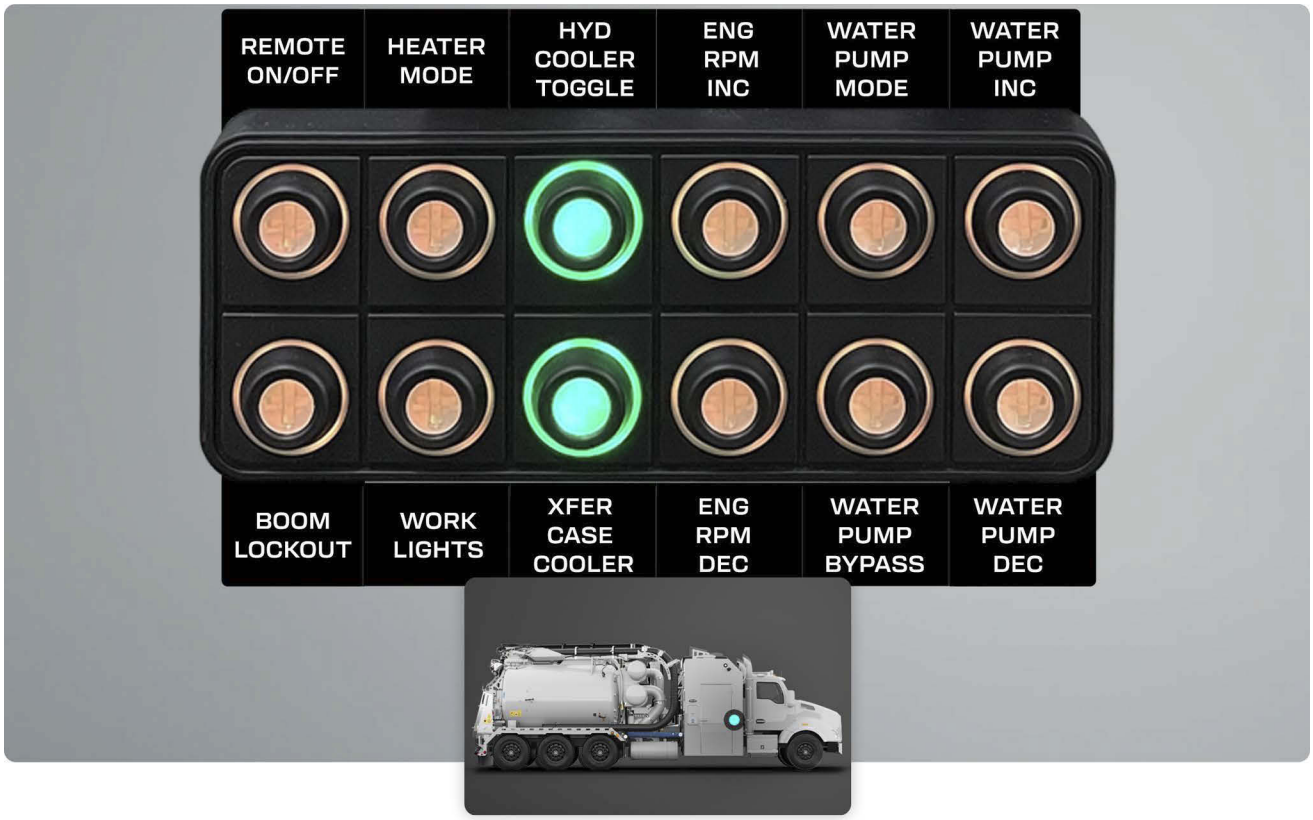



| CONTROL PANEL | |
|---|---|
| **Item** | **Description** |
| **IRAT Port** | Data port used by factory service personnel. |
| **Emergency Stop** | See “Machine Stop Buttons” on page 37 for details. |
| **Human Machine Interface (HMI)** | See “Human Machine Interface (HMI)” on page 48 for details. |
| **2x6 Keypad** | See “2x6 Keypad” on page 46 for details. |

### 3.6.1 2x6 Keypad

This section describes the functions of the 2x6 keypad located on the main control panel.

***Figure 3-6. 2x6 Keypad***




| 2X6 KEYPAD BUTTONS | |
|---|---|
| **Item** | **Description** |
| **Remote On/Off** | Toggles to enable/disable remote control function (see “Remote Control” on page 73 for details). Illuminates blue when toggled on. |
| **Boom Lockout** | Toggles to enable/disable control of the boom with the handheld remote controller. This button does not disable the boom controls at the valve block from moving the boom.<br>• Not illuminated = Boom enabled (lockout OFF)<br>• Red = Boom disabled (lockout ON) |
| **Heater Mode** | Toggles the fan speed for all heaters.<br>• Orange = Low speed<br>• Green = High speed |
| **Work Lights** | Toggles work lights on/off. Illuminates green when toggled on. |
| **Hydraulic Cooler Toggle** | Overrides the automatic controls to manually toggle the hydraulic cooler fan on/off (see Note). Illuminates green when toggled on. |
| **Transfer Case Cooler Toggle** | Overrides the automatic controls to manually toggle the transfer case cooler fan on/off (see Note). Illuminates green when toggled on. |

| 2X6 KEYPAD BUTTONS | |
|---|---|
| **Engine RPM Increase** | Press and hold to increase engine speed. Illuminates green while pressed. |
| **Engine RPM Decrease** | Press and hold to decrease engine speed. Illuminates green while pressed. |
| **Water Pump Mode** | Toggles between water pump operating modes.<br>• Green = Manual (pump speed is controlled on the control panel)<br>• Blue = Remote (pump speed is controlled by the handheld remote controller) |
| **Water Pump Bypass** | Toggles the water pump on/off. The water pump mode must be set to “Manual” for this button to be enabled. Illuminates green when toggled on. |
| **Water Pump Increase** | Press and hold to increase water pump speed. The water pump mode must be set to “Manual” for this button to be enabled. Illuminates green while pressed. |
| **Water Pump Decrease** | Press and hold to decrease water pump speed. The water pump mode must be set to “Manual” for this button to be enabled. Illuminates green while pressed. |

***NOTE:*** *The HMI will show “Warning” or “Critical” when the hydraulic or transfer case temperature is high or critically high. The cooler fan turns on automatically whenever the hydraulic temperature exceeds 185°F (85°C) or the transfer case temperature exceeds 194°F (90°C).*

# 3.7 Human Machine Interface (HMI)

The following subsections describe the navigation and functions of the human machine interface (HMI).

## 3.7.1 HMI Layout and Navigation

This section describes the controls found on the HMI. Upon startup, the HMI will display a splash screen. Press any button on the HMI or the 2x6 keypad to access the main screen.

***Figure 3-7. HMI Controls***




| HMI CONTROLS | |
|---|---|
| **Item** | **Description** |
| **Selection Buttons** | Select the adjacent water pump pressure preset options. |
| **Navigation Buttons** | Navigate through menus. |
| **OK Button** | Select the currently highlighted option on the main screen. |
| **ESC Button** | Exit the sub-menu to return to the main menu, or switch between the main menu and the main status screen. |

The HMI main status screen will display the current settings, as indicated in the following table. The HMI will show “Warning” (yellow) or “Critical” (red) pop-up messages when a setting exceeds the values listed in the table.

***Figure 3-8.*** *HMI Main Status Screen*




| HMI MAIN STATUS SCREEN | |
|---|---|
| **Item** | **Description** |
| **Water Temperature Indicator** | Displays the current temperature of the water exiting the water heater.<br>• Warning temperature: 221°F (105°C)<br>• Critical temperature: 230°F (110°C) |
| **Water Pressure Indicator** | Displays the current water pressure.<br>• Warning pressure: 2900-psi<br>• Critical pressure: 3100-psi |
| **Blower Temperature Indicator** | Displays the current temperature of the sump oil at the bottom of the blower.<br>• Warning temperature: 265°F (129°C)<br>• Critical temperature: 290°F (143°C) |
| **Hydraulic Fluid Temperature Indicator** | Displays the current temperature of the hydraulic oil entering the hydraulic cooler.<br>• Warning temperature: 185°F (85°C)<br>• Critical temperature: 413°F (212°C) |

| HMI MAIN STATUS SCREEN | |
|---|---|
| **Transfer Case Temperature Indicator** | Displays the current temperature of the transfer case oil entering the transfer case cooler.<br>• Warning temperature: 194°F (90°C)<br>• Critical temperature: 212°F (100°C) |
| **Transfer Case Hour Meter** | Hour meter for the transfer case. Only increases when the hydraulics are engaged. |
| **Blower Hour Meter** | Hour meter for the blower. |
| **Water Pump Hour Meter** | Hour meter for the water pump. |
| **Water Pressure Preset Buttons** | Eight buttons allow the operator to select from preset water pressure settings (see Note). |

***NOTE:***

- *The presets will only be active when the water pump mode is set to "Remote" (illuminated blue on 2x6 keypad). The selected preset pressure will be highlighted by an orange border (as shown in Figure 3-8 with 1000-psi).*
- *When the water pump is turned on via the remote controller, the control system will maintain the preset pressure.*

### 3.7.2 HMI Main Menu

The main menu provides access to the available sub-menus.

- Press ESC from the main status screen to access the main menu.
- Use the left/right navigation buttons to move through the menu options and press OK to open a sub-menu. Press ESC from a sub-menu to return to the main menu.
- Press ESC from the main menu to return to the main status screen.

*Figure 3-9. HMI Main Menu*




| HMI MAIN MENU SCREEN | |
|---|---|
| **Item** | **Description** |
| **Functions** | Access options for the weight system, if installed (see “Air-Weigh Scale” on page 113). If no weight system is installed, the icon displayed on the screen will be gray. |
| **I/O** | Access inputs and outputs screens to view status displays of various input and output variables (see “HMI I/O Sub-Menu” on page 52). |
| **Settings** | Access controls for display screen parameters (see “HMI Settings Screen” on page 58). |
| **Troubleshooting** | Access troubleshooting information (see “HMI Troubleshoot Screen” on page 59). |
| **Maintenance** | Access recommended maintenance information (see “HMI Maintenance Screen” on page 60). |

### 3.7.3 HMI I/O Sub-Menu

The I/O sub-menu provides access to the Inputs, Outputs, and Radio screens that display the status of various input and output variables. Use the left/right navigation buttons to scroll through the screens.

The first Inputs screen shows status indicators for the items in the following table. The indicator is illuminated green if the input is active.

***Figure 3-10.*** *HMI I/O Sub-Menu - Inputs Screen 1*




| HMI INPUTS SCREEN 1 | |
|---|---|
| **Item** | **Description** |
| **Panel E-Stop** | Indicates whether the machine stop button on the control panel is engaged. |
| **Dirty Filter** | Indicates that the charge filter switch on the rear of the van body is closed. A closed switch could indicate that the filter is dirty, so it should be inspected and replaced, if necessary. |
| **Boom in Stow Cradle** | Indicates the status of the position switch on the boom cradle. If the indicator is green, the boom is stowed in the cradle. |
| **Truck E-Stop 1 and Truck E-Stop 2** | Indicates whether the respective machine stop button on the truck chassis is engaged. |
| **Drive Shaft Status** | Indicates whether the driveshaft is spinning above or below 25-RPM. If the indicator is green, it is spinning above 25-RPM. |
| **Pump PTO Engaged** | Indicates the status of the feedback air pressure switch. If the indicator is green, the green airline to the transfer case has air pressure above 60-psi and the hydraulics are engaged. |
| **Blower Engaged** | Indicates the status of the feedback air pressure switch. If the indicator is green, the black airline to the transfer case has air pressure above 60-psi and the blower is engaged. |

***NOTE:*** *PTO (power take-off) is shorthand for "hydraulics".*

The second Inputs screen shows the raw and conditioned temperature/pressure for different truck components. The following table indicates where each sensor is located.

***Figure 3-11.*** *HMI I/O Sub-Menu - Inputs Screen 2*




| HMI INPUTS SCREEN 2 | |
|---|---|
| **Item** | **Sensor Location** |
| **Hydraulic Temperature** | On the hydraulic cooling fan on the rear of the van body |
| **Transfer Case Temperature** | On the transfer case cooling fan on the rear of the van body |
| **Blower Temperature** | On the underside of the blower on the front driver side near the oil-level sight glass |
| **Water Temperature** | At the water heater's outlet |
| **Water Pressure** | On the plumbing of the water pump |

The third Inputs screen shows the input of the 2x6 keypad buttons on the main control panel (see “2x6 Keypad” on page 46) and the 2x2 keypad buttons in the cab of the truck (see “Cab Controls” on page 40). Pressing any of the keypad buttons will illuminate that button’s indicator on this screen while the button is being held. It is recommended that the buttons be tested when the ignition is turned on but the engine is not running.

**⚠ WARNING!**

Equipment can move when using this screen as keypad buttons will function normally when the truck is on unless the engine is not running. Contact with moving parts may cause serious injuries, amputations, or death. This screen can be used during normal operation if a second operator assists.

***Figure 3-12.*** *HMI I/O Sub-Menu - Inputs Screen 3*




The Outputs screens show status indicators for the items in the following tables. The indicator is illuminated green if the output is active. The second Outputs screen also shows the pump speed output and the powercell indicators.

*Figure 3-13. HMI I/O Sub-Menu - Outputs Screen 1*




| HMI OUTPUTS SCREEN 1 | |
|---|---|
| **Item** | **Description** |
| **PTO On/Off** | Indicates an output from the control panel commanding the engine/transmission into PTO mode. Typically indicates that the hydraulics are engaged. |
| **PTO Decrease Speed** | Indicates an output from the control panel commanding the engine to decrease speed. |
| **PTO Increase Speed** | Indicates an output from the control panel commanding the engine to increase speed. |
| **Hydraulic Cooler On/Off** | Indicates when the control panel has turned on the hydraulic cooler fan. Typically occurs automatically when the hydraulic fluid temperature reaches its set point or when the Hydraulic Cooler toggle is manually enabled on the 2x6 keypad. |
| **Bluetooth On/Off** | Indicates power to the Bluetooth® module is turned on (if equipped). |
| **Blower Toggle On/Off** | Indicates an output from the control panel commanding the blower air solenoid to shift the transfer case, engaging the blower driveshaft. Typically indicates that the blower is engaged. |
| **Pump Mode Toggle On/Off** | Indicates an output from the control panel commanding the hydraulic air solenoid to shift to engage the transfer case and is a general indicator that the control panel is in “Hydraulic” mode. |
| **Transfer Case Cooler On/Off** | Indicates when the control panel has turned on the transfer case cooler fan. Typically occurs automatically when the transfer case temperature reaches its set point or when the Transfer Case Cooler toggle is manually enabled on the 2x6 keypad. |

***Figure 3-14.*** *HMI I/O Sub-Menu - Outputs Screen 2*




| HMI OUTPUTS SCREEN 2 | |
|---|---|
| **Item** | **Description** |
| **Water Pump Command** | Indicates how much current is being applied to the hydraulic pump. |
| **Ceiling Fan** | Indicates control system power to the ceiling fan in the van body is turned on. By default, control system power to the ceiling fan is always turned on and cannot be turned off. This means ceiling fan operation is controlled by its handheld remote. |
| **Ceiling and Toolbox Lights** | Indicates control system power to the interior lights in the van body and any frame-mounted toolbox lights is turned on. By default, it is always on and cannot be turned off. |
| **Work Lights** | Indicates control system power to the exterior work lights is turned on. Work lights are controlled using the 2x2 or 2x6 keypad. |
| **All Heaters Low** | Indicates control system power to all heater fans is turned on at low speed. Fan speed is controlled using the 2x6 keypad. |
| **Driver Side Heater High** | Indicates control system power to the driver-side heater(s) is turned on at high speed. Fan speed is controlled using the 2x6 keypad. |
| **Passenger Side Heater High** | Indicates control system power to the passenger-side heater(s) is turned on at high speed. Fan speed is controlled using the 2x6 keypad. |
| **Rear Beacon Output** | Indicates control system power to the rear tank beacon is turned on. Beacons are controlled using the 2x2 keypad. |
| **Radio Power On/Off** | Indicates control system power to the Aarcomm® radio system is turned on. Radio power is controlled by the 2x6 keypad. |

***NOTE:*** *If an indicator is on but the item is not working, check if a fuse is blown.*

The Radio screen indicates the input status of the corresponding buttons on the handheld remote controller. If the handheld remote controller and truck ignition are turned on, pressing any of the remote controller's buttons will illuminate that button's indicator on this screen while the button is being held. The following outputs are displayed:

- Boom Up/Down
- Door Unlock/Lock
- Boom Left/Right
- Door Open/Close
- Boom In/Out
- Debris Dozer In/Out
- Vacuum On/Off
- Engine Speed Increase/Decrease
- Water Pump On/Off
- Water Pressure Increase/Decrease
- Battery Percent

**⚠ WARNING!**

Equipment can move when using this screen as the remote controller buttons will function normally when the truck is on unless the engine is not running. Contact with moving parts may cause serious injuries, amputations, or death. This screen can be used during normal operation if a second operator assists.

***Figure 3-15.*** *HMI I/O Sub-Menu - Radio Screen*



### 3.7.4 HMI Settings Sub-Menu

This sub-menu provides access to the Settings screen, which allows the operator to change the brightness of the HMI screen and select the display units used for pressure and temperature. The following adjustments are available:

- Backlight Brightness
- Pressure Units
- Temperature Units
- Weight Units

***Figure 3-16.*** *HMI Settings Screen*



### 3.7.5 HMI Troubleshooting Sub-Menu

This sub-menu provides access to the Troubleshoot screen, which provides guidance for diagnosing common issues with the hydrovac. Use the up/down navigation buttons to select an issue and press OK to view more details. Press ESC to return to the main list.

***Figure 3-17.*** *HMI Troubleshoot Screen*



### 3.7.6 HMI Maintenance Sub-Menu

This sub-menu provides access to the Maintenance screen, which displays the cumulative operating hours for the transfer case, water pump, and blower, as well as a summary of the scheduled maintenance for the hydrovac. For more information, see “Chapter 4: Maintenance” on page 85.

***Figure 3-18.** HMI Maintenance Screen*




## 3.8 Valve Block Hydraulic Functions

This section describes the valve block controls and basic operation of the boom and dump door.

### 3.8.1 Valve Block Controls

The valve block—located at the rear passenger side of the truck—includes control levers, a lockout valve, and a pressure indicator. These components allow the operator to manually control boom movement, to operate the debris tank’s dump door, and to control the vacuum breaker.

**CAUTION**

Operation of the manual valve block controls is not disabled by the machine stop or by the safety interlocks that affect remote control functions. Be careful to avoid unintended movement.

***Figure 3-19.*** *Valve Block*




| VALVE BLOCK | |
|---|---|
| **Item** | **Description** |
| **Hydraulic Pressure Gauge** | Indicates the pressure in the hydraulic system. |
| **Door Lockout Valve** | Ball valve that locks out operation of the dump door locks when closed to prevent accidental release. |
| **Door Lock Lever** | • Push to lock the dump door.<br>• Pull to unlock the dump door. |
| **Door Lever (See Caution)** | • Push to close the dump door.<br>• Pull to open the dump door. |
| **Boom Lift Lever** | • Push to lower the boom.<br>• Pull to raise the boom. |
| **Boom Swing Lever** | • Push to move the boom left.<br>• Pull to move the boom right. |
| **Boom Extend Lever** | • Push to retract the boom.<br>• Pull to extend the boom. |
| **Vacuum Breaker Lever (See Note 2)** | • Push to close the vacuum breaker(s)—required for suction at the boom hose during normal operation.<br>• Pull to open the vacuum breaker(s)—stops suction at the boom hose. |

**CAUTION**

- Do not adjust hydraulic valve settings. Improper adjustment may cause damage to equipment and void the warranty.
- Do not open or close door while door locks are engaged or while door locking pins are installed.

***NOTE:***

1. *Hydrovacs equipped with a sludge pump or debris dozer will have one or two additional control levers. See “Appendix A: Hydrovac Options” on page 112.*
2. *The vacuum breaker is automatically opened when a machine stop button on the truck chassis or the control panel is engaged.*

### 3.8.2 Boom Operation

The boom is used to position the boom hose over the excavation site for debris vacuuming. It can be raised, lowered, extended, retracted, and rotated using the valve block levers or the handheld remote controller; however, only the valve block controls will be referenced in this section for simplicity.

**⚠ WARNING!**

- Improper operation of the boom can lead to serious injury or death. Critical hazards include overhead power lines, crush injuries, and the high-powered vacuum. Review all safety information prior to operating the boom (see “Chapter 2: Safety Information” on page 15).
- Only operate the boom in the safe operation zone (see the Boom Safe Operation Zone decal in “Safety and Informational Decals” on page 18). Operating in the caution zone can result in equipment damage or injury to personnel.

**CAUTION**

The boom is not engineered as a lifting device and must not be used to lift, pull, or push other objects. Doing so may damage equipment and void the warranty.

Two operators are required to safely perform this procedure.

1. Verify that all applicable safety precautions have been satisfied before operating the boom.
2. Ensure the hydraulics are engaged (see “Engaging Hydraulics” on page 40).
3. Pull the boom lift lever to raise the boom out of its cradle.
4. Use the appropriate boom controls to position the boom over the excavation point.

When not in use or preparing for transport, stow the boom, boom hose, and any dig tubes in their designated secured positions (see “Stowed Positions” on page 39). Turn off the blower or open the vacuum breaker while repositioning the boom hose between excavation points to prevent vacuuming unintended objects.

### 3.8.3 Dump Door Operation

Opening the dump door allows operators to discharge debris from the debris tank or to allow access for maintenance activities. It can be unlocked, locked, opened, and closed using either the valve block controls or the handheld remote controller; however, only the valve block controls will be referenced in this section for simplicity.

Operators can also connect a hose to the 6-in gate valve or the 8-in gate valve to discharge to a storage tank or other discharge point. The 6-in gate valve allows operators to separate the top layer of immiscible liquids.

**⚠ WARNING!**

Improper operation of the dump door or improper procedures for accessing the debris tank can lead to serious injury or death. Critical hazards include crush injuries and confined space hazards. Review all safety information prior to operating the dump door (see “Chapter 2: Safety Information” on page 15).

