



MN-PV-CIS-007

Wet Vacuum Competency Manual

MN-PV-CIS-007 – Wet Vac Competency Manual
Rev 1

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Table of Contents

Table of Contents.....	1
Training Expectations Letter	2
Acknowledgement	3
Objective	4
General Overview	6
Equipment Overview	8
Equipment Safety Features	9
Main Equipment Components.....	11
Accessory Equipment	24
Operation and Understanding a Wet Vac Unit.....	26
Safety Considerations.....	30
Maintenance	33
Technical Quiz	37
Practical Assessment.....	39



Training Expectation Letter

It is required that this document is completed prior to the Employee starting training on a P&V Wet Vacuum Truck. This document will serve as formal record that all parties have reviewed and understand the expectations for training on the Wet Vacuum Truck.

Trainee Name:

Date of Discussion:

Expectations of Supervisor/Leader

- Ensuring trainee has scheduled time for training.
- Ensure trainee has reviewed and understand the technical documentation
- Ensure trainee has been provided a demonstration on equipment operation
- Verify field competency sign offs once completed
- Ensure trainee is working with a competent mentor until they are competent themselves
- Provide support for the assessor, mentor, trainer and trainee whenever possible.
- Ensure training documentation is sent to CEDA Training Department

Expectations of Trainer, Mentor, assessor

- Must be qualified in the position for which he/she is training.
- Educate and support trainee with technical review package.
- Ensure trainee has been provided a demonstration on equipment operation
- Review trainee's technical knowledge and verify acceptable understanding
- Educate and support trainee with field tasks identified in the competency check sheet
- Verify trainee has the ability to perform tasks identified in the competency check sheet
- Communicate to Supervisor that the technical review and field competency is complete

Expectations of Trainee

- Complete all prerequisites outlined within the training program.
- Understand the training process outlined in this document.
- Understanding systems and spending time in the field.
- Ensure all lessons and tasks are signed off by the appropriate personnel as indicated on the training documents.
- Inform Supervisor/Leader on progress of training through face to face meetings.
- Will utilize all the materials provided to ensure a comprehensive training program is followed.
- Provide feedback on the training process and any updates that are required to the training material.
- Inform Supervisor/Leader of any training barriers that may exist during the training process.

Training Expectation Acceptance Agreement

I, _____ understand the expectations of me as a trainee as outlined in this document

(Operator Name)

Operator\Trainee

Name

Signature

Date (MM/DD/YY)

Supervisor/Leader

Name

Signature

Date (MM/DD/YY)

Acknowledgement

This manual has been developed using information and knowledge obtained from manufacturer's documentation and input from experienced Operators. Additionally, this manual has been validated by numerous Subject Matter Experts at CEDA. We welcome any comments or suggestions pertaining to this manual and its contents.

Many thanks to those who have demonstrated a clear dedication to CEDA and our values by participating in the creation of this program.

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Objective

Welcome to CEDA WET VACUUM TRAINING

This program is designed to provide you with the training necessary to carry out your job in a manner that safeguards yourself, those around you and our environment. Upon Completion of this Module you will be able to:

- Describe purpose of Wet Vacuum operation.
- Describe/ locate major equipment and components.
- Describe/ locate operator controls.
- Identify principles of operation.
- Understanding of operating limits and Safety Considerations
- Operate CEDA Wet Vacuum Truck

Employee(s) will demonstrate knowledge & skill in the proper application of equipment through practical application.

Instructions

All material must be completed in the order presented to ensure that prerequisites are met.

Employees will demonstrate knowledge and skill in the proper application of equipment through practical demonstration and application.

NOTE: All forms and procedures included are those required by CEDA. Work must be performed in accordance with these standards. On Client work sites, there may be additional standards and modified work procedures that will also have to be met.

Description: This is a knowledge and practical skill that requires written material to be reviewed along with the completion of an on-the-job demonstration prior to the test being written.

Whenever possible, the on-the-job demonstration should be completed at a job site or the shop under controlled conditions.

Arrange a time with your Mentor/Supervisor/Trainer to complete the On-the-Job Demonstration, where you will observe the proper operation of the Wet Vacuum unit and its components.

Assessment of Competency: Successful completion of this competency requires:

- A score of 100% on the written examination.
- A successful demonstration by trainee requiring a sign-off from Trainer.



Prerequisites

- CEDA Orientation
- Vacuum Orientation
- Specific work location Orientation

Below is a list of the learning resources that are included and others you must obtain the most recent version from your Supervisor.

- Wet Vacuum Operations Procedures
- Wet Vacuum Truck Operators Manual
- Wet Vacuum Daily Pre-Job Checklist
- CEDA Pre-Trip Inspection (Vehicle Inspection Report)
- Site specific documentation
- Job Hazard Analysis for the work
- CEDA FLHA
- Other CEDA procedures and practices that pertain to the job being completed

NOTE: All forms and procedures included are those required by CEDA. Work must be performed in accordance with these standards and can be found in CEDA Health, Safety and Environment Management System (HSEMS) or be requested from your Leader. On Client work sites, there may be additional standards and modified work procedures that will also have to be met.



General Overview

Federal & Provincial Legislation

All work must be completed in accordance with applicable Municipal, Provincial, & Federal Acts & Regulations, including but not limited to:

Transportation of Dangerous Goods (TDG)

- Vehicle must be DOT Approved and be equipped with appropriate safety devices
- DOT approved vehicles will have sticker on side of unit
- Operator must place appropriate placards on side of vehicle
- Operator must prepare bill of lading prior to transporting materials

The Workplaces Hazardous Materials Information System (WHMIS)

- All CEDA field employees working with or around equipment will have WHMIS and TDG training prior to starting work.

Occupational Health & Safety (OH&S)

Seat Belts

Anytime a vehicle (CEDA owned or personal) is being operated during business hours for business use, or on CEDA property, the occupants must be wearing seatbelts.



Personal Protective Equipment (PPE)

To operate the Wet Vacuum unit, employees must have and utilize the following personal protective equipment (PPE):

- CSA Certified Hard Hat
- CSA Certified Safety Boots (Boot Grips when required)
- Fire Retardant Coveralls
- Hearing Protection (plugs or muffs)
- Approved Gloves for the Site/Task
- Safety Glasses with Side Shields.
- Rain Gear as Required

For hot materials, the following additional personal protective equipment may also be required:

- Rubber gloves



- Steel-toed rubber boots
- Face shield

Workplace Organization

CEDA's goal is to reduce waste (time, energy and materials) by maintaining an orderly and clean workplace, including our trucks and equipment. We ask that you take pride in the equipment you operate; treat it as if it were your own. A clean and organized vehicle/workspace is a safer vehicle/workspace. There are many ways to eliminate waste:

Allocation & Utilization of Resources: Have the right people and equipment in the right place, at the right time. Use equipment and resources on tasks and activities that are required and add value to our business.