***Figure 3-20.** Dump Door Operation*




To open the dump door:

1. Verify that all applicable safety precautions have been satisfied before operating the dump door.
2. Engage the hydraulics (see “Engaging Hydraulics” on page 40).
3. Open the door lockout valve located on the valve block.
4. Pull the door lock lever to unlock the dump door, ensuring the locking rams are fully retracted to prevent damage while opening.

5. Pull the door lever to open the dump door, ensuring it opens to the correct position for insertion of the locking pins in the door hinges.
6. Securely insert both door locking pins through the hinges and the pin holes on the ears of the dump door, being careful to avoid pinch points (see the Pinch Point decal in “Safety and Informational Decals” on page 18).

**CAUTION**

It is important that both locking pins are used and that the pins are removed before operating the door. Damage will occur if the door is closed while locking pins are in place.

---

***NOTE:*** *See “Confined Space Entry” on page 34 for safety precautions related to working inside the debris tank.*

---

To close the dump door:

1. Inspect the debris tank, dump door, and door seal to ensure it is safe to close the dump door.
2. Remove and store the door locking pins, being careful to avoid pinch points.
3. Push the door lever to fully close the dump door, ensuring it is fully closed to prevent damage when locking.
4. Push the door lock lever to lock the dump door, ensuring the locking rams are fully extended to ensure a proper seal.
5. Fully close the door lockout valve.

## 3.9 Water System

The water system includes the water side of the debris tank, pump, plumbing, hose reel(s), and water heater. Two operators are required to safely perform the following procedures.

### 3.9.1 Water Tank Filling

1. Remove the dust cap from the water fill camlock, located on top of the toolbox (F3) or on the front of the passenger-side fender (F4 or F5).
2. Connect a 2-in water fill hose to the water fill camlock.
3. Connect the other end of the 2-in hose to the filling station.
4. Open the 6-in air-actuated gate valve to allow filling.
5. Start the pump at the fill station.
6. Monitor the sight glasses to confirm water is flowing into the tank.
7. Once the top sight glass is full, stop the pump or shut off the water at the fill station.
8. Close the 6-in air-actuated gate valve.
9. Disconnect the hose from both the unit and the fill station.

***Figure 3-21.*** *Water Tank Filling*




## 3.9.2 Vacuum-Assisted Water Filling Operations

If a traditional powered fill station is unavailable, the vacuum-assisted water filling feature allows operators to use their hydrovac's vacuum system to fill the water tank from an approved water source. Operators must be properly trained to perform vacuum-assisted fill operations and authorized to use the chosen water source for this application.

**CAUTION**

- Debris tank must be completely empty before performing vacuum-assisted water filling operation.
- The water pump and internal plumbing are not vacuum rated. Failing to close the main water supply valve before performing vacuum-assisted water filling operation may result in pump or plumbing damage.
- Only use water sources that have been approved for use. Unauthorized sources are not permitted and may pose operational or environmental risks.

1. Place the end of the 3-in vacuum-rated hose—with the filter strainer attached—securely into the approved water source. Ensure the strainer is fully submerged and free from debris or surface contaminants.
2. Attach the opposite end of the vacuum-rated hose to the 3-in camlock fitting located on the back side of the van body. Ensure a secure and sealed connection.

3. Before proceeding, verify that the main water supply valve inside the van body is fully closed.
4. Engage the blower (see “Engaging Blower” on page 41) and set the engine to operating speed.
5. Ensure the 6-in filling valve is closed to maintain vacuum pressure and prevent loss of suction.
6. Turn the vacuum-assisted water fill handle to the open position.
7. Cap the end of the boom hose to ensure the vacuum system functions properly (see Note 1).
8. Close the vacuum breaker to allow suction to be applied during vacuum filling.
9. The operator must confirm that the boom hose cap is secure and holding vacuum. A poor seal will result in loss of suction and failed water transfer.
10. Open the external 3-in main water line valve located on the rear of the van body.
11. Push up the 3-in vent ball plunger to initiate the suction and begin filling the water tank. Monitor the water tank fill level using the sight glasses.
12. Open the vacuum breaker when the water reaches the top sight glass (see Note 2).
13. Immediately close the 3-in water shutoff valve to prevent water loss once vacuum is disengaged.
14. Turn the vacuum-assisted water fill valve to the closed position.
15. Disengage the blower.
16. Once sealed, disconnect the 3-in hose from the camlock fitting and remove it from the water source.
17. Drain any residual water and inspect hose and fittings for wear or damage. Stow the hose properly.
18. Record water source and volume filled if required by site protocol.

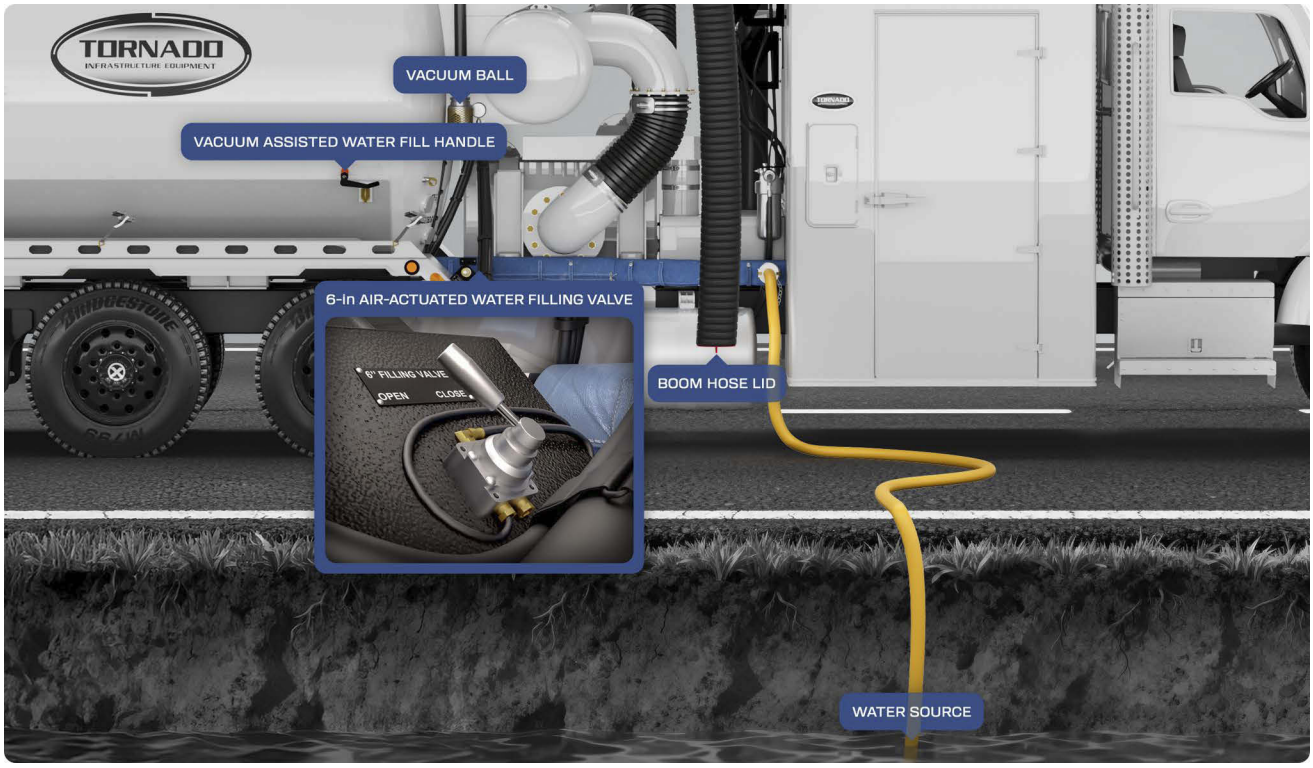
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***NOTE:***

1. *If the optional dig tube storage equipment is not equipped with your truck, use the end of the boom hose tray to cap the hose. Alternatively, the boom hose lid (part number HVAC-3731) can be used, or any flat, sealed surface that can withstand vacuum will suffice.*
2. *Do not overfill the tank. Overfilling will cause water to enter the debris side of the tank.*
3. *The inline water filter must be cleaned after every water load due to increased debris levels in water sources.*
4. *If vacuum assist water filling is performed daily or as part of regular operations, the water side of the debris tank should be cleaned every 1 to 3 months to prevent buildup and maintain system performance.*

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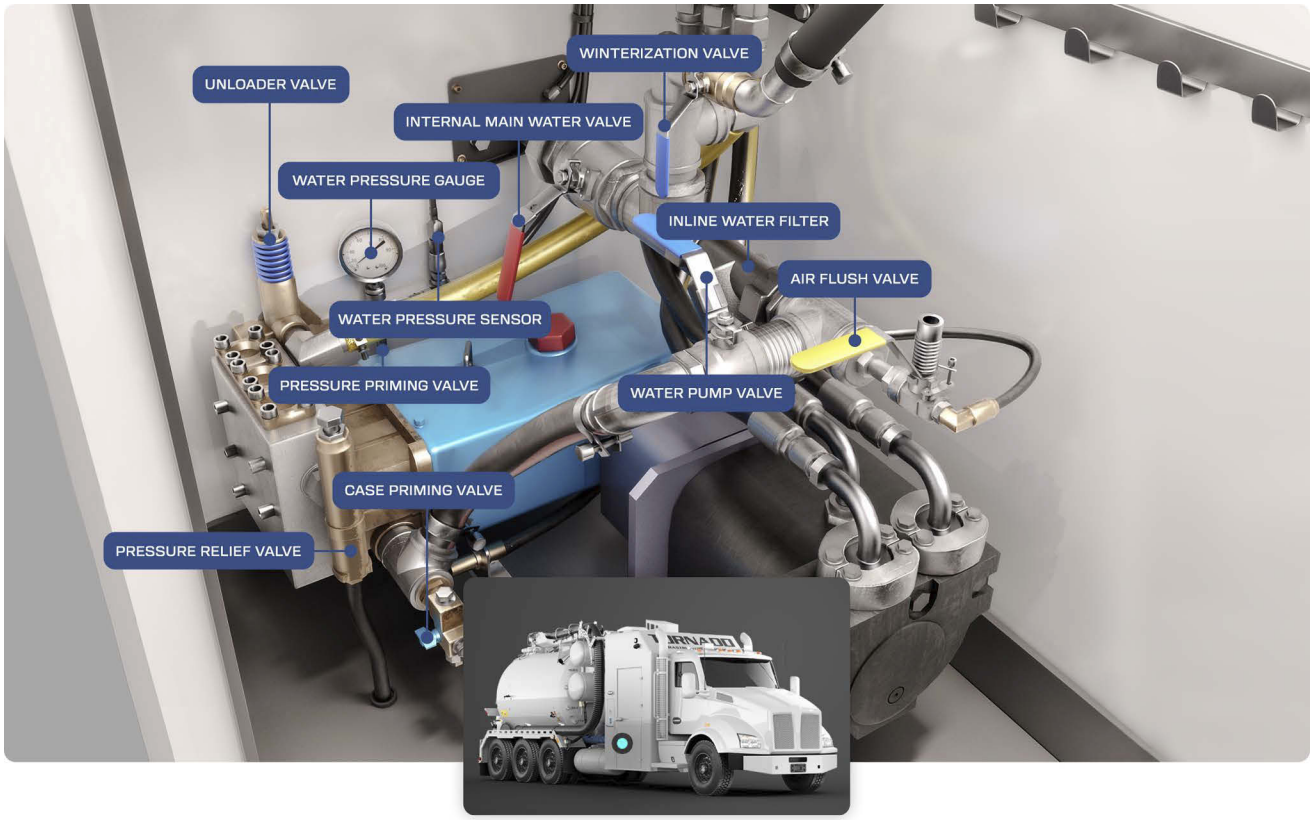
***Figure 3-22.*** *Vacuum-Assisted Water Fill Controls*




## 3.9.3 Water System Controls

The following figures show the controls for the hydrovac water system.

***Figure 3-23.** Water System Controls 1*




| WATER SYSTEM CONTROLS 1 | |
|---|---|
| **Item** | **Description** |
| **Internal Main Water Valve** | Controls water flow into the water system plumbing. |
| **Winterization Fluid Valve** | Controls the flow of winterization fluid into the water system plumbing. |
| **Air Flush Valve** | Purges water from the system during winterization using high-pressure air from the truck. |
| **Water Pump Valve** | Controls water flow into the water pump. |
| **Case Priming Valve** | Used to prime the water pump and drain air from the water system. |
| **Pressure Relief Valve** | A factory-set safety device to relieve excess system pressure if it exceeds 3200-psi. |
| **Unloader Valve** | A factory-set bypass valve that allows manual control of the water pressure in the system and will bypass water back to the water pump inlet manifold. |
| **Pressure Priming Valve** | Used to prime the water pump. |
| **Discharge Water Pressure Gauge** | Shows the analog discharge water pressure. |
| **Water Pressure Sensor** | Reads the discharge water pressure for monitoring by the HMI. |
| **Hose Reel Retraction Valve (not shown)** | A momentary lever that retracts the hose reel using high-pressure air from the truck. |

***Figure 3-24.*** *Water System Controls 2*




| WATER SYSTEM CONTROLS 2 | |
|---|---|
| **Item** | **Description** |
| **Water Tank Temperature Gauge** | Shows the analog temperature of the water tank. |
| **Water Recirculation Port** | Allows water to recirculate back into the water tank from the dig hose. |
| **External Main Water Valve** | Controls the water flow from the water tank into the van body's plumbing system. |

***Figure 3-25.*** *Water System Controls 3*




| WATER SYSTEM CONTROLS 3 | |
|---|---|
| **Item** | **Description** |
| **Water Heater Fuel Pressure Gauge** | Shows the fuel pressure of the water heater. |
| **Water Heater Fuel Primer Squeeze Bulb** | Primes the water heater's combustion chamber with diesel fuel from the truck's fuel tank (see Note). |
| **Hose Reel Isolation Valve** | Controls the water flow from the water heater to the hose reels. |
| **Water Outlet Temperature Gauge** | Shows the analog water temperature exiting the water heater. |
| **Winterization Recirculation Valve and Port** | Allows winterization fluid to recirculate back into the winterization fluid tank from the dig hose. |

***NOTE:*** *If you have to prime the water heater frequently, this may indicate an air leak in the fuel lines.*

### 3.9.4 De-Winterization and Pump Priming

If the truck is winterized, the water system needs to be de-winterized and the pump primed before it can be used. This procedure starts with winterization fluid reclamation, then moves to pump priming. Two operators are required to safely perform this procedure.

If the truck was not winterized (i.e., no fluid reclamation is required), but there is air trapped in the system that needs to be removed, start this procedure from Step 11.

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***NOTE:***

- *All trucks are winterized from the factory and must be de-winterized during first use.*
- *Winterization fluid will need to be topped up when low and replaced when it becomes too diluted. Replacement periods will vary depending on frequency of winterization and the amount of water still in the system during winterization.*

---

1. Check the water tank sight glasses to verify there is adequate water available.
2. Engage the hydraulics (see “Engaging Hydraulics” on page 40).
3. Ensure the winterization fluid valve and the internal main water valve are closed.
4. Open the winterization tank cap so that air can escape.
5. Connect the dig hose valve to the winterization recirculation port.
6. Open the water pump valve, hose reel isolation valve, dig hose valve, and winterization recirculation valve.
7. Open the air flush valve 25% and purge the system with air until the clear hose behind the winterization recirculation valve is empty of fluid, indicating the winterization fluid has been reclaimed.
8. Wait approximately 1 minute to allow the system to depressurize following the air purge.
9. Close the winterization tank cap.
10. Close the dig hose and winterization recirculation valves, then disconnect the dig hose valve from the winterization recirculation port.
11. Connect the dig hose valve to the water recirculation port on the water tank.
12. Open the dig hose valve.
13. Open the external main water valve, internal main water valve, and water pump valve.
14. Open the case priming valve for 10–15 seconds or until there is a steady stream of winterization fluid flowing out under the van body, then close this valve again.
15. Set the water pump to operate in “Manual” mode (see “2x6 Keypad” on page 46).
16. Turn on Water Pump Bypass to start the pump.
17. Gradually increase the pump speed to 20%. Do not increase the pump speed above 20% until it is fully primed.
18. Allow the pump to run for 5 minutes to purge any remaining air from the system (see Note).
19. Turn off Water Pump Bypass to stop the pump.
20. Close the dig hose valve, then disconnect the dig hose valve from the water recirculation port.

Once all winterization fluid has been purged from the system and the pump is primed, the operator can engage the water system, prepare for excavation, and safely run the pump at a suitable speed for the excavating conditions (see “Excavating with Dig Wand” on page 76).

***NOTE:*** *If cavitation occurs during the 5-minute purging session, the pressure side priming valve may be opened to release air from the pump head earlier.*

### 3.9.5 Engaging Water System

**⚠ WARNING!**

High-pressure water can cause lacerations and high-pressure injection injuries that lead to serious injuries, health complications, or death (see “Vacuum Hose and High-Pressure Fluid Hazards” on page 31). Ensure only trained personnel operate the dig wand. Whenever the pump is running, operators must maintain control of the wand and never direct water at people or animals.

***NOTE:*** *Before beginning operations, ensure there is sufficient water in the tank to complete the job.*

If the winterization fluid has been reclaimed and the water pump is fully primed, this procedure can be followed to engage the water system. Two operators are required to safely perform this procedure.

1. Check the water tank sight glasses to verify there is adequate water available.
2. Engage the hydraulics (see “Engaging Hydraulics” on page 40).
3. With the water pump off and the dig hose valve closed, connect the dig wand or other desired attachments to the dig hose valve.
4. Ensure the following valves are open:
   - External main water valve
   - Internal main water valve
   - Water pump valve
   - Hose reel isolation valve
   - Dig hose valve
5. Set the water pump to operate in “Manual” mode (see “2x6 Keypad” on page 46).
6. Turn on Water Pump Bypass to start the pump, ensuring the dig hose or attachments are aimed in a safe direction.
7. Gradually increase the pump speed to 20%, observing pump behavior to ensure no cavitation is occurring.
8. If pump cavitation is observed, open the pressure priming valve until trapped air is released.
9. Once you verify that no cavitation is occurring, increase the water pump speed to an appropriate level based on excavating conditions (see “Excavating with Dig Wand” on page 76).

## 3.10 Water Heater System

The water heater is a diesel-fired heating system that warms the truck's water supply before use. By delivering hot, pressurized water to the digging wand, it allows efficient excavation in frozen or compacted ground, prevents system freeze-ups, and ensures safe, reliable year-round operation.

**⚠ WARNING!**

- Carbon monoxide exposure or equipment fires may result from improperly used or maintained equipment. Ensure exhaust is safely vented, and follow all safety and maintenance procedures in the water heater manufacturer's documentation.
- Operators should avoid contact with heated water, plumbing, and internal water heater components that could present a burn risk.

The water heater operates independently of the HMI's Vortex control system and must be controlled at the heater's dedicated control panel. Prior to starting the water heater, the van body ceiling fan must be turned on to provide adequate ventilation. Operating procedures, including ignition and shutdown instructions, are provided in the water heater manufacturer's operations manual and must be followed at all times.

The water system can be engaged before or after turning on the water heater. However, the burner will only ignite once the flow switch detects water moving through the system. If water flow stops, the burner automatically shuts off. Power to the control panel remains on, so unless the water heater is switched off, the burner will automatically re-ignite once water flow is restored.

***NOTE:***

- *When shutting down the water heater, you must allow water to continue to run through the unit until the coil is completely cooled to the inlet water temperature.*
- *Pressing any machine stop button will shut off the water flow, disabling the water heater's burner. If the water heater control switch remains on, the burner will automatically re-ignite once water flow is restored.*

## 3.11 Remote Control

Remote control allows the operator to control a number of operating functions wirelessly via a handheld remote controller. This controller communicates with the Aarcomm® receiver located inside the van body, beside the control panel.

When the handheld remote controller is powered on and linked, its functions will be displayed on the digital screens adjacent to the corresponding control buttons. Press and hold the green button to switch the screen icons and controls to their alternate functions.

***Figure 3-26.*** *Handheld Remote Controller*




***NOTE:*** *The Debris Push functions correspond to the debris dozer equipment option. If it is not equipped, these buttons will have no effect.*

## 3.11.1 Enabling Remote Control

1. Power on the receiver by pressing the Remote On/Off button on the 2x6 keypad on the control panel. The button will illuminate blue.
2. Press and hold the red button on the handheld remote controller to begin linking to the receiver.
3. Press and hold the green button on the handheld remote controller.
4. Release the red button on the handheld remote controller.
5. Release the green button on the handheld remote controller.

When successfully linked, the LED light on the handheld remote controller will briefly flash green, then turn to solid green. When a button is pressed, the LED light on the bottom of the receiver will change from green to light blue. When the button is released, the LED will return to green.

***NOTE:*** *On the main control panel, the Water Pump Mode button needs to be set to "Remote" for the water pump controls to be enabled on the handheld remote controller. See "Control Panel" on page 45 for details.*

### 3.11.2 Water Pump Remote Shutoff

Pressing the red button on the handheld remote controller will shut off the water pump if the truck is in remote water bypass mode. The red button on the handheld remote controller cannot be used as an emergency stop or machine stop.

### 3.11.3 Turning Remote Off

Powering off the handheld remote controller requires two steps:

1. Press and release the red button on the handheld remote controller.
2. Press the Remote On/Off button on the 2x6 keypad on the main control panel to disable the remote handheld controller.

### 3.11.4 Remote Control Interlocks

As a safety feature, the boom extend and retract functions are disabled on the handheld remote controller while the boom is in the cradle.

## 3.12 Pre-Operations Checklist

The following lists outline actions and checks that must be performed before moving or operating the hydrovac truck. These lists outline basic minimum requirements and may not be comprehensive for all cases.

### 3.12.1 Before Traveling

Every time the hydrovac will be driven, the following checks or actions must be performed beforehand:

- Perform all required equipment inspections and maintenance.
- Ensure the hydrovac is not overweight.
- Verify the boom is stowed securely in the boom rest cradle.
- Verify the boom hose and all dig tubes are stowed securely.
- Verify the dump door is fully closed and locked.
- Verify the door lockout valve and both rear gate valves are closed.
- Verify any attached hoses for filling or dumping are disconnected and properly stowed.
- Verify the water pump and water heater are turned off.
- Verify the blower and hydraulics are disengaged.
- Verify the handheld remote controller is returned to its charging station.
- Verify all water hoses are properly reeled up and the dig wand is securely stowed.
- Properly stow any loose tools and equipment on the truck.
- Remove and stow all wheel chocks.
- Verify the beacon and work lights are turned off.

### 3.12.2 Before Operating Hydrovac Equipment

Every time operators will be conducting any excavating or dumping operations, the following checks or actions must be performed beforehand:

- Perform all required equipment inspections and maintenance.
- Verify that all job hazards analysis and emergency response requirements are met.
- Verify that all utility locates (above and below ground) were completed and are clearly identified.
- Verify that there is sufficient clearance around the equipment for boom and/or dump door movement, and any excavation sites are located within the safe operation zone of the truck.
- Verify water and debris tank levels are adequate for the operations being performed.
- Verify hydrovac is positioned on stable ground and is level.
- Verify parking brake is set and wheels are chocked, if appropriate.
- Verify dump door is fully closed and locked prior to excavating.
- Verify door lockout valve and both rear gate valves are closed prior to excavating.
- Verify handheld remote controller is charged and within range, if using.
- Verify beacon and work lights are turned on, if appropriate.
- Grease the boom manifold in accordance with maintenance requirements (see “Greasing Hydrovac System Components” on page 99).

## 3.13 Excavation

The following sections describe excavation procedures for the hydrovac systems. Ensure all pre-work actions have been performed prior to starting excavation activities (see “Before Operating Hydrovac Equipment” on page 76).

### 3.13.1 Excavating with Dig Wand

Prior to starting excavation or similar operations (e.g., cleaning the debris tank), ensure the water system has been de-winterized and the pump has been primed (see “De-Winterization and Pump Priming” on page 71). Two operators are required to safely perform this procedure.

**⚠ WARNING!**

High-pressure water can cause lacerations and high-pressure injection injuries that lead to serious injuries, health complications, or death (see “Vacuum Hose and High-Pressure Fluid Hazards” on page 31). Ensure only trained personnel operate the dig wand. Whenever the pump is running, operators must maintain control of the wand and never direct water at people or animals.

1. Check the water tank sight glasses to verify there is adequate water available.
2. Pull out an appropriate length of dig hose from the hose reel.
3. Connect the dig wand or other attachments to the dig hose valve as desired.
4. Open the dig hose valve, ensuring the dig hose or attachments are aimed in a safe direction.

5. Engage the water system and run the pump at low speed (see “Engaging Water System” on page 72).
6. Increase the water pump speed to the desired level based on both the soil conditions and the material of any utilities being exposed.
7. Optionally, engage the water heater (see “Water Heater System” on page 73).
8. Firmly hold the dig wand over the area to be excavated, ensuring you and others are out of the line of fire. Keep the dig wand moving during operation (see Note).
9. Continuously monitor the water tank fill levels, stopping operation and turning off the water pump when the water level is low (see “Monitoring Operation” on page 78).

***NOTE:***

- *If water unexpectedly stops spraying from the dig wand nozzle or does not spray as expected, the nozzle may be clogged or damaged. Turn off the hydrovac equipment, close the isolation and dig hose valves, and inspect the nozzle—clean or replace as needed.*
- *Ensure you keep the dig wand moving as directing high-pressure water at the same point for a prolonged time increases the risk of damaging utility lines or pipes.*

### 3.13.2 Vacuuming Debris with Boom Hose

**⚠ WARNING!**

The high-powered vacuum can draw in body parts or cause suffocation leading to serious injury or death (see “Vacuum Hose and High-Pressure Fluid Hazards” on page 31). Never expose yourself or others to the boom hose while the equipment is running. In the event of an emergency, press one of the machine stop buttons on the truck chassis or the control panel to stop suction at the boom hose.

Two operators are required to safely perform this procedure.

1. Engage the hydraulics (see “Engaging Hydraulics” on page 40).
2. Position the boom hose in the area to be excavated.
3. Engage the blower (see “Engaging Blower” on page 41).
4. Close the vacuum breaker to begin suction.
5. Monitor the debris tank fill levels (see “Monitoring Operation” on page 78).
6. Open the vacuum breaker to break suction as needed during operations.

***NOTE:***

- *Prolonged deadheading (blocked suction) should be avoided. Allow the system to move air occasionally by releasing the dig tube from a sumped position or, if necessary, opening the vacuum breaker.*
- *If opening the vacuum breaker still does not resume air flow, there is a blockage somewhere in the system. Shut down and turn off all systems and resolve the blockage.*
- *Do not throw garbage or cans into the excavation site as they can cause the filter to plug up.*

## 3.14 Monitoring Operation

Always monitor equipment and material levels during excavation and debris vacuuming. This helps maintain safe and efficient operation.

1. Monitor water tank levels:
   - While excavating with water, always remain aware of the water tank levels by regularly checking the tank sight glasses at the front of the tank.
   - Refill the water tank once levels reach the bottom sight glass to ensure you do not run out of water.
   - Never allow the tank to run dry, as operating the pump without water will cause damage.
2. Monitor debris tank levels:
   - While vacuuming with the boom hose, regularly check the debris float arrow on the side of the debris tank to monitor the fill level.
   - Stop vacuuming as soon as the debris float arrow indicates full. The float balls are designed to limit overfilling, but they cannot be relied upon as a complete safeguard.
   - Overfilling can allow material to pass beyond the floats and cause severe damage to the blower.
3. Monitor equipment sensors:
   - Monitor equipment temperatures and other sensor data provided in the HMI to ensure all values are in range (see “HMI Layout and Navigation” on page 48).
4. Monitor truck weight:
   - Monitor the debris tank level and overall truck weight to stay within legal and safe limits. Use an onboard weight scale if equipped (see “Air-Weigh Scale” on page 113 or “RIGHT WEIGH Scale” on page 122).

**CAUTION**

Overfilling the debris tank or operating with an empty water tank can cause serious equipment damage and create unsafe conditions.

***Figure 3-27.** Monitoring Levels*




## 3.15 Dumping Debris and System Shutdown

This section outlines the procedures for dumping collected debris and shutting down the hydrovac system. These steps are critical to ensure safe operation and to prevent premature wear or damage to system components. Failure to follow these procedures may result in equipment malfunction, increased maintenance requirements, or safety hazards caused by unexpected component failure.

Additionally, operators must ensure all pre-work actions have been performed prior to starting dumping activities (see “Before Operating Hydrovac Equipment” on page 76).

**⚠ WARNING!**

- The raised dump door is a crush hazard. Stand clear of the door any time it is being moved or both locking pins are not installed. Failure to comply can result in serious injury or death to personnel. It is important that both locking pins are used and that the pins are removed before operating the door. Damage will occur if the door is closed while only a single pin is in place.
- Entering the debris tank without proper confined space entry procedures can result in suffocation, toxic exposure, or entrapment, potentially causing negative health effects or even death. See “Confined Space Entry” on page 46 for safety precautions related to working inside the debris tank.

### 3.15.1 Emptying Debris Tank

1. Ensure the boom is in transport position and haul to approved dumping area.
2. Engage the hydraulics (see “Engaging Hydraulics” on page 40).
3. Open the door lockout valve (see “Dump Door Operation” on page 63).
4. Ensure all personnel are clear of the dump door and unlock. Note that debris will start to flow as soon as the door is unlocked.
5. Fully raise the dump door.
6. Remove the door locking pins from the storage brackets and insert both door locking pins in the appropriate positions to lock the door in the raised position (see the Dump Door Locking Pins decal in “Safety and Informational Decals” on page 18).
7. Remove the washout gun from storage, pull an appropriate length of water hose from the hose reel, and connect the washout gun.
8. Turn on the water system and adjust pressure appropriately (see “Engaging Water System” on page 72).
9. Use the washout gun to thoroughly rinse the inside of the tank and around the door seal.
10. Remove the door locking pins and replace them in the storage brackets.
11. Fully close the dump door.
12. Lock the dump door.
13. Close the door lockout valve.

---

***NOTE:***

- *Optionally, you can partially drain the debris tank using the gate valves on the rear of the tank prior to opening the dump door. A 6-in camlock jumper hose can be connected to the 6-in gate valve to discharge any top-level fluids, while an 8-in camlock jumper hose can be connected to the 8-in gate valve to drain most of the debris.*
- *For trucks equipped with the optional sludge pump and/or debris dozer, these devices can be used to aid with emptying the tank. See “Sludge Pump” on page 123 or “Debris Dozer” on page 117 for more information.*

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*Figure 3-28. Emptying Debris Tank*




## 3.15.2 Blower Diesel Flush

To prevent internal corrosion and potential freeze-up in cold climates, the blower must be flushed with diesel after operation whenever moisture buildup on the impeller lobes is suspected. This step is critical for maintaining seal integrity and minimizing blower wear.

**⚠ WARNING!**

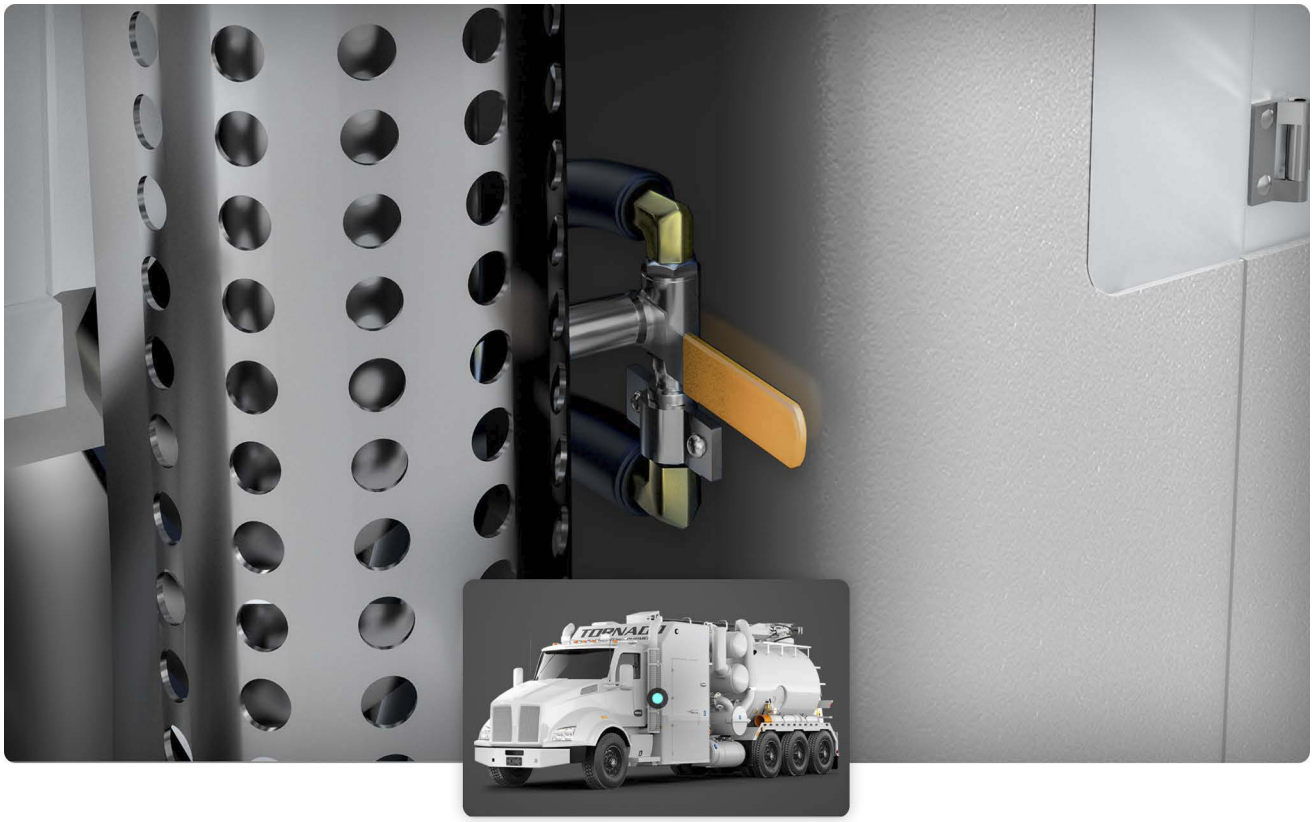
- Diesel is flammable. Use extreme caution during this procedure to avoid contact with hot parts that may ignite the fluid.
- During this procedure, if white smoke is seen from the discharge silencer vent or if a strong diesel odor is suddenly present during flushing, the valve must be released immediately. Do not flush for more than 10 seconds, as excess diesel may damage the air filter and reduce system performance.

1. Open the vacuum breaker(s).
2. Run the blower at low idle speed for at least 10 minutes to allow sufficient cool down (see Note).
3. Close the vacuum breaker.
4. Open and hold the diesel flush valve for 5–10 seconds, then release it (see Note).
5. Open the vacuum breaker.

***NOTE:***

- *Failure to lubricate the blower can lead to premature seal failure and increased blower lobe wear. In cold climates, failure to lubricate the blower could result in the blower lobes freezing in place, causing damage to the drive components when starting the blower.*
- *For operations in hotter ambient temperatures, cooling for more than 10 minutes may be required.*
- *The diesel flush valve is spring-loaded. If the valve does not fully close after being released, it must be replaced immediately to mitigate potential equipment damage.*

**Figure 3-29.** *Blower Diesel Flush*



### 3.15.3 System Shutdown

Perform the following steps when shutting down the equipment after excavating or if preparing for transport.

1. If the water heater was used, shut it off and run water through the system until the coil is completely cooled to the inlet water temperature. When shutting down for the winter, see “Winterization Procedure” on page 83, if applicable.
2. Return all equipment to its proper stowed positions (see “Stowed Positions” on page 39).
3. If appropriate, flush the blower with diesel (see “Blower Diesel Flush” on page 81).
4. Run the engine at low idle speed with no load for at least 10 minutes to cool the blower. If the diesel flush procedure was followed, this step is not necessary.
5. Disengage the blower.
6. Disengage the hydraulics.
7. Shut off the truck if finished, or perform the pre-travel actions before transport to another location (see “Before Traveling” on page 75).

**CAUTION**

Failure to correctly perform the required shutdown steps, including the diesel flush when conditions demand it, can result in significant equipment damage and unsafe operating conditions.

### 3.15.4 Winterization Procedure

Winterization is an important measure to protect your equipment from damage in freezing temperatures or during prolonged periods of inactivity. Two operators are required to safely perform this procedure. Equipment options affecting the hydrovac’s water system and plumbing may require modified steps to ensure that equipment is properly winterized.

1. At a suitable dumping location, engage the hydraulics (see “Engaging Hydraulics” on page 40).
2. Increase the engine speed to operating levels.
3. Close the external main water valve.
4. Ensure the internal main water valve and water pump valve are open.
5. Remove the 3-in camlock cap—water will begin to drain from the plumbing side of the system.
6. If desired, a 3-in hose can be connected to the camlock fitting for draining water to a specific location.
7. Close the internal main water valve once the plumbing side of the system is drained.
8. Open the external main water valve to drain the water tank.
9. When the tank is empty, close the external main water valve and reinstall the 3-in camlock cap.
10. Open the case priming valve and pressure priming valve until water stops flowing, then close both valves.

11. Remove and drain the inline water filter.
12. Reinstall the inline water filter.
13. Pull the dig hose to a suitable location, then open the hose reel isolation valve and dig hose valve.
14. Purge as much water as possible from the system by holding the air flush valve open about 25% until water stops coming out, then release the air flush valve to close it.
15. Open the winterization fluid valve.
16. Open the case priming valve for 10–15 seconds or until there is a steady stream of winterization fluid, then close the valve.
17. Set the water pump to operate in “Manual” mode (see “2x6 Keypad” on page 46).
18. Turn on Water Pump Bypass to start the pump, ensuring the dig hose is aimed in a safe direction.
19. Gradually increase the pump speed to 20%.
20. Watch the dig hose valve’s outlet. Once you see winterization fluid coming out, turn off Water Pump Bypass to shut off the pump.
21. Close the dig hose valve.
22. Tag the truck as being winterized.

**⚠ WARNING!**

Avoid contact with high-pressure fluids and never direct pressurized water toward people or animals. (see “Vacuum Hose and High-Pressure Fluid Hazards” on page 31). Ensure only trained personnel operate the dig wand.

**CAUTION**

To prevent environmental harm, only perform the winterization process at a suitable dumping location or ensure all winterization fluid is safely captured to prevent environmental release.

# 4 Maintenance

## 4.1 Maintenance Precautions

In addition to hazards related to regular operation, maintenance activities may expose workers to additional hazards that could cause equipment damage, serious injury, or death. Operators and maintenance personnel must read and understand all safety information in this manual, and receive proper training prior to using or working on the hydrovac equipment.

**⚠ WARNING!**

- Misuse of the machine can cause death or serious injury. Follow all appropriate safety procedures before use. Know how to use all controls.
- Lower any unsecured, raised components and apply all appropriate lockout-tagout procedures before servicing the equipment.
- Unless otherwise instructed, all maintenance should be performed with the engine off and the equipment fully cooled.
- Unless otherwise instructed, all maintenance should be performed with the machine parked on a level surface.

## 4.2 Washing Precaution

**CAUTION**

Water can damage electronics. When cleaning equipment, do not spray electrical components with water.

## 4.3 Welding Precaution

**CAUTION**

Welding can damage sensitive electronics. Take measures to protect electronic components and refer to the chassis manufacturer's manual for additional precautions related to welding.

Welding can overload sensitive electronic components, permanently damaging them. Prior to welding on any part of the hydrovac:

- Always disconnect all negative cables from the truck batteries.
- Connect the welding equipment's ground as close as practical to the welding point and ensure no electronic components are located along the primary current return path.

## 4.4 Working on Debris Tank

**⚠ WARNING!**

Falling from heights, failure to avoid pinch points, or collisions with equipment can cause serious injury or death. Fall protection must be used and hydraulic equipment must be safely shut down and locked out while personnel are working at heights (see "Fall Protection" on page 33).

Access to the top of the debris tank is restricted and appropriate fall protection must be used when accessing the top of the tank and when using the tank platform. The rear of the truck has two steps that can be lowered for access to components on the rear of the debris tank or to access the top of the tank.

The tank platform has a maximum load capacity of 300-lb and must be inspected prior to use to ensure it is in good condition. The anchor points must also be inspected before use and can only be used for fall protection when properly torqued. If accessing the top of the tank, the hydrovac truck must be shut down and all hydraulic equipment properly locked out. Do not use the tank platform while truck is in operation or moving.

***Figure 4-1.** Maintenance Platform and Steps*



## 4.5 Hydrovac Maintenance Tasks

The following tables provide a list of periodic maintenance tasks that should be performed to maintain the hydrovac in optimum working condition. Certain maintenance tasks are explained in more detail later in this chapter. If any components are identified to be faulty or worn out, they must be replaced prior to operating the equipment. The definitions of the tasks are as follows:

- **Visual check –** Visually inspect the component.
- **Clean –** Physically clean the component.
- **Inspect –** Physically inspect the component (for example, open/close a valve).
- **Lube –** Lubricate the component.
- **Operational check –** Operate in a controlled environment outside of regular operations to test the functionality of related components and determine whether repair or replacements are needed.

***NOTE:*** *Some optional equipment may require additional or modified maintenance tasks not detailed in these tables (see "Appendix A: Hydrovac Options" on page 112).*

### 4.5.1 Hydrovac Maintenance Daily Tasks

| DAILY MAINTENANCE TASKS | | |
|---|---|---|
| **Maintenance Task** | **Type** | **Core Location** |
| **All Hoses and Connections** | Visual Check | All |
| **Air Filter (See Note 1)** | Visual Check<br>Clean | Chassis |
| **Blower Oil Level** | Visual Check | Chassis |
| **Machine Stop Buttons** | Operational Check | Chassis |
| **Transfer Case Oil Level** | Visual Check | Chassis |
| **Hydraulic Fluid Level** | Visual Check | Van Body |
| **Inline Water Filter (See Note 2)** | Clean | Van Body |
| **Water Pump Oil Level** | Visual Check | Van Body |
| **Cyclone Cleanout** | Clean | Debris Tank |

***NOTE:***

1. *The air filter must be clean and fully dry prior to starting work each day. It should also be cleaned at the end of each shift (see "Clean or Change Hydrovac Air Filter" on page 97).*
2. *The inline water filter must be cleaned daily and the filter screen must be inspected for damage (see "Inline Water Filter Cleaning" on page 108). Damaged filters must be replaced immediately.*

### 4.5.2 Hydrovac Maintenance Weekly Tasks

All daily maintenance tasks should be performed in addition to the weekly maintenance tasks.

| WEEKLY MAINTENANCE TASKS | | |
|---|---|---|
| **Maintenance Task** | **Type** | **Core Location** |
| **Blower Components** | Visual Check | Chassis |
| **Blower Diesel Flush (See Note)** | Lube | Chassis |
| **Grease Points on Driveline** | Lube | Chassis |
| **Grease Points on Blower Driveline** | Lube | Chassis |
| **Water Heater** | Operational Check | Van Body |
| **Grease Points on Dump Door** | Lube | Debris Tank |
| **Hydraulic Cylinders** | Visual Check | Debris Tank |
| **Boom Hose** | Visual Check | Boom |
| **Boom Hose Connections** | Visual Check | Boom |
| **Grease Points on Boom (Grease Manifold)** | Lube | Boom |
| **Hydraulic Cylinders** | Visual Check | Boom |
| **Rockhead and Deflector Plate** | Inspect | Boom |
| **Wash Wands, Dig Wands, and Dig Tubes** | Inspect | Equipment |

***NOTE:*** *This blower diesel flush may need to be performed more often (potentially daily) in wet or humid conditions (see "Blower Diesel Flush" on page 81).*

### 4.5.3 Hydrovac Maintenance Monthly Tasks

All daily and weekly maintenance tasks should be performed in addition to the monthly maintenance tasks.