Improve Productivity: Eliminate redundant or unnecessary steps/tasks without negative impact to the safety or quality of our products and services.

Use of Materials: Ensure equipment is stocked with required supplies (filter bags, duct tape etc.) before leaving for jobsite – replace the materials you have used during the shift to ensure that the next crew is adequately stocked. Use the correct materials in the quantities required to do the job safely & correctly.

Preventative Maintenance: Tools and equipment should be assessed as per the performance maintenance schedule to ensure safe operation. Regular maintenance will reduce costly breakdowns in the field.

There are steps we can take to improve our current state and move towards a more productive, organized and safe work environment. Improving workplace organization will reduce costs, improve morale and create a safer work environment. The following steps outline how best to achieve an organized workplace:

Sort, organize and eliminate unnecessary items from the workplace to eliminate clutter. Keep only essential items.

- Tools and equipment that are not utilized for day-to-day operations should be repurposed within the organization or discarded.
- Garbage or loose items should be removed or properly stored.

Prioritize tools, parts and materials based on usage and keep them in easily-accessible places.

- A place for everything and everything in its place.

Create storage areas that are easy to access and clearly laid out:

- Tools and equipment should be stored clean and ready for use.
- Storage areas and stored items should be properly identified using signage, labels or a visual outline.

Set clear standards for workplace organization:

- 
- Hold yourself and others accountable for keeping the work areas clean and safe. Make workplace organization a standard work rule in your area.
 - Clean general work areas and equipment after each shift.
 - Put clean tools away in the proper place.
 - Note any spills, leaks or other messes – clean and report if equipment requires maintenance
 - Inspect the area(s) regularly and immediately record and correct any infractions. Handle deviations from work rules in a timely manner.
 - Review processes and procedures regularly and adjust as required.

Equipment Overview

Wet Vacuum trucks are used at CEDA to vacuum and transport wet materials between sites/locations during tank and vessel cleaning operations, spill recovery and materials transfers.

Materials Most Commonly Removed:

- Sewage From Septic Systems
- Slurry Materials
- Flammable and Combustible Oil-based Liquids
- Caustics
- Hazardous Materials

**** The Wet Vacuum unit is designed for liquid materials only. Do not attempt to vacuum dry materials as significant damage to the equipment will occur. ****

Worker Roles & Responsibilities

CEDA Wet Vacuum units shall be operated with a one or two-person crew. A two person crew typically contains one (1) Operator and one (1) Labourer. Both roles receive this training. It is the responsibility of both individuals to ensure they are aware of the chemical composition of the materials that are loaded. When necessary, refer to the ***Material Safety Data Sheets*** for proper handling guidelines.

Specific details for each role were communicated at the point of hire and can be very generally summarized as the following:

Laborer

Responsible for physical removal of materials using the wet vacuum hose. Utilized as spotter for all equipment moves.

Operator

In addition to Laborer duties, the Operator is responsible for driving (where applicable), general maintenance and overall the operation of the Wet Vacuum unit.

Any Operator driving CEDA vehicles must hold a valid Class 1 or Class 3 license AND must have passed CEDA's driving assessment.



Equipment Safety Features

Wet vacuum unit pumps are very powerful & can create tremendous amount of vacuum, pressure. As such, it is important to follow the proper procedures when loading and offloading materials. Employees must adhere to all safety practices and workplace procedures (CEDA & Client Specific). Should Client requirement exceed CEDA's own, the Client's requirements must be observed (whichever is strictest).

Fire Extinguisher & Spill Containment Kit

Every Wet Vacuum unit is equipped with an ABC Fire Extinguisher and Spill Containment Kit. Trays, absorbent pads and socks should be included in the Spill Kit. The location of these items on the unit should be identified prior to operation.

Grounding Systems

One of the most important elements of the wet vacuum truck is the grounding system. Prior to starting transfer operations, vacuum trucks need to be grounded directly to the earth or bonded to another object that is inherently grounded, such as a large storage tank or underground piping. Grounding minimizes the electrical potential differences between objects and the earth to prevent a static charge. Grounding brings all parts of any system to zero electrical potential by allowing electrical currents to dissipate to earth.



The wet vacuum units rely on either a single grounding cable (a cable that is attached from the unit to a grounded object) or a Posiground System.

CEDA uses different styles of vacuum units and as such, some features outlined in this manual may be different. The Operator must be aware of the equipment's specified controls and operating limits (as per manufacturer).



Positive Air Shutoff

The positive air shut off, also known as a "Rig Saver", "ESD", or "Roda Deaco" valve is mounted to the engine air intake. The switch to activate the positive air shut off is typically located on the

dash of the truck and is used in case of a “Runaway Diesel”. Once activated, the valve closes ensuring no air or fumes can enter the engine, and stalls the engine. On most units the valve is air actuated, so sufficient pressure is required in the trucks air system for it to function. This system should be tested once a week in accordance with most manufacturers’ recommendations.



Whip Checks

Whip checks are used for the offloading of materials during Wet Vacuum operations or when positive pressure is applied to hoses. Should a connection fail the whip check will prevent the hose from whipping around. For proper usage instructions refer to the manufacturers labelling. Whip check should be inspected prior to use. Inspections should be looking for cuts, tears, burns, worn stitching, missing keepers, excessive wear, UV degradation and chemical contamination. If a whip check is determined to be unsafe they should be destroyed and properly disposed.



Wheel Chocks

Any vehicle weighing over 4500kg or any trailer regardless of size shall be parked using wheel chocks. Wheel chocks should be placed between the tandem wheels as shown.



Main Equipment Components

Cargo Tank

Pressure-tested vacuum cargo tanks are used to collect and transport petroleum liquids and hazardous wastes. The cargo tanks are made of carbon or stainless steel and have a capacity of 13,000 Liters or roughly 3,000 US gallons. Tri-drive units have more capacity. The Cargo Tank is a confined space and as such, all Confined Space Entry rules apply.

The rear door is sealed to the tank with a rubber gasket and is raised when access to the inside of the tank is necessary or when dumping occurs. The wet vacuum truck must never be moved with the rear door partially or fully opened. This may result in hinge failure.

On some units, the rear door also has a site glass. The site glass and seal must be inspected before each use.

Isolation Valve

The Isolation Valve (also known as the “Rollover Protection Valve”) is a safety shut off valve located on the outside top of the tank and is air operated (pictured right). If the air system is interrupted, the valve will automatically close, sealing-off the materials inside the tank. This valve must remain in the closed position during transport.

If an emergency situation occurs, the operator can switch the isolation valve to the ‘close’ position, thus preventing any materials from entering the moisture trap, microscreen and pump. This valve is also placed in the close position during transportation. With this valve closed, the truck will not build up vacuum.