***NOTE:*** *For situations where the hydrovac is operating at a high usage rate (in excess of 200 hours per month), all checks listed below should be performed on a bi-weekly basis.*

| MONTHLY MAINTENANCE TASKS | | |
|---|---|---|
| **Maintenance Task** | **Type** | **Core Location** |
| **Battery Cables and Connections** | Visual Check | All (See Note) |
| **Decals** | Visual Check | All |
| **General Damage** | Visual Check | All |
| **Blower Mounting Bolts** | Inspect | Chassis |
| **Blower Run Test – Record Vacuum Pressure** (see "Record Vacuum Pressure" on page 110) | Operational Check | Chassis |
| **Remote Control System** | Operational Check | Chassis |
| **Tank Mounting Bolts** | Inspect | Chassis |
| **Vacuum Breaker(s)** | Operational Check | Chassis |

| MONTHLY MAINTENANCE TASKS | | |
|---|---|---|
| **Water Heater** | Operational Check | Van Body |
| **Water Pump Drive Motor Coupling (CAT PUMPS® Pump Only)** | Visual Check | Van Body |
| **Water Pump Mounting Brackets** | Visual Check | Van Body |
| **Water Pump Operation** | Operational Check | Van Body |
| **6-in Gate Valve** | Operational Check | Debris Tank |
| **8-in Gate Valve** | Operational Check | Debris Tank |
| **Door Hinge Bolts** | Inspect | Debris Tank |
| **Door Locking Pins** | Visual Check | Debris Tank |
| **Door Locking Rollers** | Operational Check | Debris Tank |
| **Door Seal** | Visual Check | Debris Tank |
| **Debris Fill Level Assembly** | Inspect | Debris Tank |
| **Debris Tank Water Side Sight Glasses** | Visual Check | Debris Tank |
| **Micro Switch Function (Boom Lockout)** | Operational Check | Debris Tank |
| **Shutoff Float Ball Assembly and Gasket** | Visual Check | Debris Tank |
| **Silencer Mounting Bolts** | Inspect | Debris Tank |
| **Tank Debris Side Internal Coating** | Visual Check | Debris Tank |
| **Vacuum-Assisted Water Fill Handle** | Inspect | Debris Tank |
| **Valve Block** | Operational Check | Debris Tank |
| **Bearing to Tank Seal** | Visual Check | Boom |
| **Boom Mounting Bolts External** | Inspect | Boom |
| **Boom Mounting Bolts Internal** | Inspect | Boom |
| **Boom Pivot Pins** | Visual Check | Boom |
| **Boom Rollers** | Visual Check | Boom |
| **Boom Swivel Motor** | Visual Check | Boom |

***NOTE:*** *The battery locations vary. Check the battery connection points and the control panel connection points.*

### 4.5.4 Hydrovac Maintenance Annual Tasks

- Annually, the water side of the debris tank must be inspected and cleaned to ensure longevity of the tank (see “Annual Water Tank Inspection and Cleaning” on page 108). Inspect and verify function of the vacuum-assisted water filling valve during this inspection. If vacuum-assisted water filling is performed daily or as part of regular operations, the water tank should instead be cleaned every 1 to 3 months to prevent buildup and maintain system performance. All daily, weekly, and monthly maintenance tasks should also be performed.
- The water heater should be inspected and cleaned either yearly or every 500 water heater hours, whichever comes first (see “Water Heater Inspection and Maintenance” on page 109).
- Inspect all electrical connections on the unit annually. Open and inspect the control panel and Aarcomm® receiver electrical panels for water ingress, corrosion, and loose components, but do not remove the panelboards.

## 4.6 Maintenance During Periods of Inactivity

When the hydrovac is not in use for extended periods, maintenance must still be performed to prevent component deterioration and ensure reliable startup.

- **Daily and weekly maintenance tasks –** These may be deferred during inactivity, but must be completed before the next operation or at least once every 30 days, whichever comes first.
- **Monthly maintenance tasks –** These must be completed every 30 days, regardless of activity.
- **Blower diesel flush –** Perform at least once every 30 days during periods of inactivity (see “Blower Diesel Flush” on page 81).

## 4.7 Change Intervals

### 4.7.1 Recommended Change Intervals

The following table defines the recommended intervals for changing fluids, filters, and other components in the hydrovac.

| MAINTENANCE CHANGE INTERVALS | | |
|---|---|---|
| **Maintenance Task** | **Initial Change** | **Routine Change** |
| **Blower Oil** | 500 hours | 4000 hours |
| **Hydraulic Fluid (See Note 1)** | N/A | N/A |
| **Transfer Case Oil** | 100 hours | 1500 hours |
| **Water Pump Oil (See Note 2)** | 50 hours | 500 hours |
| **Air Filter** | N/A | upon damages |
| **Hydraulic Charge Filter (See Note 3)** | 100 hours | 500 hours |
| **Hydraulic Return Filter (See Note 4)** | 100 hours | 500 hours |
| **Inline Water Filter** | N/A | upon damages |
| **Deflector Plate** | N/A | upon damages |
| **Dump Door Seal** | N/A | upon damages |

***NOTE:***

1. *Sample hydraulic fluid every 500 hours. Sample must meet or exceed ISO 4406. Change the hydraulic fluid based on sample results.*
2. *For units equipped with a Pratissoli pump, the Routine Change interval is every 1000 hours.*
3. *Sample oil when a dirty filter warning is displayed on the HMI. Change hydraulic charge filter when dirty or upon listed interval, whichever comes first.*
4. *Change hydraulic return filter upon dirty filter warning or at listed interval, whichever comes first.*

### 4.7.2 Recommended Lubricants and Fluids

| RECOMMENDED LUBRICANTS AND FLUIDS | |
|---|---|
| **Item** | **Description** |
| **Hydraulic Fluid** | Chevron Clarity® Hydraulic Oil AW32 |
| **Pratissoli Water Pump Lubricant** | ISO 220 Mineral-Based or Synthetic Oil |
| **CAT PUMPS® Water Pump Lubricant** | CAT PUMPS® High Pressure Pump Oil |
| **Transfer Case Lubricant** | Mobilube™ 1 SHC 75W-90 or Equivalent |
| **Blower Lubricant** | ISO 220 Mineral-Based or Synthetic Oil |
| **Winterization Fluid** | Windshield Wiper Fluid Rated -50°F or Colder |

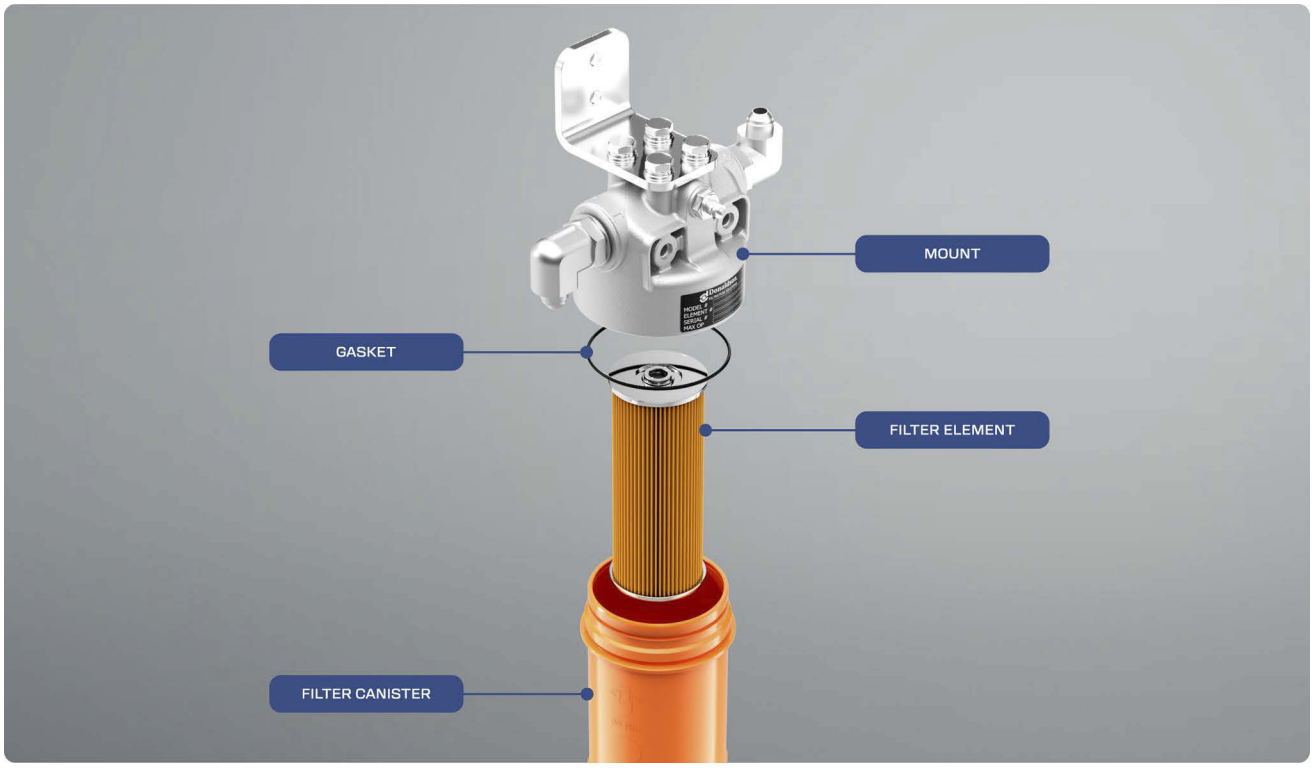
## 4.8 Change Hydraulic Charge Filters

The primary hydraulic system charge filter is mounted on the passenger-side exterior rear wall of the van body. Replace the charge filter at the prescribed interval as follows:

1. Ensure the hydraulic system is shut down and the pressure has been bled from the system by removing the pressure release plug on the bottom of the charge filter.
2. Unscrew the filter canister from the mount.
3. Drain the fluid from the filter canister and remove the filter element and gasket.
4. Inspect the gasket for any signs of damage or wear that might result in leaks. Replace if necessary.
5. Dispose of the used filter element in accordance with local regulations.
6. Inspect the replacement filter element for any signs of shipping or handling damage. Do not install a damaged filter element.
7. Using a clean lint-free rag, clean the filter mounting surface and threads of any debris or contamination.
8. Apply a thin film of clean oil to the gasket and to filter mounting surface and threads.
9. Install the filter element in the filter canister, and thread it into the mount. Spin the filter canister on until the gasket first contacts the sealing surface.
10. Carefully tighten the filter canister in accordance with the directions on the canister, torquing the canister to 26-ft·lb (35-N·m).
11. Reinstall the pressure release plug, torquing the plug to 20-ft·lb (27-N·m).
12. Bleed any air from the hydraulic system and check for leaks.

***NOTE:*** *Do not overtighten the filter canister or pressure release plug.*

***Figure 4-2.** Charge Filter Replacement*




## 4.9 Checking and Changing Hydraulic Fluid and Return Filter

**CAUTION**

Accessing or servicing the closed hydraulic system incorrectly could cause injury or equipment damage. The hydraulic system must be safely depressurized, parts must be installed correctly, and care must be taken to prevent contaminants from entering the system. Only trained personnel should perform these tasks.

The primary hydraulic system return filter is mounted on the top of the hydraulic tank, inside the van body. Replace the return filter as follows:

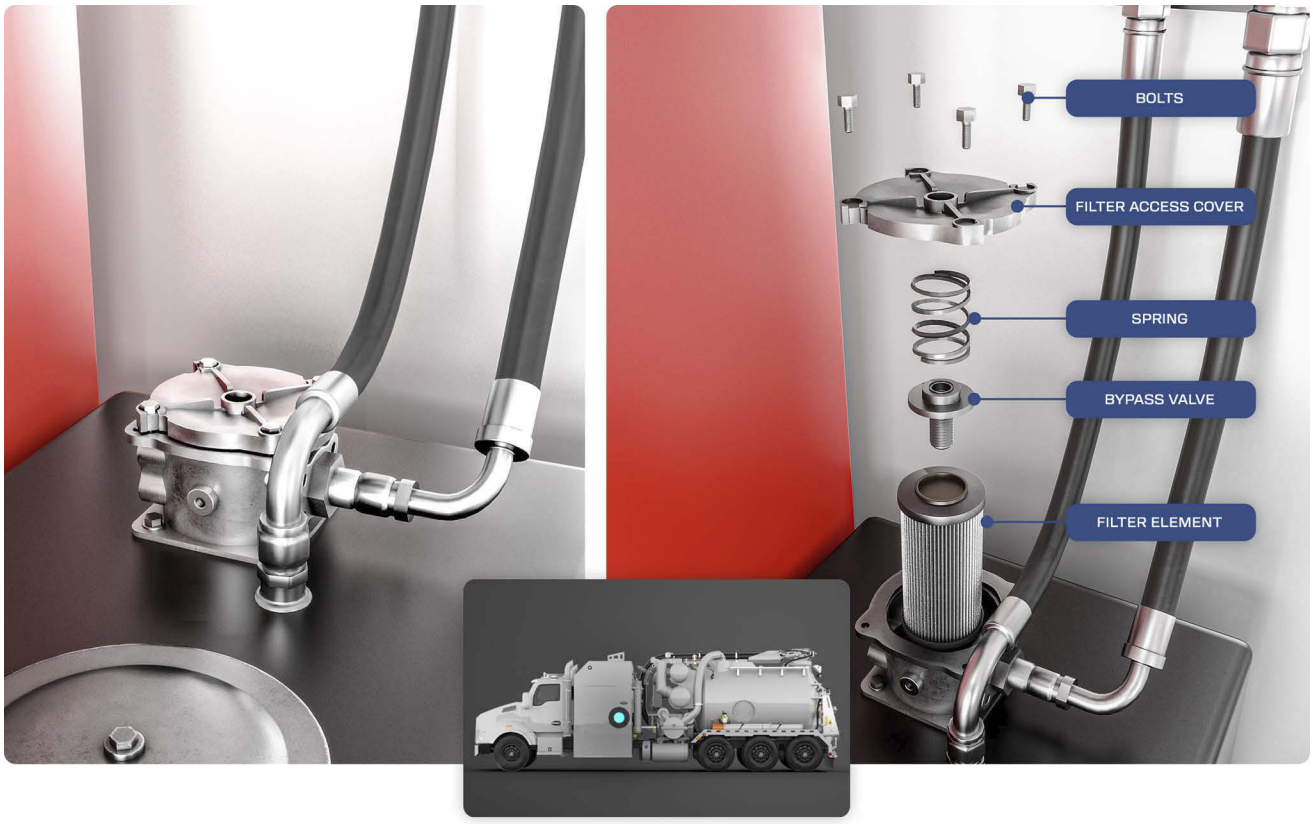
1. Ensure the hydraulic system is shut down and the pressure has been bled from the system.
2. Remove the four bolts and the filter cover.
3. Remove the spring, bypass valve, and filter element.
4. Dispose of the used filter element in accordance with local regulations.
5. Inspect the replacement filter element for any signs of shipping or handling damage. Do not install a damaged filter element.
6. Using a clean lint-free rag, clean the filter mounting surface and threads.
7. Apply a thin film of clean hydraulic fluid to the filter mounting surface and threads.

8. Install the filter element, bypass valve, and spring into the filter housing, ensuring they are properly arranged and seated (see Caution below).
9. Install the filter cover and secure it with the four bolts, tightening the bolts evenly across the cover.
10. Bleed any air from the hydraulic system and check for leaks.

**CAUTION**

To prevent serious equipment damage, care must be taken to install the bypass valve and other parts in the correct orientations. Removal of parts threaded directly into the aluminum tank, such as the return filter housing, should be avoided, but if removed, service personnel must be careful to avoid overtightening threaded components into the aluminum tank.

***Figure 4-3.*** *Return Filter Replacement*



Use the sight glass at the front of the hydraulic tank to monitor hydraulic fluid levels. Check the fluid level and condition as prescribed (see “Hydrovac Maintenance Daily Tasks” on page 87 and “Recommended Change Intervals” on page 90). New fluid can be added via the fill port on top of the tank when appropriate.

***Figure 4-4.*** *Checking Hydraulic Fluid*

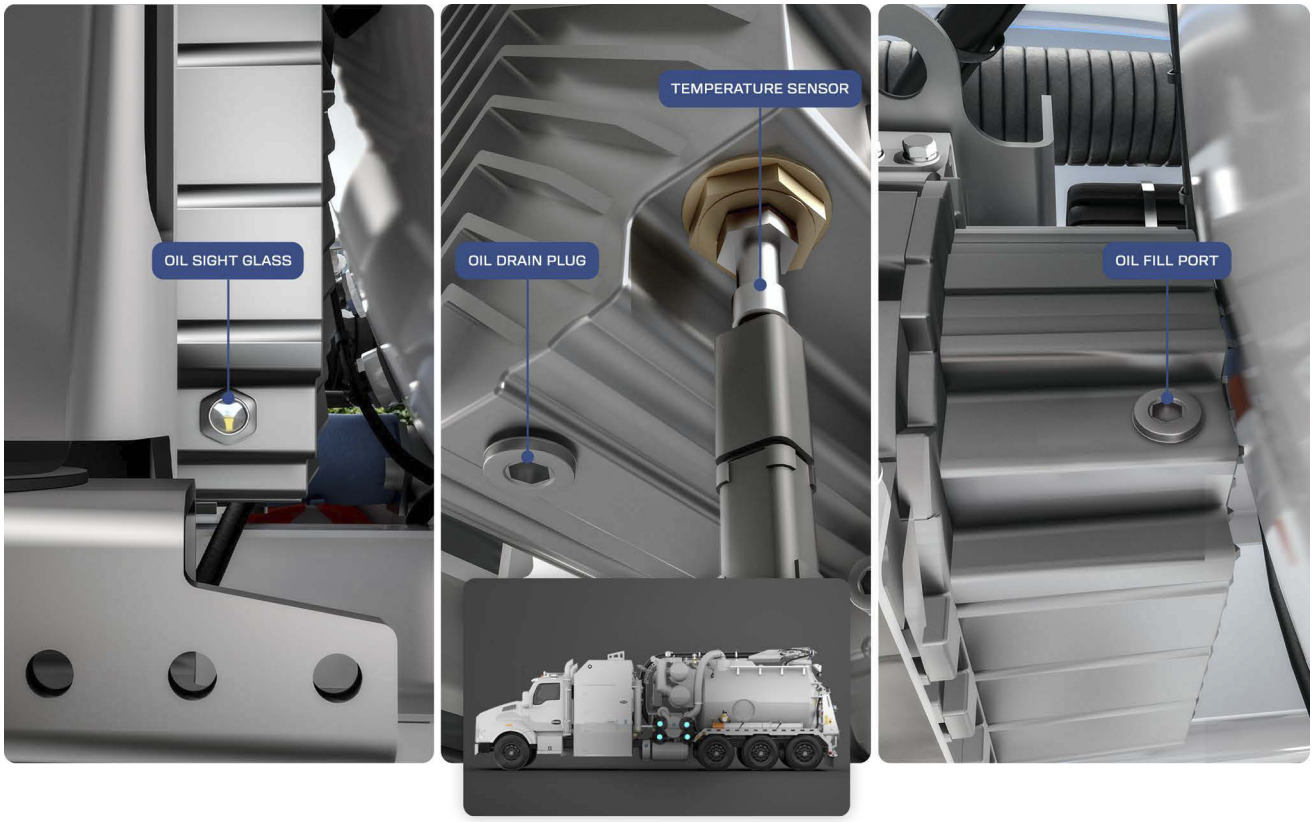


## 4.10 Checking and Changing Blower Oil

The blower oil level should be checked daily prior to running the blower. The blower has two oil reservoirs with sight glasses visible from the driver's side and both must be checked. With the equipment parked on level ground, the oil level should reach the halfway point on each sight glass. Add oil via the oil fill ports as necessary (see "Recommended Lubricants and Fluids" on page 91 for the specified lubricant).

Changing oil must also be performed for both reservoirs of the blower. The drain plugs are positioned below the sight glasses.

***Figure 4-5.*** *Blower Oil Checks*



# 4.11 Check and Change Transfer Case Oil Level

## 4.11.1 Checking Transfer Case Oil Level

The transfer case oil level should be checked daily. Add oil via the oil fill port(s) as necessary (see “Recommended Lubricants and Fluids” on page 91 for the specified lubricant).

1. Run the truck for approximately 5 minutes to ensure the cooler circuit is full of oil.
2. Turn the truck off.
3. Immediately check oil level using the dipstick on the transfer case.

**CAUTION**

Transfer case oil will be hot. Avoid contact to prevent possible burns.

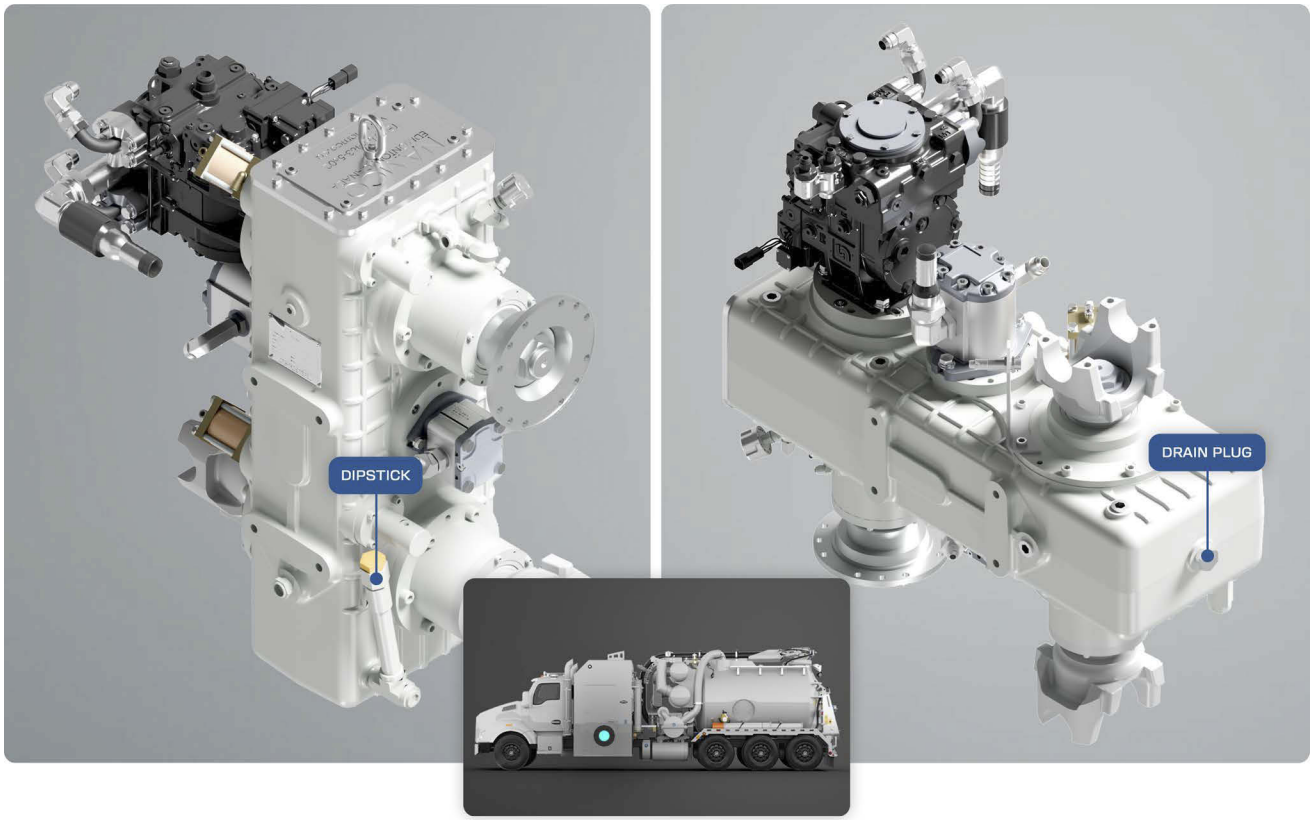
## 4.11.2 Changing Transfer Case Oil

***NOTE:***

- *Avoid oil change immediately after the truck has been running because the cooler circuit will be full of fluid. Fluid should only be changed after the truck has been off for 3 or more hours to allow oil to collect in transfer case and cool down.*
- *Oil capacity of the transfer case and cooler circuit is approximately 3.6-US gal.*

1. Place an oil collection reservoir under the transfer case drain plug.
2. Carefully remove the drain plug and allow all oil to drain out of both the transfer case and the oil cooler circuit.
3. Drain the lines between the secondary hydraulic pump and the oil cooler by disconnecting at the secondary hydraulic pump.
4. Reinstall and properly tighten the lines you removed and reinstall the drain plug.
5. Fill the transfer case with oil (see “Recommended Lubricants and Fluids” on page 91 for the specified lubricant).
6. Start the truck and run the engine at low idle speed for 5 minutes to allow oil to cycle through the cooler circuit.
7. Turn the truck off.
8. Use the dipstick to check the oil level before using the truck.
9. Dispose of the used fluid in accordance with local regulations.