This valve must be visually inspected daily.



Tank Inspection

Cargo tanks require a formal inspection on a regular basis with the results displayed on the tank. The results indicate when the tank was last inspected and what type of inspection was completed. The inspection type and frequency of inspection are as follows:

V- Visual (External)- Annual

K- Leak Test – Annual

I- Internal- 5 years

P- Pressure- 5 years



Label Format: Month/Year/Inspection Type/ 3 Digit Test Facility Code (MM YY VKIP XXX)

Safety Switches

There are two main safety switches near the hydraulic bank which the Operator may activate in case of emergency; Isolation valve switch and Emergency Use Only switch.

The Isolation valve switch opens and closes the air operated safety valve at the top of the tank. The vacuum pump isolation valve is closed during transportation to provide protection to the vacuum pump. When this valve is in the open position, the vacuum pump can be used for loading and unloading.

The “Emergency Use Only” switch is in the open position during normal operation. This will allow the intake and discharge valves to be opened and closed as necessary. In an emergency situation, switching the “Emergency Use Only” switch to the close position will automatically close the intake and discharge valves at the rear of the tank and the isolation valve at the top of the tank but the pump will still be running.



Wing Nuts

The rear of the tank is sealed with a hinged door that is secured with wing nuts. The wing nuts can be tightened by hand when negative pressure (vacuum) is applied to the tank. The truck must never be moved off the jobsite with the wing nuts unfastened.

Wet vacuum trucks are subject to corrosive conditions, extra care must be taken to ensure that all wing nuts on the rear door are properly maintained. Before starting a job, it is the operator's responsibility to grease all wing nuts on the rear door.



Baffle Plate



Baffle plates have been installed in MOST Wet Vacuum units to reduce the amount of sloshing that occurs inside the tank during transportation. Sloshing can interfere with the Operator's ability to slow or stop the vehicle during braking and pose a significant safety risk.

Cleaning the baffle plates can be difficult due to size and location.

Door Prop

The manual door prop is used to secure the cargo tank door in the fully open position and must be in place before raising the tank. Employees should never go under the door without the door prop in place. It is the Operators responsibility to ensure door prop is removed before attempting to close the door to avoid damage to the door prop.

****Operator should check to make sure that the door prop is on the equipment prior to starting any job.****



Overflow Shutoff

The Overflow Shut-off Ball is located inside the cargo tank.

The overflow shut-off ball (pictured right) is contained inside a 'basket' directly below the vacuum line intake. The ball inside the basket is hollow. When too much material is drawn into the tank, the ball automatically floats up & seals the vacuum line intake, preventing materials from entering the moisture trap and pump.

This should never happen and is why we fill our trucks only to $\frac{3}{4}$ full. Filling completely would potentially result in materials entering the pump and causing excess wear.

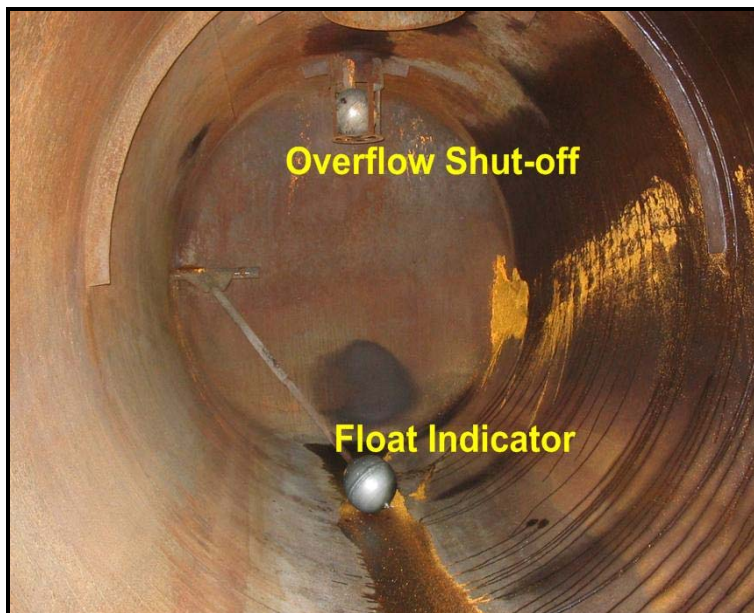




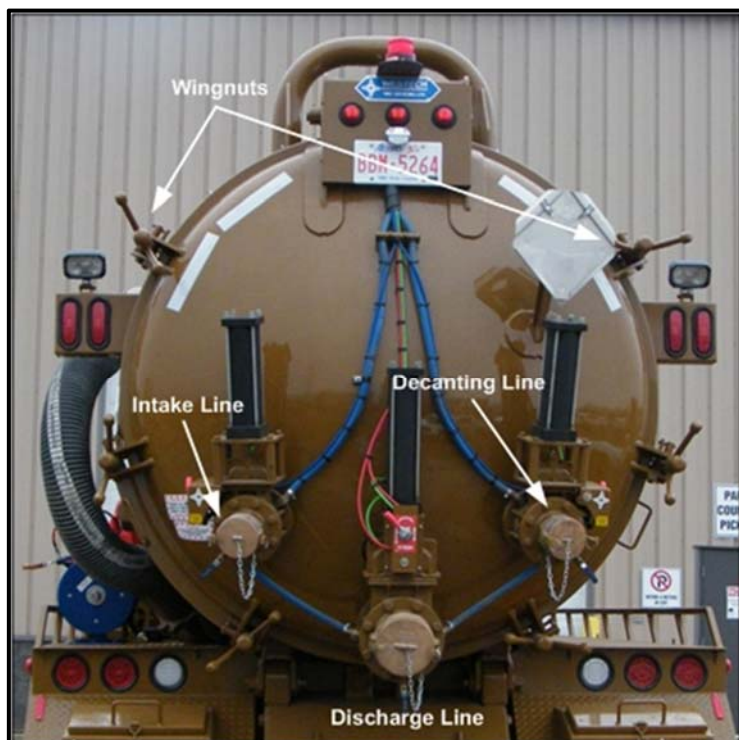
Float & Level Indicator

The inside of the tank contains an indicator float and overflow shut-off. The float indicator is simply a rod with a hollow steel ball on the end. As the material fills the tank, the ball rises. The indicator on the outside of the tank displays to the operator the level inside the tank (right). CEDA only fill their trucks to $\frac{3}{4}$ full. Filling completely would potentially result in dirt entering the pump and cause excess wear.

Legal weight limits must not be exceeded, so filling to $\frac{3}{4}$ full may not always be allowed. Refer to the MSDS or contact a supervisor to confirm the weight of a product.