***Figure 4-6.*** *Transfer Case Maintenance*




## 4.12 Clean or Change Hydrovac Air Filter

**CAUTION**

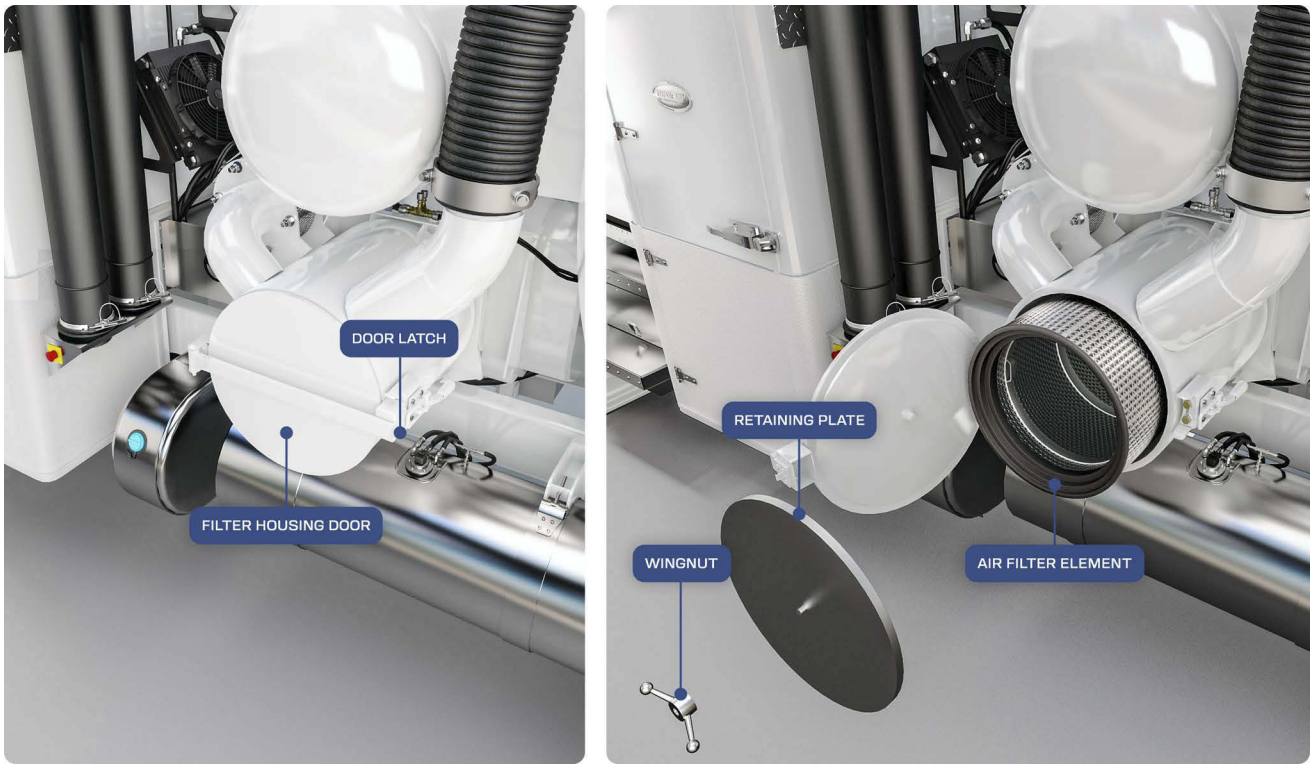
Handle the filter element with care as operating the hydrovac with a damaged air filter can allow dirt or debris to bypass the filter and enter the blower, causing blower damage or failure.

***NOTE:*** *Ensure the air filter is cleaned at the required interval, as it must be clean and fully dry before every job. It is recommended to have two filters to allow one to be drying while the other is in use.*

1. Release the latch on the air filter housing and open the door.
2. Unscrew and remove the wingnut and retaining plate.
3. Grasp the dirty filter element and remove from the filter housing.
4. Clean the dirty filter element using clean, high-volume, low-pressure water if available. If using the hydrovac's spray gun attachment, keep the gun's tip at least 12 inches away from the filter and use the minimum pressure required to dislodge any debris. Do not use a pressure wand. Wash downward along the filter pleats until the water runs clean. Work around the filter, then turn the filter over and repeat.

5. Spray from the inside of the filter to flush out any missed debris.
6. Let the filter dry for 24 hours.
7. Inspect the clean and dry filter element and the rubber seals on both ends for any holes, tears, cuts, or other damage that would allow dirt to bypass the filter or otherwise degrade filter performance. If necessary, replace the filter element.
8. Insert and carefully seat the clean, dry filter element onto the retaining ring in the air filter housing.
9. Install the retaining plate and wingnut to secure the filter element.
10. Swing the air filter housing door closed and secure with the door latch.

***Figure 4-7. Air Filter Maintenance***



# 4.13 Greasing Hydrovac System Components

## 4.13.1 Greasing Blower Driveshaft

- On the blower side of the driveshaft, apply grease to the two grease nipples on the U-joint until you see it coming out.
- On the transfer case side of the driveshaft, apply grease to the two grease nipples on the U-joint and the grease nipple on the slip joint connection until you see it coming out.

## 4.13.2 Greasing Dump Door Components

- Apply grease to the grease nipple on either locking ram until you see it coming out.
- Apply grease to the grease nipples located at either end of the open and close ram until it is coming out on either side of the ram.

## 4.13.3 Greasing Additional Components

- Apply one pump of grease to the grease nipple on the debris tank fill arrow.
- Apply one pump of grease to the grease nipple on the vacuum-assist water fill valve lever.

## 4.13.4 Greasing Boom Components

The boom components are greased via a manifold mounted just below the valve block. Apply grease to the fittings on the grease manifold in accordance with the following table. Two operators are required to safely perform this procedure.

**BOOM GREASE MANIFOLD AMOUNTS**

| Grease Fitting | Item | Amount of Grease (Number of Pumps) |
|---|---|---|
| 1 | Boom Roller | 5 |
| 2 | Boom Hinge | 5 |
| 3 | Boom Hinge | 5 |
| 4 | Ram Connection | 5 |
| 5 | Ram Connection | 5 |
| 6 | Ram Heel Pin | 5 |
| 7 | Ram Heel Pin | 5 |
| 8 | Turret Worm Bearing | 5 (see Note) |
| 9 | Turret Worm Bearing | 5 (see Note) |
| 10 | Turret Open Gear | 15 (see Note) |
| 11 | Turret Main Bearing | 30 (see Note) |

***NOTE:*** *These items require the boom swivel motor to be operating while greasing. Ensure the turret is rotating while applying grease.*

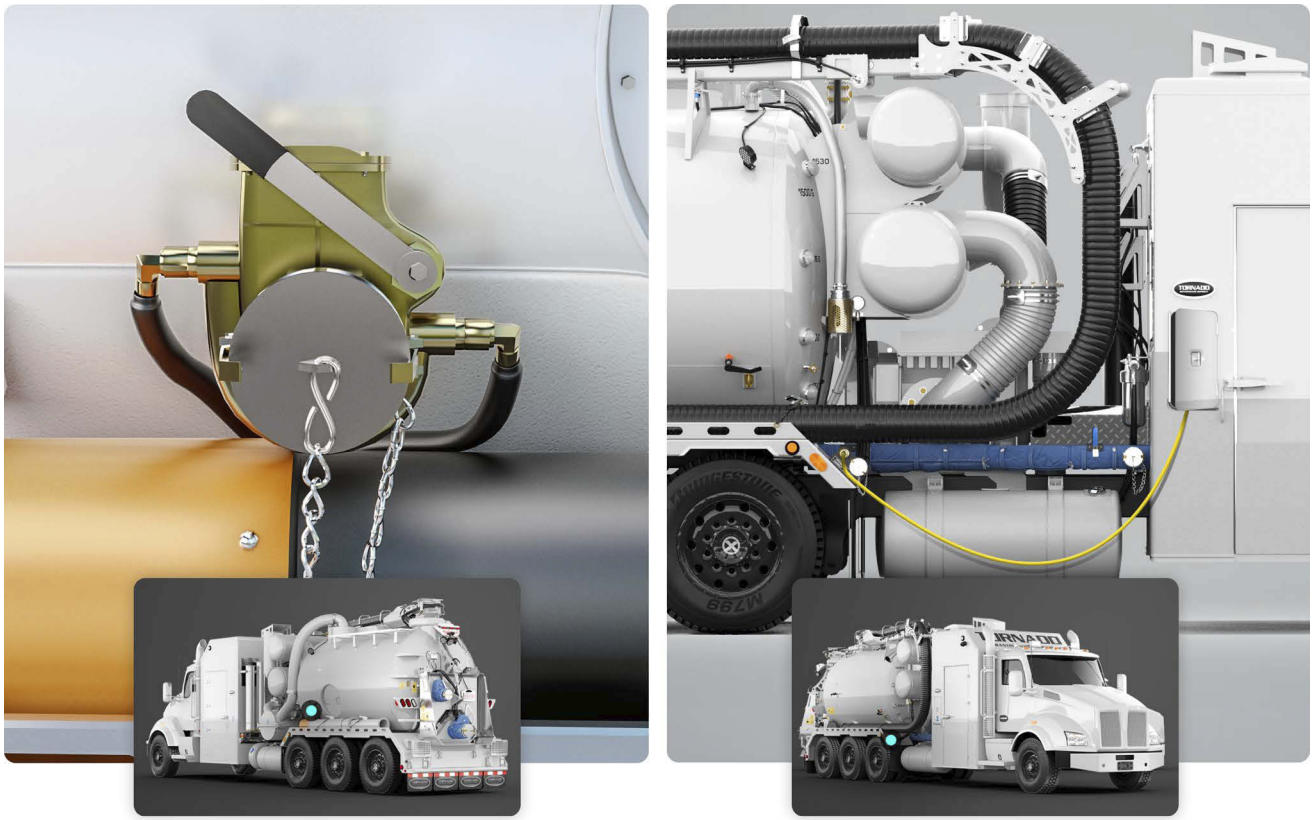
**Figure 4-8.** *Grease Manifold and Grease Points*




## 4.14 Cleaning Cyclone

1. Remove the 4-in camlock from the cyclone cleanout port on the driver side of the unit.
2. Connect a 4-in hose to the cyclone cleanout port and place the other end into the dump site or an approved dumping location.
3. Open the 4-in cyclone cleanout valve.
4. Engage the hydraulics (see “Engaging Hydraulics” on page 40).
5. Connect the dig hose to the cyclone cleanout port located on either the passenger-side fender or above the toolbox, depending on your hydrovac model.
6. Engage the water system (see “Engaging Water System” on page 72) and set the water pump percentage to 50%.
7. Run water for approximately 2 minutes, or until the discharge from the 4-in hose runs clear.
8. Disengage the water system.
9. Disconnect hoses and perform cleanup.

***Figure 4-9.** Cleaning Cyclone*



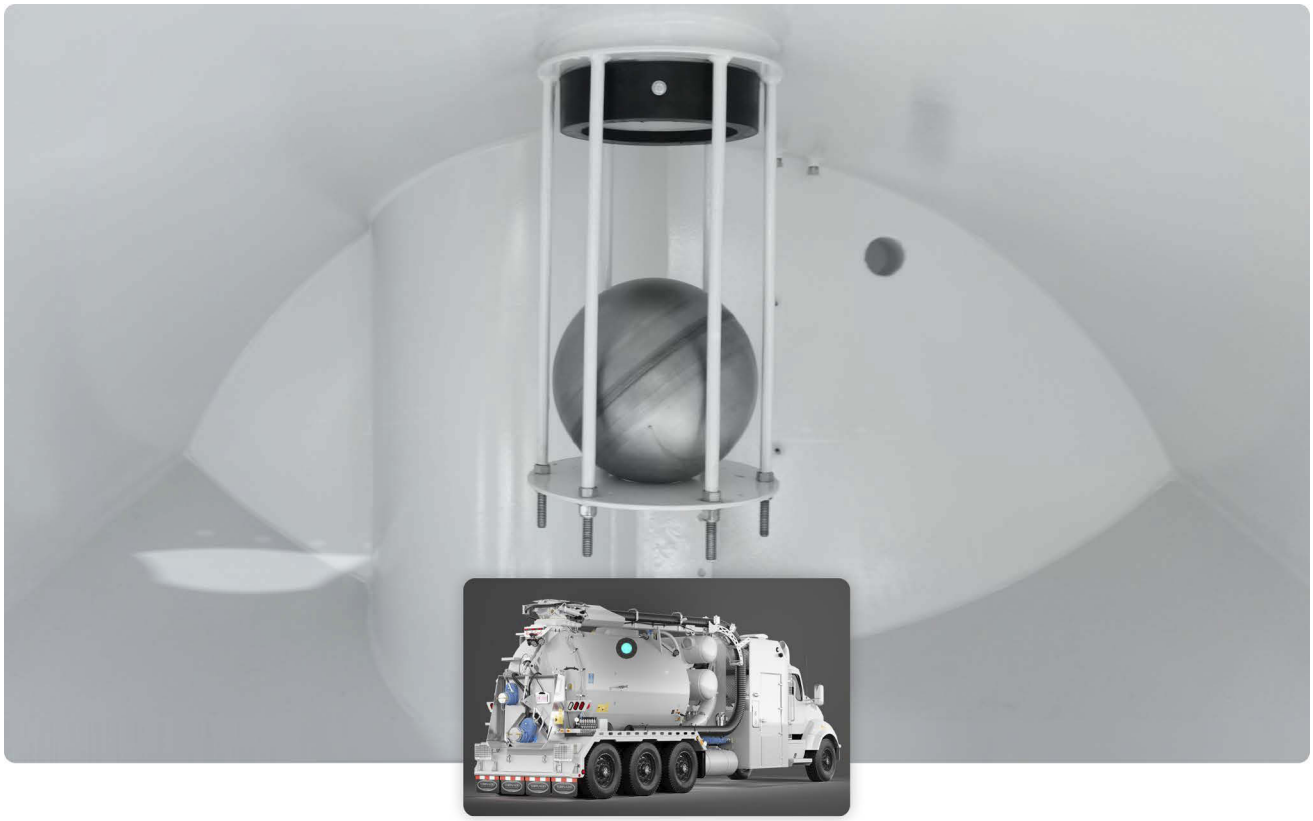
## 4.15 Inspect Rear Debris Tank and Dump Door

1. Inspect the dump door seal and visible areas of the seal groove for signs of wear, damage, corrosion, or other defects that might impair operation. Look for signs of leakage that could indicate a faulty seal. Repair or replace defective components as required.
2. Inspect the dump door surface (inside and outside) for wear, damage, corrosion, or other defects. Repair or replace as required.
3. Inspect the door hinges, door ears, and locking pins for signs of wear, damage, corrosion, or other defects that might impair operation. Check that all fasteners are present and properly tightened. Repair or replace defective components as required.
4. Inspect the hydraulic rams, hoses, and other components of the dump door for signs of leakage, wear, damage, corrosion, improper operation, or other defects that might impair operation.
5. Inspect the debris door's 6-in gate valve and 8-in gate valve for signs of leakage, loose or missing hardware, and proper operation of valve levers. Repair or replace defective components as required.
6. Inspect the exterior surfaces and components of the debris tank for signs of wear, damage, corrosion, or other defects that might impair operation. Repair or replace defective components as required.
7. Inspect the interior surfaces and components of the debris tank for signs of wear, damage, corrosion, or other defects that might impair operation. Repair or replace defective components as required.
8. Inspect the shutoff float ball assembly for signs of wear, damage, corrosion, or other defects that might impair operation. Inspect the gasket for wear or damage that might result in leaks. Repair or replace defective components as required.

**Figure 4-10.** *Dump Door Inspection*




**Figure 4-11.** *Float Ball Assembly*



### 4.15.1 Dump Door Seal Replacement

**⚠ WARNING!**

- Avoid dump door pinch points and always use the dump door locking pins to prevent serious crush injuries.
- Ensure all personnel stand clear of the rear of the truck while squishing and locking the dump door on a new door seal. This step applies additional stress to the dump door locking rollers, possibly turning door locking components into projectiles if a catastrophic failure occurs.
- Wear chemical-resistant disposable gloves while handling super glue, urethane, and other chemicals.

1. Ensure the truck is turned on and the hydraulics are engaged (see “Engaging Hydraulics” on page 40).
2. Open the dump door and securely insert both door locking pins (see “Dump Door Operation” on page 63).
3. With the door secured in the open position, reduce the engine speed to low idle and disengage the hydraulics, then turn off the truck.
4. Remove the screws from the eight ¼-in weeping holes around the dump door seal; there are two on the top, two on each side, and two on the bottom.
5. Locate the joint seam of the dump door seal and use the flat edge of a small pry bar to pry the seal apart.
6. Pull the door seal out of the tank groove, using the pry bar as needed, until the dump door seal has been fully removed.
7. Clean the dump door’s seal channel thoroughly with a wire wheel or equivalent cleaning tool until bare metal is exposed and all debris and contaminants are removed (see Note). Verify that all eight weeping holes are clear and exposed.
8. Dry fit the rubber seal in the channel to confirm it is the correct length. Do not apply urethane at this stage.
9. Cut the seal ends as square as possible, making sure the edges are flat and the cut is perpendicular to the seal.
10. Apply a thin layer of super glue to one end of the door seal, then firmly press the ends together to form a continuous loop, rubbing them against each other to spread the glue and let air escape (see Note). Secure the joint in a bench vice with the rounded edge facing upwards.
11. Spread a small amount of additional super glue just along the accessible rounded edge of the joint, then allow the glued joint to cure for at least 15 minutes, until set.
12. Apply black windshield urethane evenly into the channel, just enough to cover the bottom of the groove (see Figure 4-12). Maintain a consistent bead size around the entire perimeter to ensure full seal coverage.
13. Install the door seal into the urethane-filled channel using a large mallet. Position the glued seam at the top center of the door, then work evenly down both sides, alternating back and forth. At the corners, twist the vertical part of the seal slightly to help it bend and press it into the corners. Complete the installation at the bottom of the door.

14. Generously spray a layer of white lithium grease onto both the door seal and the areas of the debris tank near the seal to prevent urethane from bonding to these areas and make cleaning easier.
15. Cover the inside of the dump door with adhesive-backed plastic wrap to prevent urethane from bonding to the door.
16. Turn on the truck, engage the hydraulics, and increase the engine speed to operating levels.
17. Remove and stow both dump door locking pins, then close the dump door firmly onto the seal, but do not engage the locks.
18. Open the dump door and reinstall the locking pins.
19. Inspect the grease imprint on the plastic around the dump door. Ensure that three parallel grease lines are clearly visible along the entire track, indicating that proper seal contact was achieved. If there are breaks or less than three lines are visible, the door seal needs to be worked deeper into its groove and reinspected.
20. Once the door seal is deemed to be properly seated, remove the dump door locking pins, then fully close and lock the dump door, ensuring that the door pins engage with the rollers.
21. Safely perform the truck shutdown steps (see “System Shutdown” on page 83).
22. Ensure that the dump door remains clamped shut against the door seal for a minimum of 48 hours. Do not expose the door seal or urethane to any fluids while the urethane cures.
23. After curing is complete, turn on the truck, engage the hydraulics, and increase the engine speed to operating levels.
24. Unlock and open the dump door, then install both dump door locking pins.
25. Remove the plastic wrap and clean any excess grease and urethane.
26. Install $^{3}/_{16}$-in x 1-in self-drilling screws into the eight weeping holes around the dump door seal, being careful not to overtighten them.

***NOTE:***

- *Proper metal exposure is critical for good urethane adhesion.*
- *Before gluing the ends of the door seal together, ensure there are no twists in the rubber seal. Do not to apply too much glue to the ends.*

*Figure 4-12. Door Seal Urethane Application*




## 4.16 Boom Inspection

Routine inspection of the boom assembly is essential for maintaining safe hydrovac operation and minimizing component wear. Perform the inspections below monthly or every 100 operating hours, whichever occurs first. Two operators are required to safely perform these procedures.