Intake Line



The intake and discharge lines are located at the rear of the tank. The intake line is used for uploading materials into the tank during routine vacuum operations. The intake line is controlled by a manual valve and an air operated valve. The air operated valve will only open when the Emergency Use Only switch is in the open position.

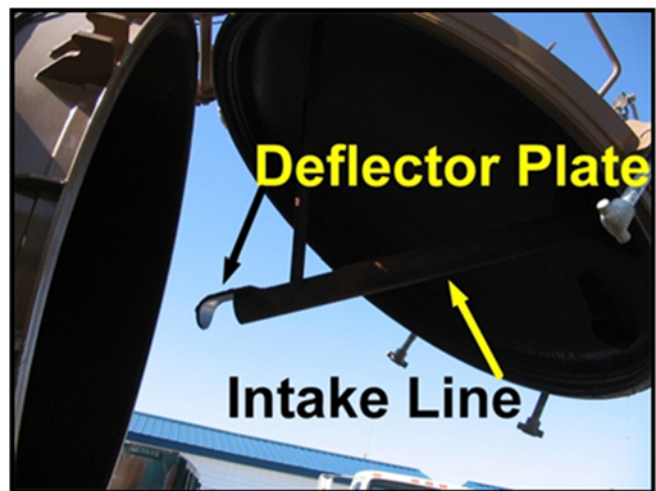
Problems may arise during vacuum operations when either the manual or air operated valves do not properly close (see images below).

During these instances, the valve(s) must be cleaned in order to proceed. If the valves do not close, materials may seep from the tank and/or proper vacuum pressures may never be achieved. **DO NOT USE HAMMER TO CLOSE THE VALVE.** Damage to the valve will occur.



Deflector Plate & Sand Pipe

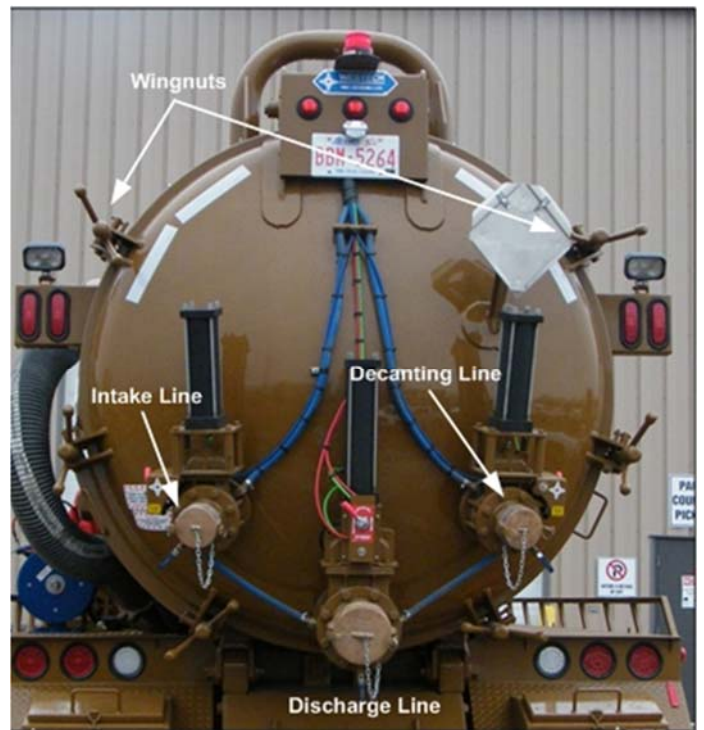
At the top portion of the intake is the deflector plate. This deflector plate re-directs wet product to the bottom of the tank and prevents materials from entering the vacuum intake line at the top of the tank. Some units may utilize a sand pipe rather than a deflector plate.



Discharge Line

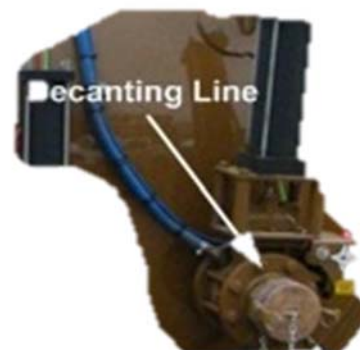
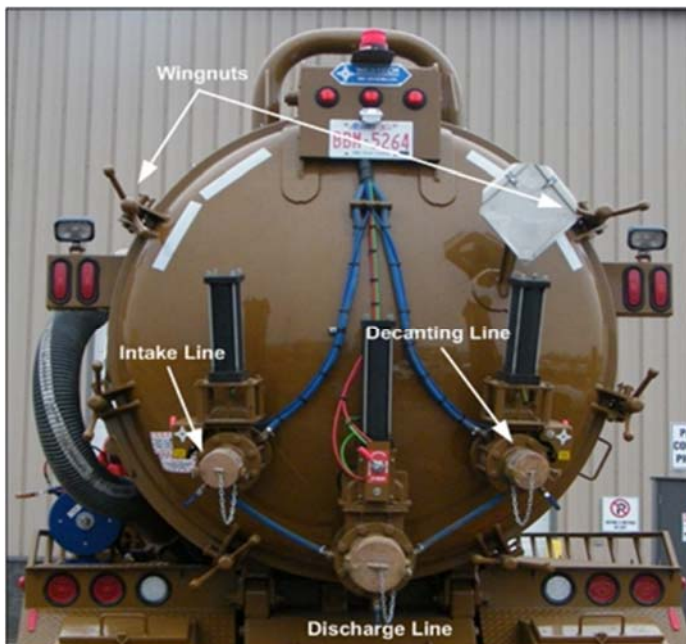
The discharge line is used for offloading material from the tank during routine vacuum operations. The discharge line is also controlled by a manual valve and an air operated valve.

Like the air operated valve on the intake line, the air operated valve on the discharge line will only open when the Emergency Use Only switch is in the open position.



Decanting Line

Some units are equipped with a decanting line which is located to the right of the discharge line and level with the intake line. When loading materials, the solids will settle to the bottom of the tank and the Operator can utilize the decanting line to drain off the liquids.



Bleeder Line(s)

Bleeder line(s) are located on both the discharge and intake lines. It is used to vent excess pressure between the valve and cap before the cap is removed. A spill pan is placed beneath the bleeder line to collect any debris/ liquids.

If excess debris/ liquids drain from the bleeder line, one or more of the valves may be leaking.

The bleeder line is small in diameter and may freeze/ plug prematurely. Care must be taken to ensure bleeder line is clear.



Note: If bleeder line is frozen, steam is the only method to be used to clear it.

Vibrator

Mounted under the tank is the vibrator. This device is used during offloading and helps to 'shake out' loose material or sludge that has settled to the bottom of the tank. The operator opens the rear door and raises the tank using the hoist. Once the tank has been raised, the operator can activate the vibrator to loosen the materials at the bottom of the tank during offloading. A spotter must be used when raising the tank.

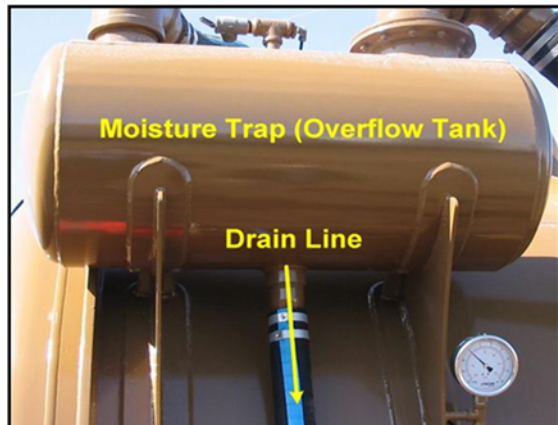
Some trucks may come equipped with a light on the dashboard to inform the operator that the tank is in the raised position.

The operator must **not** leave the vibrator on for an extended period of time. Extended use of this device may cause the welds at the bottom of the tank to crack. It should be operated for 8 seconds, then stopped for 30 seconds.





Moisture Trap (Overflow Tank)



The moisture trap is an auxiliary tank used to collect moisture and other materials that escape from the main tank during vacuum operations. Significant moisture may be present during the removal of materials such as hot condensate. Moisture and other debris can cause the pump to wear out sooner and must be removed from the system.

Below the tank is a drain line that is used to drain moisture after a job has been completed. A spill pan should be used to collect the moisture from the drain line.

The tank should be drained into a spill tray after every load.

The drain line has a manual valve that must be in the closed position during routine vacuum operations. If the line is not closed, vacuum pressure cannot be created in the system.



Microscreen

The Microscreen is designed to protect the pump by removing escaped debris from the moisture trap. The micro-screen should be inspected prior to starting the pump and must be cleaned at the end of each job. It also has a drain valve and should be drained after every load.



Closed Microscreen Chamber



Open Microscreen Chamber



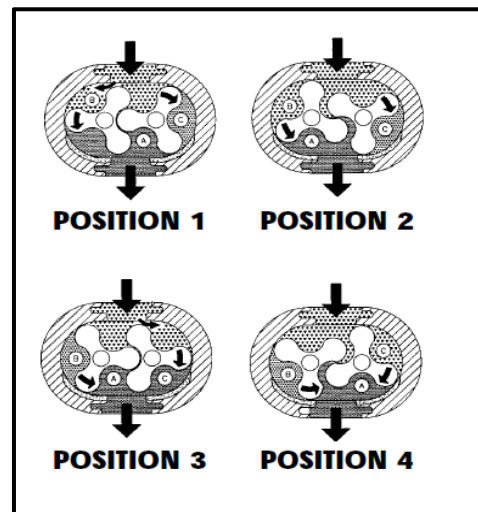
Microscreen

Pumps

Vacuum trucks use one of two types of vacuum pumps for routine operations; Sliding Vane or Rotary Lobe. Most wet vacuum trucks operated by CEDA utilize a sliding vane pump. However, some turbo vacuum units utilize the rotary lobe pump. These pumps are powered by the Power Take-off (PTO).

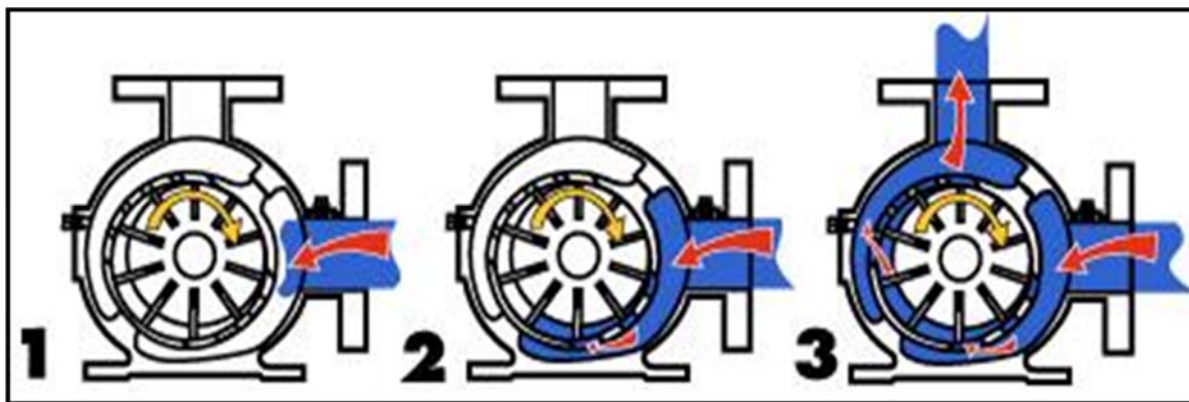
Rotary Lobe Pump

Rotary Lobe Vacuum pumps typically operate at speeds between 1300-1800RPM. A basic Rotary Lobe is comprised of two figure eight shaped impellers mounted on parallel shafts. They rotate in opposite directions. As each impeller passes the inlet, it traps a definite volume of air and carries it around the casing to the discharge. These pumps are oil lubricated and oil must be checked through the site glass near the base of the pump.



Sliding Vane Vacuum Pump

Sliding Vane Vacuum pumps typically operate at speeds between 900 – 1800 RPM. Each vacuum unit will have the recommended operating limits posted inside the cab of the vehicle.



1. Sliding vane pumps have fiber vanes that are fitted in a slotted rotor. Vanes or blades fit within the slots of the impeller. The vanes are forced against the wall by hydraulic pressure, spring force or the centrifugal force resulting as the ring is rotated. A constant supply of oil is maintained in the cylinder to lubricate the vanes and minimize wear as

the vanes are pushed outward against the pump housing. As the vane rotates (yellow arrow) the air is drawn into to pump (red arrow).

2. As the ring rotates the air is trapped in the compartment between the vanes and the pump housing.
3. The air is then compressed and forced out through the discharge connection at the top of the pump.

Pump Oil Crank

A small crank located on the outside of the pump assembly should be rotated prior to engaging the pump. The crank primes the pump oil system with lubricant.



Oil Inspection Window

Once the pump has been engaged, pump oil should begin to flow through the pump and will become visible through an inspection window mounted at the front of the pump. The operator must observe that oil is flowing through the pump during the first few minutes of operation (normally 2 - 3 drops of oil/minute). A lack of oil in the pump can cause overheating and significant wear.



Pump Control: 3-Way Valve

Mounted on top of the pump is the 3-way valve that controls the airflow produced by the pump. The pump must not be engaged when moving the valve into any position.