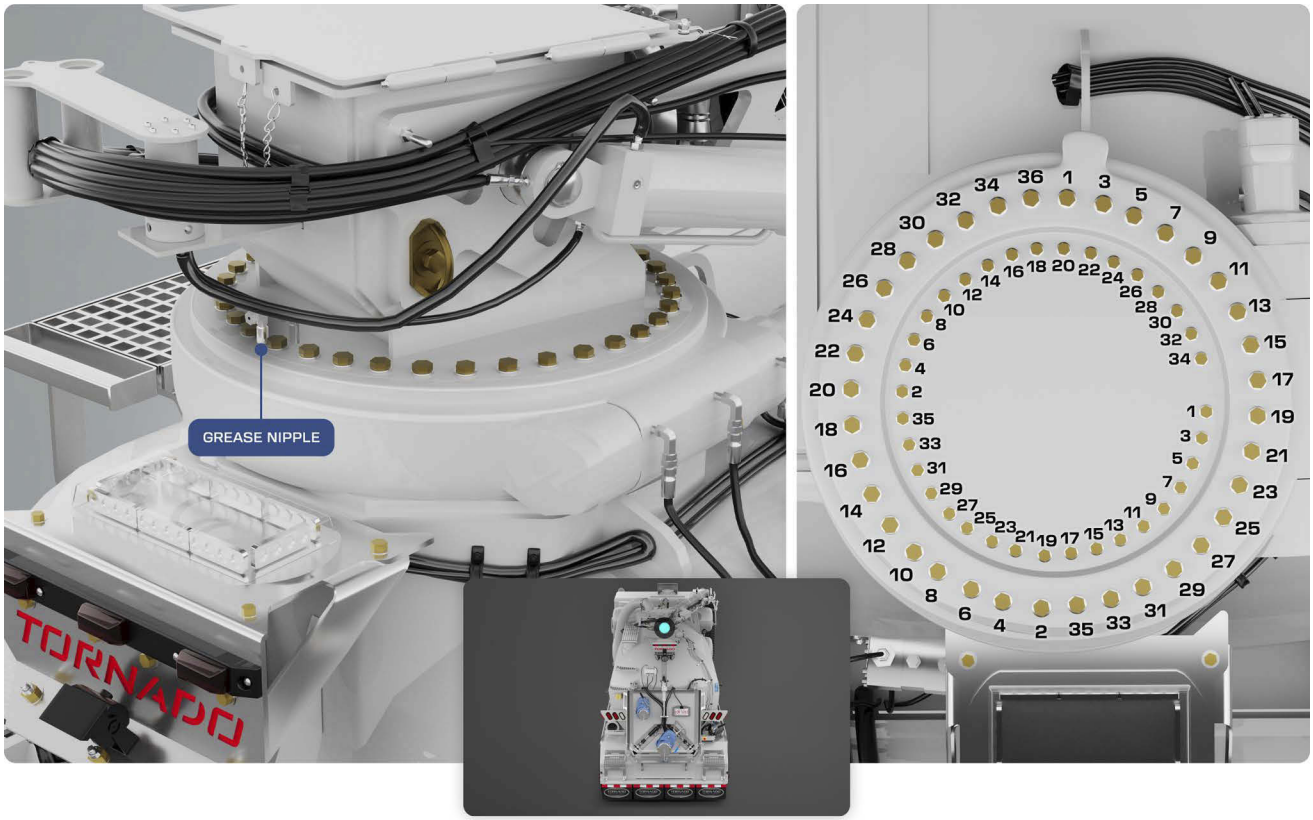
### 4.16.1 Boom Mounting Bolts

Inspect all boom turret mounting bolts for correct torque and signs of wear or loosening.

- **Torque specification –** All top (exterior) and bottom (interior) boom turret bolts must be torqued to 285-ft·lb.
- **Torque pattern –** Use the star pattern shown in Figure 4-13 to torque both the interior and exterior bolts. Torque one bolt set completely (top or bottom) before proceeding to the other.
- **Loose hardware –** Any bolts found excessively loose or damaged must be discarded and replaced. Use ¾-in × 2½-in Grade 8 bolts with ¾-in wedge lock washers. Apply Loctite® 242 to threads during installation.

***NOTE:*** *The top (exterior) bolts at positions #2 and #35 are adjacent to a grease nipple. These two bolts require low-profile wedge locking washers.*

*Figure 4-13. Boom Mounting Bolts*



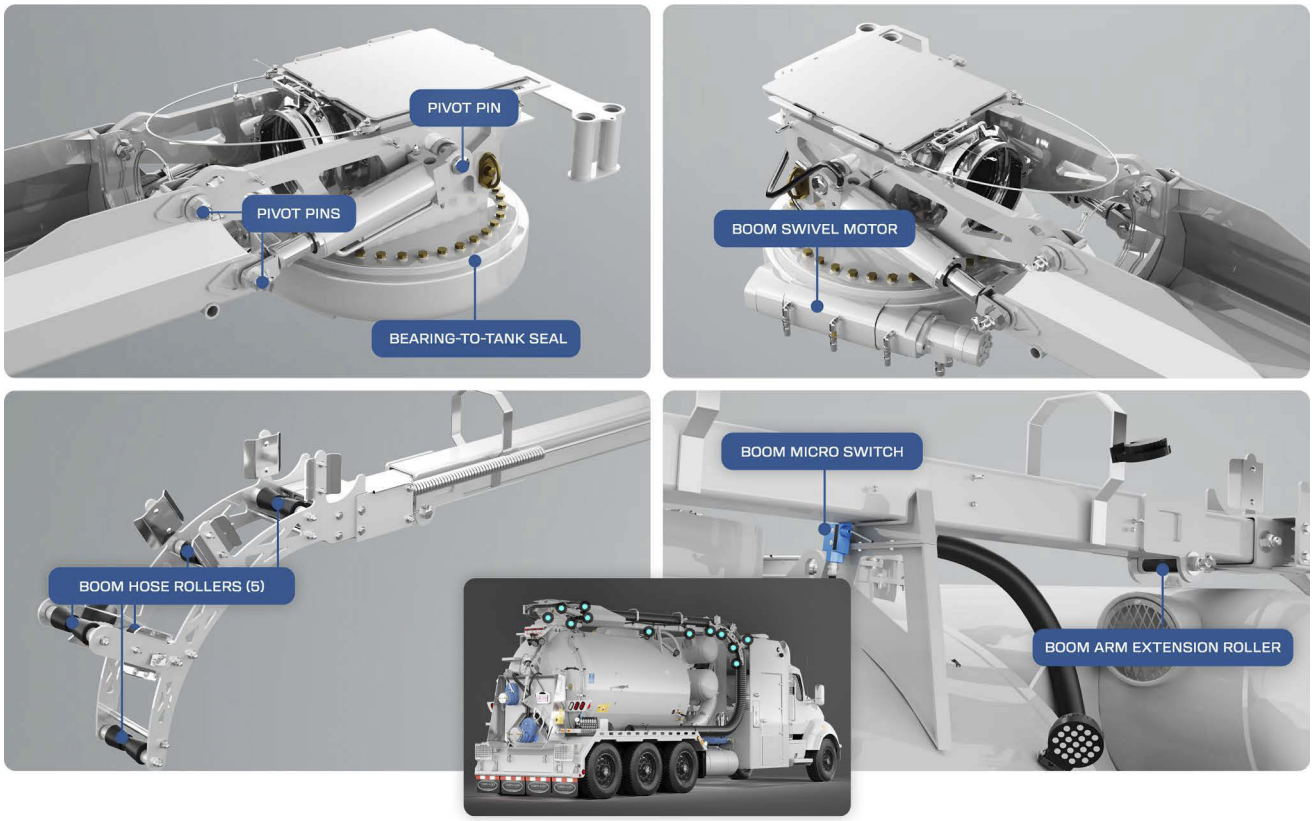

## 4.16.2 Boom Structural and Mechanical Inspection

Visually and physically inspect the boom assembly for the following conditions:

- **Pivot pins, rollers, and associated fasteners –** Check for wear, looseness, corrosion, or missing components.
- **Boom swivel motor –** Examine for signs of fluid leakage, damage, or irregular operation.
- **Bearing-to-tank seal –** Inspect for deterioration or leaks.

Repair or replace components as needed based on inspection findings.

*Figure 4-14. Boom Checks*




## 4.16.3 Boom Lockout Micro Switch Testing

**CAUTION**

Boom movement can cause crush injuries or equipment damage. Only perform the boom operational testing with clear line of sight to the boom and no obstructions nearby.

To test the boom lockout micro switch:

1. Ensure the truck is running and the hydraulics are engaged.
2. Enable remote control function.
3. Place the boom in its stowed position, if not already fully seated in the cradle.
4. Carefully use the handheld remote controller to extend or retract the boom, observing the response and stopping immediately if there is movement.

If the boom does not extend or retract using the handheld remote controller, the boom lockout micro switch is likely functioning as intended. However, if the boom moves, the micro switch or remote control interlock system is faulty and must be serviced immediately.

## 4.17 Inline Water Filter Cleaning

The inline water filter prevents debris, deposits, and other solid matter from damaging the water pump. To prevent pump damage and ensure efficient operation, the inline water filter must be cleaned daily (see the Clean Out Daily decal in “Safety and Informational Decals” on page 18) and the filter screen must be inspected for damage. Damaged filters must be replaced immediately.

1. Unscrew the water filter cannister by hand or using an oil filter wrench, if needed.
2. Dump out trapped water from the cannister and remove the filter screen.
3. Rinse off the filter screen and cannister. If needed, a soft bristled brush can be used to gently clean the filter screen.
4. Inspect the filter screen for damage and replace if needed.
5. Place the filter screen back into the cannister. Reinstall the cannister into the inline water filter’s body by hand. Do not overtighten.

## 4.18 Annual Water Tank Inspection and Cleaning

**⚠ WARNING!**

The water and debris tanks are considered dangerous confined spaces due to the risk of hazardous gases and limited access points for rescue. See “Confined Space Entry” on page 34.

Regular water tank inspections are essential to prevent contamination, detect early signs of corrosion or damage, ensure components function properly, and extend the overall lifespan of the tank. Perform the following steps annually.

1. Open the main ball valve and ensure all the water is drained out.
2. Remove the manway cover on the driver side of the tank and discard the bolts.
3. Clean out any sludge or debris in the tank.
4. Inspect the recirculation hose for damage.
5. Inspect the inside of the tank for corrosion or other signs of damage.
6. Reinstall the manway cover and secure with new ⅜-in x 1-in grade 8 bolts with Loctite® 243 or equivalent threadlocker, torqued to 33-ft·lb.

## 4.19 Inspect Water Hoses and Components

1. Inspect the water hoses for leaks, cracks, chafing, or other damage that might impair proper operation. Repair or replace defective components.
2. Inspect the washout gun, dig wands, and nozzles for leaks, cracks, or other damage that might impair proper operation. Repair or replace defective components.
3. Inspect the quick disconnects, valves, and hand levers for proper operation. Repair or replace defective components.

***Figure 4-15.*** *Washout Gun and Dig Wand*




## 4.20 Water Heater Inspection and Maintenance

**⚠ WARNING!**

Improper operation or maintenance of the water heater may cause burns, fire, explosion, or asphyxiation. The water heater must only use compatible diesel fuel and must never be used without adequate ventilation. All components and plumbing downstream of the heater module can become extremely hot during and after use.

Routine inspection and maintenance of the water heater is important to ensure safe operation and equipment readiness. Damaged, worn, or unclean components can prevent the water heater from starting, reduce performance, or create hazardous conditions.

The following procedures are general guidelines. Always refer to the specific water heater manufacturer's documentation for detailed service intervals, tolerances, and part specifications.

Perform the following steps on a weekly basis:

1. While the equipment is fully cooled, visually inspect all hoses, fittings, and fuel lines for cracks, wear, and signs of leaks.
2. Operate the water heater and perform three heating cycles between 80°F and 120°F. During each cycle, verify that the flow switch works (by momentarily stopping the water flow) and that the burner shuts off automatically once the water reaches 120°F at the heater's outlet.

Perform the following steps yearly or every 500 water heater hours:

1. Check the fuel pressure and adjust if necessary.
2. Inspect the exhaust stack for excessive soot accumulation, then clean and perform further testing if necessary.
3. Inspect and clean the flow switch.
4. Inspect the fuel nozzle and clean if necessary.
5. Measure the flame sensor's electrical resistance during use. Once cooled, clean or replace the sensor if necessary.
6. Look for signs of scaling and perform descaling if necessary.

## 4.21 Record Vacuum Pressure

Test the vacuum pressure of the hydrovac each month. Tracking vacuum pressure over time will help identify declines in vacuum efficiency, which may indicate the presence of a system leak.

1. Engage the hydraulics (see "Engaging Hydraulics" on page 40) and the blower (see "Engaging Blower" on page 41).
2. Set the engine to operating speed.
3. Cover the boom hose to deadhead the system (see Note 1).
4. Close the vacuum breaker.
5. Let the system run for 15 seconds to create negative pressure (see Note 2).
6. Record the mercury level on the vacuum pressure gauge in the table provided on the following page.

**CAUTION**

- The hydrovac generates negative pressure through the boom hose. Do not position your body or other objects near the boom hose opening while the blower is engaged.
- Do not place the board on the boom hose while the vacuum breaker is engaged. Always place the board on while the vacuum breaker is disengaged.

***NOTE:***

1. *Use the end of the boom hose tray or the boom hose lid (part number HVAC-3731) to cover the boom hose. Alternatively, any flat, sealed surface that can withstand vacuum will suffice.*
2. *If the system has been running for longer than 15 seconds and still has not created negative pressure, it should be inspected for leaks.*

| VACUUM PRESSURE TRACKER | | |
|---|---|---|
| Date | Tester | inHg |
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# Appendix A

# Hydrovac Options

This appendix provides information about the following optional equipment available for the F-Series hydrovac trucks:


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Air-Weigh Scale .....113
Arrow Board .....115
Boom Alarm .....116
Debris Dozer .....117
Dig Wand Wireless Kill Switch .....118
Dual Hose Reel .....121
Grounding Cable .....122
RIGHT WEIGH Scale .....122
Sludge Pump .....123


## A.1 Hydrovac Options List

| OPTIONS LIST | |
|---|---|
| **Option** | **Description** |
| **Air-Weigh Scale** | An onboard load scale system that measures the weight (load) being carried by the truck. |
| **Arrow Board** | Board with directional lights to guide approaching drivers safely around the vehicle. |
| **Boom Alarm** | Safety interlock system that alerts operators if the boom is not secured before moving the truck. |
| **Debris Dozer** | A hydraulically-operated system designed to push compacted dirt or debris out of the debris tank. |
| **Dig Wand Wireless Kill Switch** | A handheld wireless control device that communicates with the Aarcomm module and receiver system. |
| **Dual Hose Reel** | A second hose reel that makes digging easier in tight spots and simplifies debris cleanout at the debris end. |
| **Grounding Cable** | A cable reel and clip that allows the operator to ground the truck to reduce the potential for static discharge for sensitive environments. |
| **RIGHT WEIGH Scale** | An onboard load scale system that measures the weight (load) being carried by the truck. |
| **Sludge Pump** | A hydraulically-driven component that crushes or moves low-viscosity mixtures of liquids and solids out of the debris tank. |

## A.2 Air-Weigh Scale

The Air-Weigh® is an onboard load scale system integrated with the truck's Vortex control system and operated from the HMI. It measures the weight (load) being carried by the truck by reading air pressure from the rear axle air bags and a strain sensor on the front axle. This option allows operators to read their tare weight and gross vehicle weight.

The Air-Weigh scale is a combined monitoring tool and safety feature. It allows the operator to set alarms that trigger when an overweight condition is detected. These alarms are set independently, so operators can enable either alarm, both alarms, or neither. The alarms are interlocked with the Vortex control system and trigger the following actions when their respective weight threshold is reached:

- **Alarm 1** reduces the truck's engine speed to low idle and opens the vacuum breaker to cut off the vacuum. The vacuum breaker cannot be closed until the operator overrides Alarm 1 by pressing the OK button on the HMI or by increasing the engine speed. Note that once overridden, Alarm 1 will not activate again if more weight is added unless a higher weight threshold is set on the HMI.
- **Alarm 2** opens the vacuum breaker but does not affect the truck's engine speed. It can be overridden by pressing the OK button on the HMI. Alternatively, the operator can continue working by continuously holding the Vacuum On button of the handheld remote controller to close the vacuum breaker, but the vacuum breaker will open again if the button is released.

***NOTE:***

- *The truck needs to be on level ground for the weight to be accurate. Pressing TARE on the HMI will zero out the current weight of the truck and display only the weight added to the truck going forward. Care must be taken when calibrating and monitoring the truck's weight.*
- *The alarm value should not be set higher than the truck's gross vehicle weight rating. It is the responsibility of the operator to adhere to legal weight requirements.*
- *Refer to the OEM manual for further details on calibrating and operating the scale.*

**Figure A-1.** *HMI Settings Screen - Air-Weigh Scale*



# A.3 Arrow Board

The arrow board is an independent warning system that uses directional lights to guide approaching drivers safely around the vehicle. This option helps improve visibility, enhance safety, and prevent collisions at roadside work areas.

## A.3.1 Safety Considerations

- Ensure the correct arrow pattern (left, right, or center-out) is used to accurately direct traffic flow.
- Confirm all lights on the arrow board are working and visible from a safe distance, even in bright sunlight or bad weather.
- Always use cones, signage, and high-visibility clothing alongside the arrow board.
- Operators and workers should remain aware of passing vehicles and maintain a safe escape path.
- To avoid the possibility of confusing other drivers, turn off the arrow board before re-entering traffic.

## A.3.2 Operating Instructions

1. Press the Beacon On/Off button (see “Control Beacon Light” on page 43) on the 2x2 keypad to activate the arrow board system.
2. Press the On/Off button on the arrow board to turn on the system (the LED will light up when on).
3. Press the appropriate button to toggle the light function on or off as follows:

| ARROW BOARD OPERATION | |
|---|---|
| **Button** | **Function** |
| **On/Off** | Press to turn the arrow board on. Press and hold to turn it off. |
| **L** | Toggles the left arrow sequence on or off, directing traffic to the left of the vehicle. |
| **R** | Toggles the right arrow sequence on or off, directing traffic to the right of the vehicle. |
| **F** | Toggles the pre-programmed flashing sequence on or off. |
| **LP** | Toggles the system between normal and low-power operation. |
| **A** | Not used. |

***NOTE:*** *Refer to the OEM manual for additional details on programming and operating the arrow board.*

# A.4 Boom Alarm

The following sections describe the features and operation of the boom alarm interlock. The boom alarm interlock is designed to alert the operator when the boom is not fully stowed in the cradle before the truck is moved. This option utilizes electrical interlocks and audible alerts to reduce the risk of equipment damage or injury due to improper boom positioning during vehicle movement.

---

***NOTE:*** *The boom alarm interlock does not inhibit machine function, but provides a warning to the operator to prevent unintended movement with the boom unsecured.*

---

## A.4.1 Boom Position Detection

When the boom is lifted out of the cradle, a boom position switch is activated, indicating that the boom is no longer secured in its transport position.

## A.4.2 Operator Alerts and Actions

1. Upon detection of the boom being out of the cradle, the machine's keypad will illuminate blue to indicate the boom is in a deployed state.
2. If the parking brake is disengaged while the boom remains out of the cradle, after a delay of approximately 3 seconds, the dashboard buzzer will activate and alert the operator with an audible warning.
3. The buzzer will continue to sound until the parking brake is re-engaged and the boom is fully returned to the cradle. Both conditions must be met to silence the audible alarm.

# A.5 Debris Dozer

The debris dozer (or mud sweep) is a hydraulically operated system designed to push compacted dirt or debris out of the debris tank. This option increases unloading efficiency and reduces the risk of injury by minimizing the need for personnel to be near the dump door when debris is being discharged.

***NOTE:*** *If there is ice buildup on the debris dozer, it may not operate properly. Use the water heater and hot water through the dig wand to clear ice from the mechanism.*

## A.5.1 Safety Considerations

If the debris dozer is not moving, do not over-pressurize the system by holding the lever down for an extended period. Ensure that there is nothing obstructing the debris dozer movement.

**⚠ WARNING!**

- The debris dozer is a crush hazard that can cause serious injury or death. Do not climb inside the debris end while operating the debris dozer.
- Do not position yourself in front of the debris dozer while operating.
- Operating the debris dozer with the dump door closed can cause serious equipment damage. Ensure the dump door is open before operating the debris dozer.

## A.5.2 Debris Dozer Operation

1. To extend the debris dozer and push debris out of the tank, pull the lever on the valve block down. Once the debris dozer is fully extended, the blade will flip up and latch.
2. To retract the debris dozer, push the lever on the valve block forward. The debris dozer blade will touch the ram mount and unlatch the dozer blade.

***NOTE:*** *With the debris dozer fully extended, the pressure will read 1400-psi maximum. With the debris dozer fully retracted, the pressure will read 2800-psi maximum.*

# A.6 Dig Wand Wireless Kill Switch

The Aarcomm® wireless kill switch is a safety device that can be attached to the dig wand. It communicates with a receiver system in the van body. The wireless kill switch detects the angle of the dig wand and will automatically reduce the water pump speed if the angle exceeds a preset limit, indicating that the operator may have dropped the dig wand. Additionally, it allows the operator to control basic water pump functions remotely without using the handheld remote controller. The wireless kill switch can also be used in tandem with the handheld remote controller.

***NOTE:*** *Pairing requires both the wireless kill switch and receiver to enter matching mode within 60 seconds. Refer to the manufacturer's documentation and follow the pairing instructions carefully when setting up a new unit.*

## A.6.1 Safety Considerations and Warnings

- Always ensure the wireless kill switch is paired only with the correct Aarcomm receiver before operation.
- Do not rely solely on the wireless kill switch for machine stop—always use the main machine stop if available.
- Keep the wireless kill switch dry and clean. It is water resistant, but damage may compromise the waterproofing.
- Never attempt to open or service the device.

## A.6.2 Charging Instructions

The wireless kill switch is waterproof factory sealed. It is charged by placing it in the charging cradle. A 30-minute charge will allow the device to operate for 8 hours. A full battery will last 40 or more hours, depending on the performance setting.