- When the lever is moved to the "V" position, the pump will create the vacuum necessary for routine loading procedures.
- When the lever is moved to the "P" position, the pump will create the positive pressure necessary for pressure unloading.
- When the lever is in between "P" and "V", the valve is said to be in the neutral position.



Also, moving the valve into the neutral position is the simple way to remove positive or negative pressure from within the tank (venting). The valve should be moved slowly to help prevent excessive wear.

Pressure Gauge



The pressure gauge is located on the outside of the tank and is used by the operator to determine the pressure inside the tank. When there is no pressure in the tank, the pressure gauge will read “0”. As vacuum builds within the system the gauge will begin to display the negative pressure.

During normal operation, negative pressure is created within the tank causing a vacuum effect. The entire system must be air-tight so that this pressure can be created. The vacuum unit can operate when a pressure of approximately -5 to -25 inHG is created, however the unit is most efficient at -15 to -20inHG. When generating positive pressure, 0 to 10 PSI is the normal operating range.

Pressure Relief Valve

Located near the pump or microscreen, the Pressure Relief Valve is attached to the external vacuum line and will activate automatically if the tank over pressurizes during pressuring off (if pressure reaches 13 – 18 PSI). The system must be serviced by a CEDA technician after this valve has been released.



Secondary Moisture Trap & Vent

The secondary moisture trap is used to collect moisture and exhaust from the pump. Moisture enters the pump during routine operations and mixes with the pump oil, creating an oily mixture that is blown into the secondary trap.

The vent line extends from the secondary trap and is used to direct the air blown off by the pump. In many cases, this air contains fumes that must be directed away using an extension hose that is fastened to the end of the vent line. When the operator is vacuuming water, hoses may not be required.

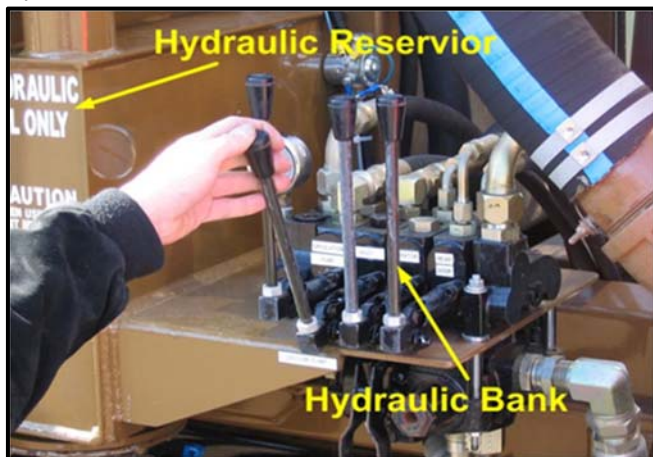
Many plant sites require that extension hoses fastened to the vent line are of a specific length. For example, BP requires that hoses are a minimum of 60 feet to deflect fumes away from the Operator.

The Operator must ensure the pump exhaust is directed to an appropriate area. Care must be taken not to direct the exhaust towards air intakes on buildings, work areas, or ignition sources. The operator must also take note of the wind direction to prevent exhaust from being carried to inappropriate locations. The vent hose should never be reduced or capped.



Hydraulic System

The hydraulic system is operated by a bank of levers that control various functions of the unit. From this location the Operator controls the vacuum pump, auxiliary pump (Bowie), hoist, vibrator, and rear door. A temperature gauge is mounted on the reservoir, (just left of the Operator) and measures the temperature within the hydraulic system.



Power Take Off (PTO)

The PTO, (Power Take off) takes hydraulic pressure from the engine and sends it to the compressor, which allows the equipment to operate. The pump is powered by a PTO mounted under the unit. Prior to engaging the PTO, the vehicle must be placed in neutral, with the parking brake applied.



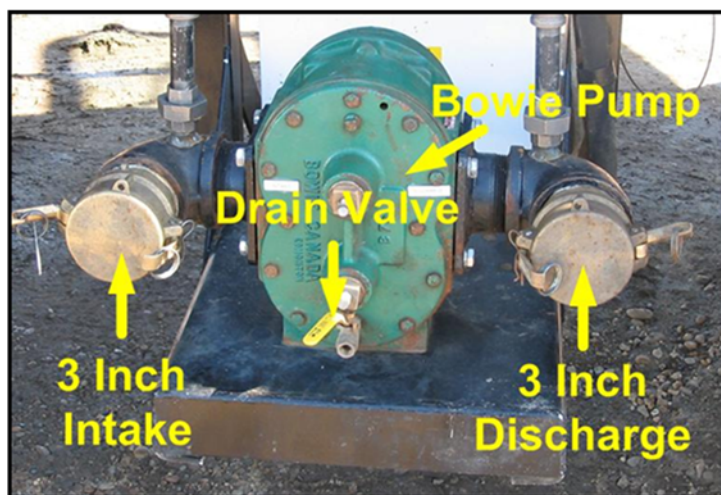
ACCESSORY EQUIPMENT

Bowie Pump

Located on the side of the wet vacuum unit is the Bowie pump. At some plant sites this pump is used to offload fluids from the tank.

During cold weather, the pump must be properly maintained to prevent freezing. The pump requires grease for proper operation and is routinely lubricated after each job.

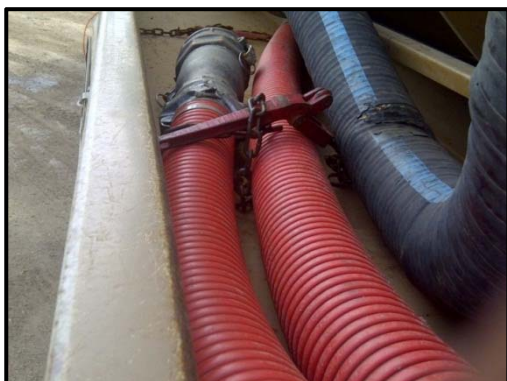
A drain valve located on the side of the pump is used to empty the pump after use. It is very important to empty the pump after every use during cold weather conditions because frozen water inside the pump can cause significant damage to internal moving parts.



Note: Steam is to be the only method to use to unthaw. The pump is powered by a hydraulic motor. The hydraulic motor is connected to the Bowie pump by a shaft. The hydraulic motor is driven by a PTO. Most motors operate at approximately 900 engine RPM. Check to ensure RPM is not exceeded for your unit.



Hoses



Camlocks & Reducers

Hoses are connected together with camlocks and secured with duct tape and utilize gaskets to prevent leaking. When required to reduce the hose line from one diameter to another, you will be required to use reducers like those shown.



Example of 3" to 2" Reducer



Example of 4" to 3" Reducer

Submersible Sump Screen

The submersible sump screen allows workers to fully submerge the end of the hose in the materials they are vacuuming without the worry of damaging the system. This screen filters solids from liquids.



Operation and Understanding of a Wet Vacuum Unit

Airflow

The following diagram shows the direction of airflow when the tank is under negative (vacuum) pressure (1 to 12). As the pump creates the negative pressure in the tank, air is drawn into the tank through the intake line. Air is then drawn out of the tank and into the moisture trap. From here, the air travels through the external vacuum line and into the microscreen before it enters the pump. Finally the air is forced out of the pump and into a secondary moisture trap and vent discharge. Under positive pressure, the airflow is reversed (12 to 1).





Operating Limits & Running Efficiently

Efficiency of vacuum unit can be determined by:

- Amount of airflow that it creates & is measured in Cubic Feet per Minute (CFM) or
- Measuring amount of vacuum (often referred to as suction) produced at suction head & is measured in inches of mercury (inHg)

The Vacuum unit is most efficient when -15 to -20 inHg is produced

PHYSICAL LIMITS	CONSEQUENSS OF NON-COMPLIANCE
-5 to -30 inHG 0-10 PSI	Equipment wear/ damage Personal injury Overflow/spill of materials Blow-out of seals
Must be on Level Ground For Loading and Unloading	Vehicle could shift
800 - 1,800 RPM (as per manufacturer's recommendation)	Excessive wear on pump resulting in premature equipment failures and/or required maintenance
No Materials Over 200°F (93.3°C)	Burning of seals

Important Information

Many jobs are performed at a client site where both loading and offloading occurs. Operators must be aware of the safety practices and workplace procedures prescribed by the client in addition to those mandated by CEDA. In addition, some clients require that only certain offloading procedures be exercised when emptying a vacuum unit on site.

Precautions:

Eye protection must be worn when loading and off-loading truck. Also, exercise caution when handling hot liquids and materials. Inhalation of material may pose respiratory risks. ***Ensure you are aware of all the hazards of materials you are handling to ensure proper PPE is worn. When unsure, please refer to the MSDS or job supervisor.***

Only individuals who have received tetanus and hepatitis A & B immunization are permitted to handle sewage.

When starting a vacuum truck ensure the pump is set to the correct mode, (vacuum or blow/pump). Do not over-pressurize tank (beyond 10 PSI).



There may be occasions where CEDA dispatches a vacuum unit to a job where a site supervisor is not present. The operator may arrive at the job and determine that the unit selected will not safely or efficiently complete the job. In order to make this assessment, the operator must be aware of the capabilities and performance limitations of the vacuum unit dispatched to a job and recognize when the unit dispatched is not suited to complete the job. For example, if a wet vac has been dispatched and there are only minor amounts of wet material present, the operator will have to either wet down the material or get a dry/wet vac dispatched. The operator must never operate a unit beyond its operating limits.

Procedural Guideline: Loading Cold Product with Vacuum Pump

1.	Complete Pre-Trip & inspect equipment	✓ Wheel chocks in place
2.	Obtain Work & Waste disposal permits	✓ If applicable
3.	Conduct Pre-Job meeting to review permits, procedures and MSDS as required	✓ Use Pre-job Checklist. All personnel working the job must attend
4.	Complete FLHA as per CEDA standards	✓ All personnel working the job must attend ✓ Must be reviewed and updated if any changes occur on the job
5.	Position equipment safely on level ground	✓ Use a Spotter when backing up & lifting the tank
6.	Install wheel chocks	
7.	Flag & Tag area, install signage & pylons	✓ "DO NOT ENTER"/Caution tape & flagging tags
8.	Rig in hoses	✓ Minimize tripping hazards ✓ Follow overhead rigging procedure as required ✓ Flag any hoses in the walk path
9.	Connect vent line	✓ Vent to a safe location
10.	Ensure equipment is grounded	✓ Utilize grounding system ✓ Equipment MUST be grounded at all times
11.	Engage Power Take Off (PTO)	✓ Depress clutch, put truck in reverse. ✓ Leave foot on clutch and switch PTO to "ON" and take out of reverse
12.	Position spill containment device	✓ Under any potential leak zones
13.	Bleed system using bleeder valve	✓ Avoid line of fire – stand off to the side ✓ Ensures system is free of product
14.	Remove intake valve cap & connect hoses	✓ Secure camlock with duct tape and camstrap ✓ Stand off to side to avoid line of fire
15.	Place pump in gear	✓ Operator must remain with equipment at all times when equipment is working ✓ 800 – 1800 RPM
16.	Open intake valve & begin vacuuming	✓ Avoid line of fire – stand off to the side ✓ Do not fill tank above $\frac{3}{4}$ full



17.	Monitor vent exhaust	✓ Shutdown immediately if gas readings appear
18.	When full, remove hose from material and vacuum it out	✓ Reduces spillage
19.	Close intake valve, disconnect hoses & install intake valve cap	✓ Avoid line of fire – stand off to the side
20.	Shutdown pump & idle down truck & disengage PTO	
21.	Remove flagging & tagging, remove signage & pylons, stow hoses	

Procedural Guideline: Offloading Cold Product (Gravity Flow)

1.	Review Pre-Trip & inspect equipment	
2.	Review Work & Waste disposal permits	✓ If applicable
3.	Review Pre-Job meeting to review permits, procedures and MSDS as required	✓ Use Pre-job Checklist. All personnel working the job must attend
4.	Complete FLHA as per CEDA standards	✓ All personnel working the job must attend ✓ Must be reviewed and updated if any changes occur on the job
5.	Position equipment safely on level ground	✓ Use a Spotter when backing up & lifting the tank
6.	Install wheel chocks	
7.	Flag & tag area, install signage & pylons	✓ “DO NOT ENTER”/Caution tape & flagging tags or as per site specification
8.	Rig in hoses if required	✓ Minimize tripping hazards ✓ Follow overhead rigging procedure as required ✓ Flag any hoses in the walk path
9.	Ensure equipment is grounded	✓ Utilize grounding system (Posiground) ✓ Equipment MUST be grounded at all times
10.	Engage PTO	✓ Depress clutch, put truck in reverse, switch PTO to “ON” position & take out of reverse
11.	Use 3-way valve to vent tank	✓ Move handle slowly
12.	Position spill containment device	✓ Under any potential leak zones
13.	Bleed system using bleeder valve	✓ Avoid line of fire – stand off to the side ✓ Ensures system is free of product
14.	Remove discharge valve cap & connect hoses	✓ Secure camlock with duct tape and/or cam strap
15.	Open discharge valve	✓ Avoid line of fire – stand off to the side ✓ Do not fill tank above $\frac{3}{4}$ full
16.	Tilt Cargo Tank	✓ Use Spotter ✓ Lift no more than 45 degrees
17.	When empty, remove hose from material	