***NOTE:*** *During operation, the red light will begin to flash when the wireless kill switch should be charged. A battery that is completely discharged will take approximately 3 hours to charge.*

1. Place the wireless kill switch on the charging cradle to begin charging. The display will show the charge status.
2. Allow 1–2 minutes for the charge level to be calculated accurately.

*Figure A-2. Wireless Kill Switch*




### A.6.3 Device Configuration

The wireless kill switch can be configured in various ways:

- **Horizontal mode –** The maximum angle is calculated as the angle from horizontal.
- **Vertical mode –** The maximum angle is calculated as the angle from vertical.
- **Slope mode –** The maximum angle is calculated from halfway between the vertical mode reference and the horizontal mode reference.

To toggle through the vertical, slope, and horizontal sensing modes, simultaneously press the top two gray buttons. When the mode has been changed, the device will display GET READY for 5 seconds and then resume normal motion sensing operation.

### A.6.4 Operating Instructions

1. Turn on the truck.
2. Power on the wireless kill switch using the following sequence of button presses:
   - 2.1. Press and hold the red button.
   - 2.2. Press and hold the green button.
   - 2.3. Release the red button.
   - 2.4. Release the green button.
3. Once powered, the screen will display the configured sensing mode (vertical, slope, or horizontal) and GET READY. After 5 seconds, it enters sensing mode and begins monitoring movement.

4. During normal operation, the display will show information for the function of each button (e.g., on, off, increase water pump speed, decrease water pump speed, etc.).
5. To power off, press the red button.

### A.6.5 Disabling Wireless Kill Switch (Optional)

If you are using the handheld remote controller and the water pump features are grayed out/disabled while other screen symbols are black, this means you need to disable the wireless kill switch lockout feature. The following instructions will disable the wireless kill switch:

1. Turn on the receiver. These parameters are saved in the receiver (and the handheld remote controller) so the receiver must be powered on to change them.
2. On the wireless kill switch, enter configuration mode, as follows:
   - 2.1. Press and hold the red button.
   - 2.2. Press and hold the green button.
   - 2.3. Release the red button while continuing to hold the green button.
   - 2.4. Wait for the green LED to stop flashing.
   - 2.5. Release the green button. You should now see a splash screen for configuration mode.
3. Reset the wireless kill switch settings to default, as follows:
   - 3.1. Use the left or right upper screen keys to advance the screens until you get to the “reset all params to default” screen.
   - 3.2. Press the button marked “YES”.
   - 3.3. When prompted for a password, enter 1314 on the bottom screen.
   - 3.4. Press the button marked “YES” again.
   - 3.5. At the “Are you sure?” prompt, press the button marked “YES” again. The screen will display “All param reset Green to save”.
   - 3.6. Press the green button. The system should now be set to factory settings and the handheld remote controller will operate properly.

Alternatively, you can change the wireless kill switch settings, as follows:

1. Use the left or right upper screen keys to advance the screens until the “Wand?” screen is displayed.
2. Press the button marked “-”.
3. When prompted for a password, enter 1314 on the bottom screen.
4. Press the button marked “-” again. The parameter should change to “none”.
5. Press the green button.
6. The new parameter is now saved.

# A.7 Dual Hose Reel

The dual hose reel allows operators to use two hoses, making digging easier in tight spots and simplifying debris cleanout at the debris end. It improves convenience, efficiency, and overall productivity.

## A.7.1 Safety Considerations

Always ensure that you are opening the correct hose reel. Opening the incorrect hose reel can result in:

- Sudden pressure spikes within the system.
- Water discharging from the wrong nozzle, potentially causing bodily harm to nearby operators or yourself.
- Burns and dangerous pressure buildup if operating with the incorrect valve closed while the water heater is on.

## A.7.2 Operating Instructions

1. Locate the two ball valves beneath the water heater on the discharge pipe. The left handle controls the upper hose reel and the right handle controls the lower hose reel.
2. Open the ball valve corresponding to the hose reel you wish to use.
3. Refer to the operating procedure for instructions on using the water pump.

---

***NOTE:*** *It is not recommended to use both hose reels at the same time while digging, as this will reduce the flow rate and pressure and reduce digging efficiency.*

---

## A.7.3 Dual Hose Reel Winterization and De-Winterization

The standard winterization and de-winterization processes differ somewhat for trucks equipped with dual hose reels; however, if only one hose reel was used in operation, the regular winterization process can be followed as it is not necessary to re-winterize the unused hose reel. It is recommended that operators tag each hose reel valve with its own winterization tag.

To winterize dual hose reels, the winterization steps to drain and purge water from the hose reel must be repeated for the second hose reel before introducing winterization fluid to the system (see “Winterization Procedure” on page 83). The steps to pump winterization fluid through the hose reel must also be repeated for the second hose reel; an additional 2 gallons of winterization fluid will be required during the process to fully winterize the system if both hose reels were used.

To reclaim winterization fluid from both hose reels, the steps to push winterization fluid back into the winterization fluid tank must be repeated for the second hose reel before introducing water to the system (see “De-Winterization and Pump Priming” on page 71). However, operators should first verify whether there is sufficient capacity in the winterization fluid tank to accommodate the fluid from the second hose reel; if not, the additional fluid should be discarded during de-winterization.

The pump priming steps are unaffected by the addition of the second hose reel. However, if the second hose reel was not filled with water, operators should run the pump at no higher than 20% speed until a steady stream of water is exiting from the dig hose.

## A.8 Grounding Cable

The grounding cable is a cable reel that is mounted to the frame of the truck or on the fender with a ground strap attached to the frame. This option allows the operator to safely ground the truck.

### A.8.1 Safety Considerations and Warnings

The grounding cable is a safety feature designed to prevent static buildup or accidental electrical discharge, which could ignite airborne particles, flammable liquids, or vapors. To mitigate hazards:

- Always attach the grounding cable to an appropriate earth ground point before beginning work.
- Inspect the cable and connections for wear or damage before each use.

Improper grounding can cause electrical damage to the truck and potential damage to an operator.

### A.8.2 Operating Instructions

1. Hammer a steel ground rod securely into the earth near the work area.
2. Pull out the grounding cable from the reel.
3. Clip the cable securely to the steel ground rod to ground the truck chassis.

## A.9 RIGHT WEIGH Scale

The RIGHT WEIGH™ is an independent onboard load scale system installed on the truck. It is not integrated into the truck HMI, but has an independent control system. It measures the weight (load) being carried by the truck by reading air pressure from the center axle air bags. This option allows operators to read their tare weight and gross vehicle weight.

This independent system does not provide warning signals; it is a manual check system. This helps mitigate potential hazards such as:

- Overloading the suspension and tires.
- Overweight fines and regulatory violations.
- Vehicle instability.
- Damage to roadways or infrastructure.

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***NOTE:*** *The RIGHT WEIGH system is not calibrated from the factory and must be calibrated to obtain accurate readings. Refer to the OEM manual for details on calibrating and operating the scale.*

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# A.10 Sludge Pump

The sludge pump is a hydraulically-driven component that assists the movement of low-viscosity mixtures out of the debris tank. Mixtures in the debris tank are gravity-fed into the sludge pump, where they are further broken down by rotating blades. The blades crush chunks in the fluid mixture, making it easier to discharge them through the gate valve without opening the door. An inlet screen prevents large rocks or other materials from passing into the sludge pump.

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***NOTE:*** *The sludge pump does not discharge high-viscosity mixtures effectively. It performs better with low-viscosity mixtures.*

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## A.10.1 Safety Considerations and Warnings

The sludge pump uses pressurized hydraulic fluid to power its motor and drive a steel propeller. Operators must follow proper procedures when using the pump. Misuse can lead to serious injury. To mitigate any potential safety hazards:

- Do not stick body parts or foreign objects inside the discharge hole.
- Maintain a safe body position while operating the sludge pump.
- Avoid high-pressure hydraulic fluid or leaks as they can cause severe damage to the body (see “High-Pressure Fluid Hazards” on page 32).
- Do not perform any maintenance actions on the sludge pump with the hydraulic system engaged. Ensure all systems are off before working on the sludge pump.

## A.10.2 Operating Instructions

1. Attach a hose to the 4-in camlock on the gate valve. Place the other end of the hose in a suitable dumping location.
2. Turn on the truck, engage the hydraulics (see “Engaging Hydraulics” on page 40), and increase the engine speed to operating levels.
3. To operate the sludge pump and push material out of the tank, pull the lever on the valve block down until it latches into place.
4. Low-viscosity mixtures will be ejected from the 4-in camlock.
5. To stop operation of the sludge pump, push the lever on the valve block forward.

---

***NOTE:*** *If the mixture stops being ejected from the camlock, the sludge pump screen may be obstructed by rocks or other debris. Shut down the sludge pump, disengage the hydraulic system, and clean the screen.*

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# Appendix B

# Legacy Information

This appendix provides information related to legacy decals used on older hydrovac trucks.

## B.1 Legacy Decals

The following decals may be installed on older model hydrovac trucks:


Decal – Hydrovac Height ..... 125
Decal – Blower Impeller Diesel Flush ..... 125
Decal – Hydraulic Tank Hot Surface ..... 126
Decal – Required PPE Within 6 Meter Perimeter ..... 126
Decal – Spinning Shaft ..... 127
Decal – No Step for Blower Driveshaft Cover ..... 127
Decal – Blower Air Filter Maintenance ..... 128
Decal – Cyclone Cleanout Discharge ..... 128
Decal – Fall Protection Tie Off Required ..... 129
Decal – Dump Door Locking Pins ..... 129
Decal – Dump Door Pinch Point ..... 130
Decal – Grease Points ..... 130
Decal – Keep Clear When Dumping ..... 131
Decal – Do Not Use Debris Dozer When Icy (Optional Equipment) ..... 131
Decal – Boom Grease Manifold Chart ..... 132
Decal – Overhead Power Line ..... 132
Decal – Boom Safe Operation Zone ..... 133
Decal – Boom Use Warning ..... 133
Decal – Debris Tank Fill Levels ..... 134
Decal – Vacuum Assisted Water Filling Operation ..... 134
Decal – Valve Positions for Vacuum Water Filling ..... 135
Decal – F3 Sight Glass Volumes ..... 135
Decal – F4 Sight Glass Volumes ..... 136
Decal – Smart Wand Notice (Optional Equipment) ..... 136
Decal – Fall Protection Tie Off Points ..... 137
Decal – Ecologically Friendly Oil Use ..... 137

**Figure B-1.** *Decal - Hydrovac Height*




**Figure B-2.** *Decal - Blower Impeller Diesel Flush*



**Figure B-3.** *Decal - Hydraulic Tank Hot Surface*




**Figure B-4.** *Decal - Required PPE Within 6 Meter Perimeter*



**Figure B-5.** *Decal - Spinning Shaft*




**Figure B-6.** *Decal - No Step for Blower Driveshaft Cover*



**Figure B-7.** *Decal - Blower Air Filter Maintenance*

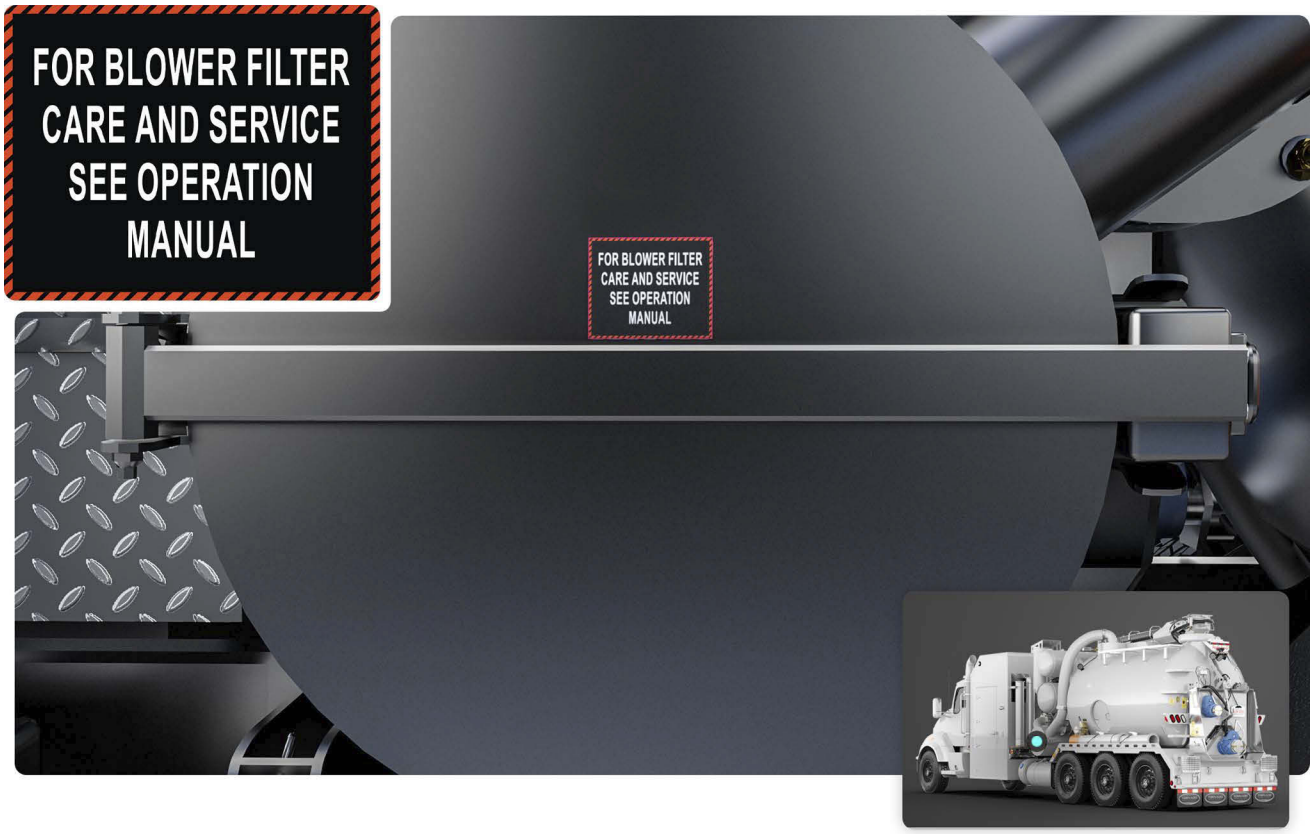



**Figure B-8.** *Decal - Cyclone Cleanout Discharge*



**Figure B-9.** *Decal - Fall Protection Tie Off Required*




**Figure B-10.** *Decal - Dump Door Locking Pins*



**Figure B-11.** *Decal - Dump Door Pinch Point*

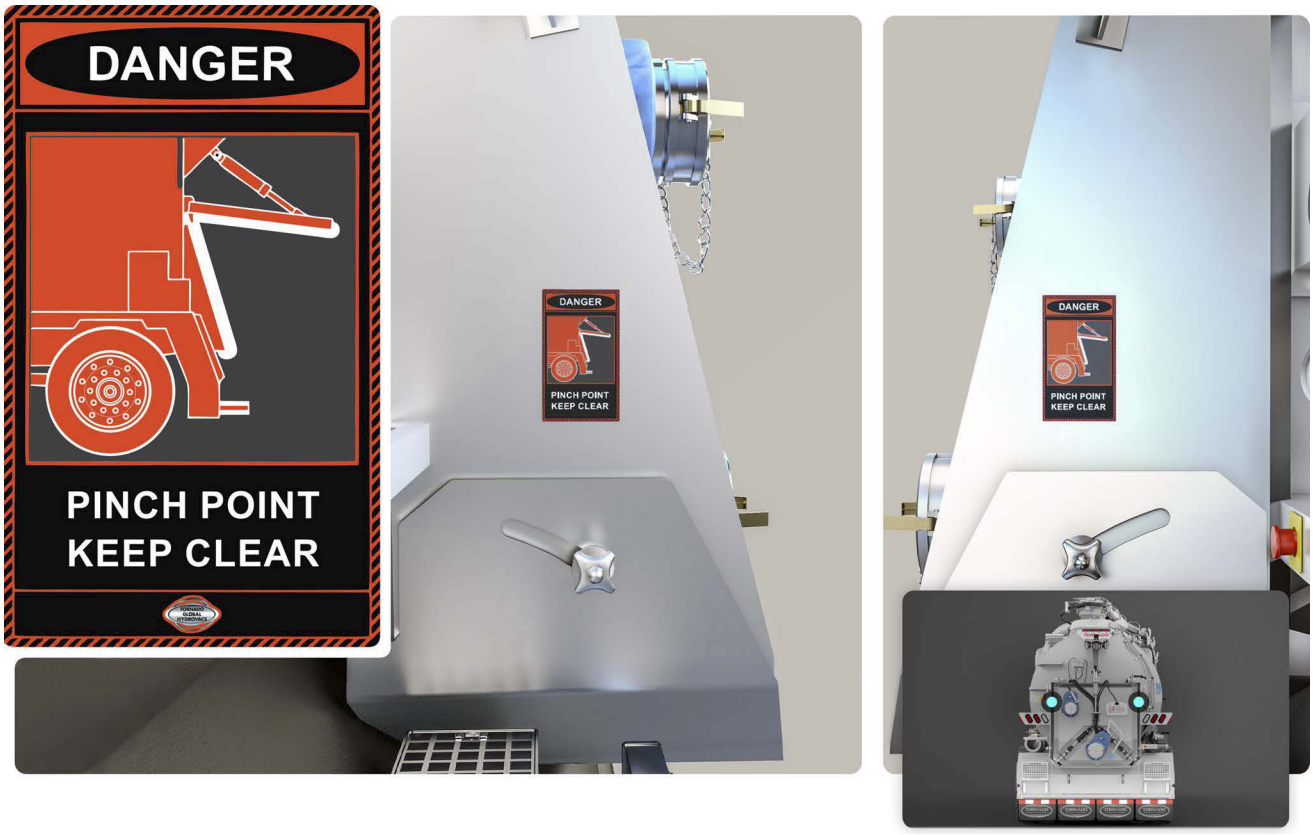



**Figure B-12.** *Decal - Grease Points*



**Figure B-13.** *Decal - Keep Clear When Dumping*

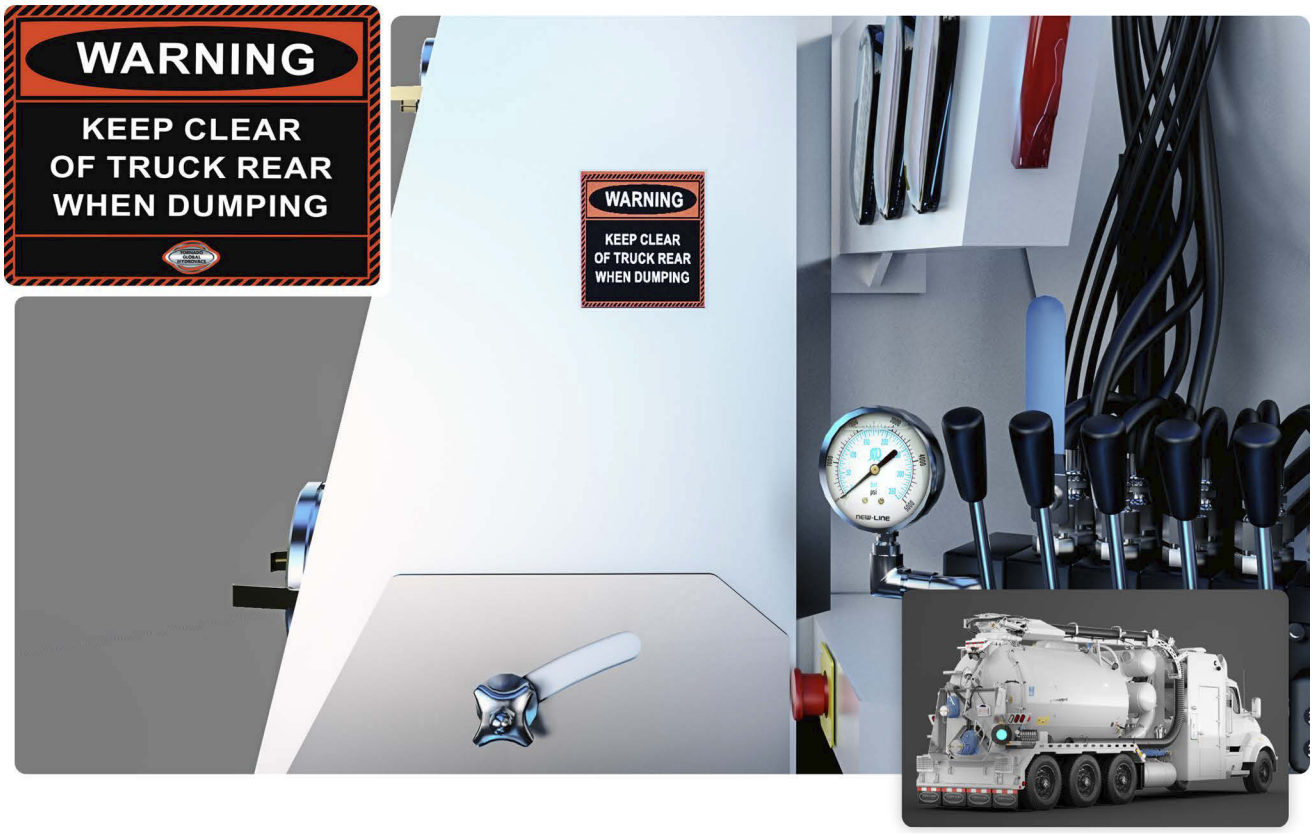



**Figure B-14.** *Decal - Do Not Use Debris Dozer When Icy (Optional Equipment)*



**Figure B-15.** *Decal - Boom Grease Manifold Chart*

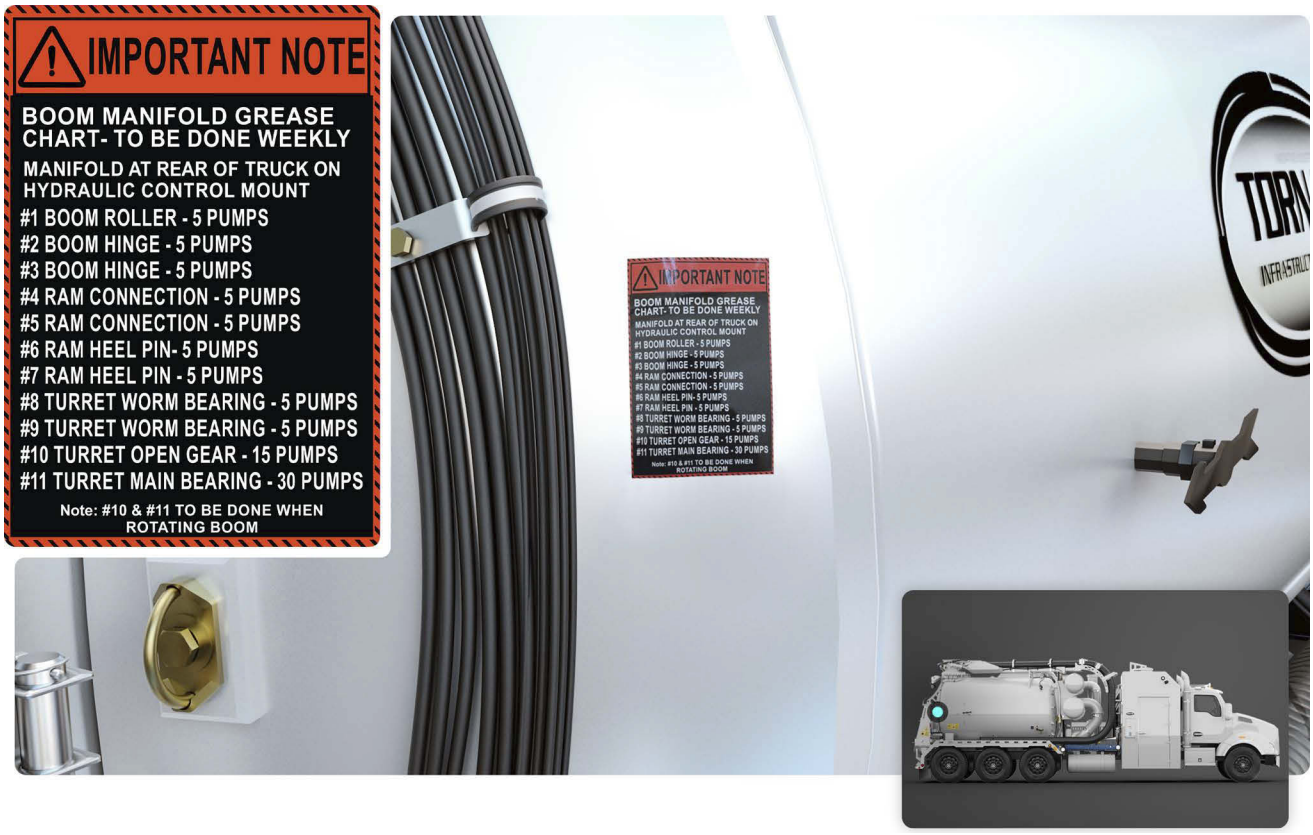



**Figure B-16.** *Decal - Overhead Power Line*

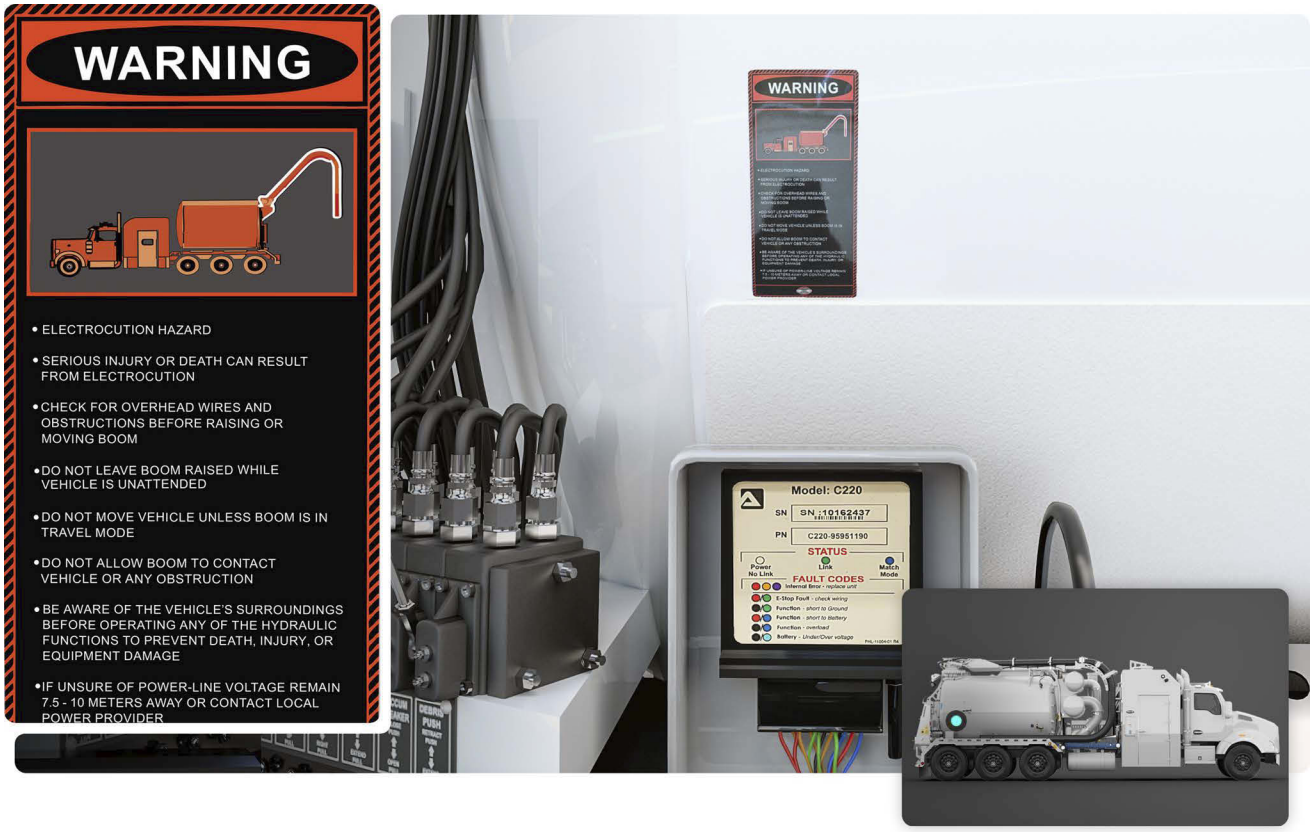


**Figure B-17.** *Decal - Boom Safe Operation Zone*




**Figure B-18.** *Decal - Boom Use Warning*



**Figure B-19.** *Decal - Debris Tank Fill Levels*

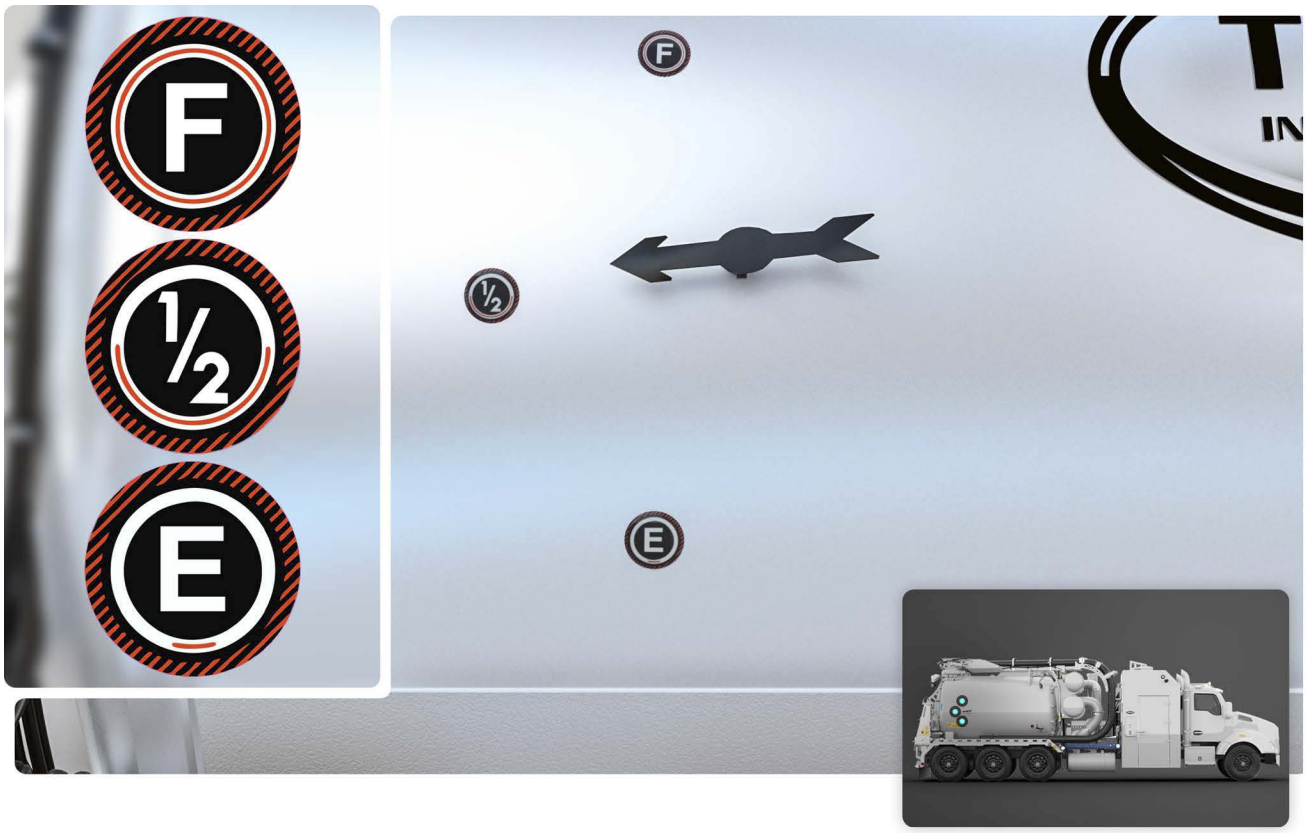



**Figure B-20.** *Decal - Vacuum Assisted Water Filling Operation*



**Figure B-21.** *Decal - Valve Positions for Vacuum Water Filling*




**Figure B-22.** *Decal - F3 Sight Glass Volumes*



**Figure B-23.** *Decal - F4 Sight Glass Volumes*




**Figure B-24.** *Decal - Smart Wand Notice (Optional Equipment)*

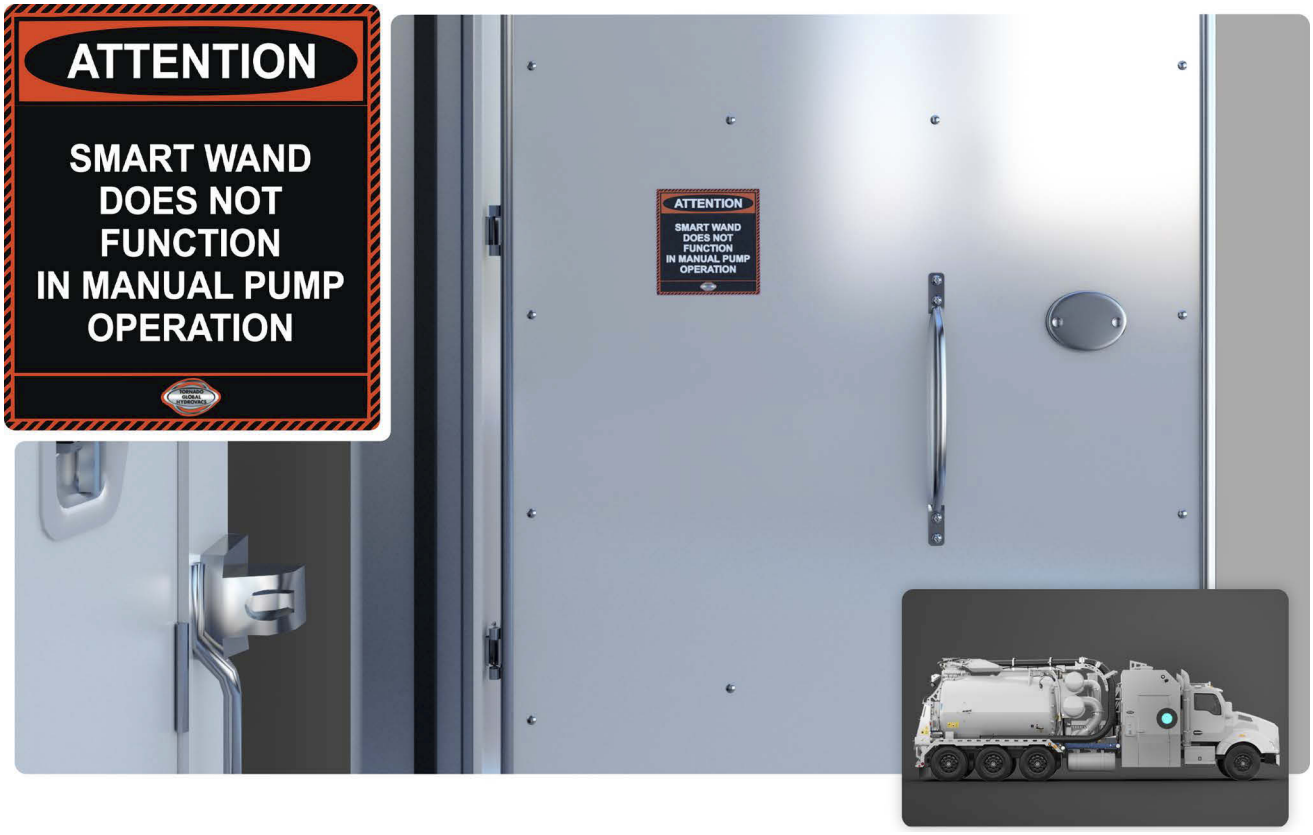


**Figure B-25.** *Decal - Fall Protection Tie Off Points*




**Figure B-26.** *Decal - Ecologically Friendly Oil Use*



# Warranty Policies & Procedures

## Warranty Coverage

1. **One (1) Year Comprehensive Warranty (the "Comprehensive Warranty")**. Subject to the exceptions, exclusions, and limitations set out herein, Tornado Global Hydrovac (North America) Inc. ("Tornado") will warranty each new Tornado Global Hydrovac Unit (each a "Unit") to be free from factory defect in material, workmanship, and design error under normal use and service, when operated in accordance with Tornado's factory instructions as contained in the decal instructions, owner's manuals, or other user guidelines provided by Tornado in respect of the applicable Unit, for ONE (1) YEAR (the "Coverage Period") from the date of delivery to the original purchasing end user (the "End User"). Tornado shall not cover, nor shall Tornado be responsible for any costs incurred in connection with repairs made to any Unit outside the Coverage Period or where the Warranty Claim Procedure (as set out and defined herein) has not been followed. Tornado's obligations under this warranty are limited to the repairing of or supplying of replacement parts in exchange for any parts that are defective due to factory material, workmanship, or design error. If a defect in material, workmanship, or design is found during the Coverage Period, Tornado will provide, in Tornado's sole discretion, new, re-manufactured, or Tornado approved repair parts or assembled components needed to correct such covered defects.

   THE EXPRESS WARRANTIES OUTLINED ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, CONDITIONS, AND TERMS AS TO QUALITY, FITNESS, OR PERFORMANCE OF THE GOODS, WRITTEN, ORAL, OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, ANY WARRANTIES OR CONDITIONS OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH OTHER WARRANTIES, CONDITIONS, AND TERMS ARE HEREBY DISCLAIMED AND EXCLUDED.

   The End User's sole and exclusive remedy with respect to the quality, performance, or fitness of the applicable Unit shall be as provided in the express warranties described above and Tornado shall have no liability with respect to any non-conformance of or defect whatsoever in the Unit (including any liability for loss of use, revenue or profit, or any other direct, indirect, special, incidental, or consequential damages) whether in warranty, contract, tort, negligence, strict liability, or otherwise.

2. **Warranty on Demonstration Units.** Where any Unit is used as a demonstration or rental unit, in order for an End User of such Unit to qualify for the Comprehensive Warranty, the Unit used as a demonstration or rental unit shall be registered by Tornado under the Comprehensive Warranty as of the date of the first usage of the Unit as a demonstration or rental unit (the "In-Service Date"). For certainty, the period of coverage of the Comprehensive Warranty on any Unit used as a demonstration or rental unit will only run from the In-Service Date specified for such Unit, notwithstanding any subsequent sale of the Unit to an End User. Demonstration units will be classified as In-Service upon first use of that unit for demonstration purposes, and therefore the warranty period will be active for the predetermined time of one year from the In-Service Date.

3. **No Warranty on Third Party Components**. The Unit may include parts or components manufactured by a third party, including, without limitation, those components listed in Schedule "A" hereto (the "Third Party Components"). Tornado does not warrant Third Party Components not manufactured by Tornado. In the case of Third Party Components, Tornado's liability shall be limited to assisting the End User in enforcing the warranty, if applicable, of the manufacturer of the Third Party Components. To the extent that any Third Party Component is warranted by their original manufacturers, and to the extent that such warranty is assignable to End User, Tornado shall assign to the End User any rights and remedies it has relating to such Third Party Component. In no manner shall the foregoing be considered an indemnity or guarantee by Tornado in relation to any warranty offered by a third party in relation to a Third Party Component.

Tornado shall not be liable in respect of any Third Party Component, and shall not be obligated to perform its obligations hereunder in respect of any Third Party Component, to the extent that such Third Party Component is discontinued and in relation to which a standard or drop-in replacement is no longer readily available.

4. **No Warranty on Consumables**. The Unit may contain parts or components in relation to which progressive degradation is expected during the use or operation of the Unit, including, without limitation, seals, bearings, fluid, hoses, coatings, rigging, and other parts, components, or items of a like nature or kind ("Consumables"). The Comprehensive Warranty specifically excludes all Consumables, and Tornado does not warrant or represent the useful life of any Consumable or shop supplies. Tornado will not pay for any shop supplies, bolts, glue, or misc. wiring.
5. **Warranty Registration**. The End User must complete and send to Tornado a warranty registration form for each new Unit within 30 days of delivery to the End User to ensure that the Unit is eligible for warranty. Tornado may, in its sole discretion, refuse warranty coverage in respect of any Unit for which a warranty registration has not been properly filed with Tornado.
6. **Exclusions**. Tornado reserves the right to deny Warranty coverage, in full or in part, if Tornado determines, in its sole discretion, that any serial number on the Unit has been tampered with or removed or that the damage to or deterioration of the Unit is caused by unauthorized or improper use, operation, transportation, or maintenance including, without limitation:
   a. unauthorized repair, alteration, or modification including but not limited to repair, alteration, or modification or parts used in connection therewith not conducted or authorized in writing by Tornado;
   b. use of improper fuels, lubricants, oils (including but not limited to unfiltered oil, dirty oil, and used oil), or other fluids;
   c. collisions, natural disasters, or acts of nature;
   d. improper methods of shipping, transporting, and storage of the Unit; and
   e. failure to follow decal instructions, owner's manuals, or other user guidelines supplied by Tornado with the Unit.

   Tornado recommends that the End User retain all certifications and records of regular maintenance of the Unit, as these documents may be important for purposes of determining the cause of any malfunction or damage to the Unit.
7. **Service Calls Excluded**. The Comprehensive Warranty excludes service calls to and from the site of the Unit. It is the responsibility of the End User to either transport the Unit to the repair facility of Tornado or a Tornado authorized repair facility, or pay the costs of having a Tornado authorized repair person attend to the End User's location.

## Warranty Claim Procedures

1. Any and all warranty claims under the Comprehensive Warranty are subject to Tornado's prior approval. The End User shall follow the following process (the "Warranty Claim Procedure") in respect of each warranty claim which is covered by the Comprehensive Warranty (each a "Claim"):
   a. Prior to the commencement of any work on a Unit to be covered by the Comprehensive Warranty, the End User must give notice in writing to Tornado's Warranty Manager or Service Department of the Claim within thirty (30) days of becoming aware of such Claim, together with sufficient particulars of the Claim (including pictures of the damage to the Unit) as may be reasonably required by Tornado's Warranty Manager or Service Department. The failure of the End User to give written notice of a Claim within the aforementioned thirty (30) days shall be a complete bar to such Claim under the Comprehensive Warranty.

b. Upon notification of a Claim from the End User, Tornado's Warranty Manager or Service Department shall review the Claim to determine if the Claim is covered by the Comprehensive Warranty. If required, Tornado's Warranty Manager or Service Department may require and/or authorize further diagnoses and inspections of the Unit to confirm that the Claim will be covered under the Comprehensive Warranty. Where applicable, upon Tornado providing its prior approval to complete any necessary diagnoses or inspections of a Unit which is subject to a Claim, the End User shall, within a reasonable time, make the Unit available to Tornado or a Tornado authorized repair facility to complete all necessary diagnoses and inspections to confirm that the Claim is covered under the Comprehensive Warranty.

c. Upon Tornado confirming that the Claim will be covered by the Comprehensive Warranty, the End User shall, within a reasonable time, make the Unit available to Tornado or a Tornado authorized repair facility to complete all necessary repairs.

d. Where the repairs will be completed by a Tornado authorized repair facility, the End User shall, before causing any repairs to be made to the Unit, provide Tornado with a complete summary and total cost estimate of the required repairs to be completed by a Tornado authorized repair facility, which summary shall include such approval forms and other digital documentation as may be required by Tornado, in its sole discretion (collectively, the "Warranty Claim Estimate") for Tornado's Warranty Manager's prior written approval. Upon Tornado's Warranty Manager granting their prior written approval of the Warranty Claim Estimate, the End User shall cause all required repairs to be completed in accordance with the costs and estimates as set out and approved in the applicable Warranty Claim Estimate. Any amendments to a Warranty Claim Estimate shall be subject to Tornado's Warranty Manager's prior written approval.

2. Any replacement part will be either a new, re-manufactured, or Tornado approved part.

3. Tornado shall not be responsible for any claims or costs associated with any repairs made to any Unit without Tornado's prior written authorization. Notwithstanding the foregoing, Tornado may, in its sole and absolute discretion, review any such after the fact warranty requests on a case-by-case basis.

4. Tornado reserves the right to charge the End User for costs associated in investigating complaints which are found to be caused by problems not associated with a defect in Tornado material, workmanship, or design error.

## Schedule A - Third Party Components

- Chassis
- Blower
- Hydraulic System
- Third Party Paint