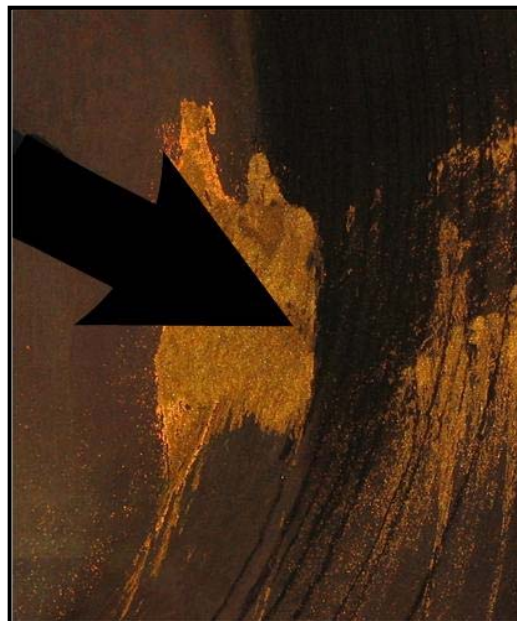


18.	Engage pump and vacuum out hose	✓ Reduces spillage
19.	Close discharge valve, disconnect hoses & install discharge valve cap	✓ Avoid line of fire – stand off to the side
20.	Shut down PTO	✓ Idle down before disengaging
21.	Stow hoses, remove flagging & tagging , remove signage & pylons	

Once a job is concluded and all materials are offloaded, the operator(s) must ensure the tank is thoroughly cleaned in the wash bay. This will prevent the carry-over of materials that may cause potentially dangerous reactions with materials that are loaded on subsequent operations.

The picture to the right shows residual materials that must be removed from the interior tank wall. Use appropriate measures to remove and dispose of residual material.

On occasion, equipment failure may occur after loading which results in the loss of materials from the tank. For example, if there is damage to the rear door gasket, or a valve is not sealing properly, materials may seep from the tank. It is the employees' responsibility to properly contain all spills. In the event of a spill, promptly report it to your Supervisor.



Safety Considerations

Minimizing Hazards During Operation

Line of fire	✓ Stand off to side when disconnecting hoses ✓ Keep face away from hose
Unauthorized Personnel	✓ Flag & Tag work area
Spills	✓ Valves closed, sealed & in place before starting work ✓ Use appropriate spill containment products (spill pan)
Backing-up/Striking Objects	✓ Utilize Spotter
Heavy/Awkward Lifting	✓ 2 Person lifts – lift with legs
Lower Explosive Limits (LELs)/Vapors/Sour Liquids	✓ Monitor vent line ✓ H2S Alive training where required
Temperature of Product	✓ Know temperature of product before starting work



Static Charge	✓ Utilizing grounding system
Slips, Trips & Falls	✓ Housekeeping
Tank Contamination	✓ Know the products & clean between jobs
Noise Level	✓ Wear appropriate PPE
Lack of Experience/Training	✓ Attend training, know your limits & ASK QUESTIONS

General Safety Overview

The following are guidelines to the safe working practices for wet vacuum trucks:

1. Always apply the parking brakes when operating the unit.
2. Be sure all valves are clear before pressuring-off.
3. Do NOT open inspection covers, man-ways or other fittings when the tank is under pressure.
4. Do NOT enter the tank without testing the atmosphere and utilizing proper breathing apparatus. The tank is considered a “Confined Space” and should be treated accordingly. Use caution when entering a tank. Use proper protective equipment. Establish proper rescue procedures. Another person should be stationed outside the tank who thoroughly understands rescue procedures.
5. Do NOT open valves without hoses attached.
6. Do NOT make repairs or adjustments while the equipment is operating.
7. Do NOT pressurize the system against closed valves.
8. Do NOT leave equipment unattended when operating.
9. Do NOT walk on the tank or catwalks without fall protection equipment (i.e. safety harness and lifelines). Please follow all rules/laws in regards to fall protection.
10. When operating PTO's, pumps, hydraulically operated equipment, etc., please follow the manufacturer's instructions.
11. Do NOT reach under or stand under any hydraulically operated hoist or rear door without a safety prop or support.
12. Do NOT reach under or go under any vehicle when the engine is running and the PTO is operating equipment.
13. Do NOT operate the unit with any safety guards removed.
14. Stay clear of hoses that are under pressure as they are known to jump and buck thereby causing injury to anyone nearby.



- 15.** Watch for overhead wires while lifting the tank. NEVER move the wet vacuum unit with the tank in the raised position.
- 16.** Ask yourself if the truck is designed to do the job? Make sure the product to be loaded is compatible with the unit's design and construction. If in doubt, contact your Supervisor.
- 17.** Wear hearing protection while operating the system and bleeding the main valves.
- 18.** Prevent potential fire hazards at all times by:
 - Keeping fire extinguishers in working order and readily available
 - Keeping the machine clear of dirt and oil
 - Keeping all electrical wiring and components in good working order
 - Ensuring that the engine air intake, fuel and exhaust systems are maintained properly.
- 19.** Do NOT load or unload on an incline or grade. Ensure the ground is stable.
- 20.** The rear door must be open to fully raise the tank.
- 21.** Ensure truck is grounded using the grounding straps before performing any operation.
- 22.** Ensure truck has a complete spill kit.
- 23.** Never stand in front of any caps to remove them. Stand off to the side, out of the line of fire.
- 24.** Ensure the area around the back of the truck and around the hoses is flagged off with barrier tape, when pressuring off loads.
- 25.** Ensure all cam-lock connections are secured with cam straps & duct tape.
- 26.** Ensure wing nuts are tightened anytime positive pressure is applied to the tank.



Maintenance

Preventative Maintenance Program

CEDA's Preventative Maintenance Program requires that all Vacuum units are evaluated by a certified Mechanic after 250 hours of operation. Operation hours are gathered and confirmed on job reports and submitted to Maintenance Group. All components of vacuum unit must receive appropriate preventative maintenance in order to operate safely.

Field Level Maintenance

COMPONENT	REQUIRED CHECKS/MAINTENANCE	FREQUENCY OF MAINTENANCE
Moisture Traps	Drain in to Spill Pan	Daily
Micro-Screen	Clean as Necessary	Daily
Bleeder Valves	Free of plugs/debris	Daily
Vacuum Pump	Oil reservoir filled Exterior free from grease/debris	Daily
Isolation Valve	Operating as Required	Daily
Airflow Shutoff	Visual Inspection	Daily
Level Indicator & Float	Visual Inspection	Daily

Preventative Maintenance – Cargo Tank

Always remember to check the deflector plate and interior for wear and damage. Product that is vacuumed into the tank will cause wear to the deflector plate. Generate a work order (W/O) form and report to your supervisor if you notice any defects with the equipment



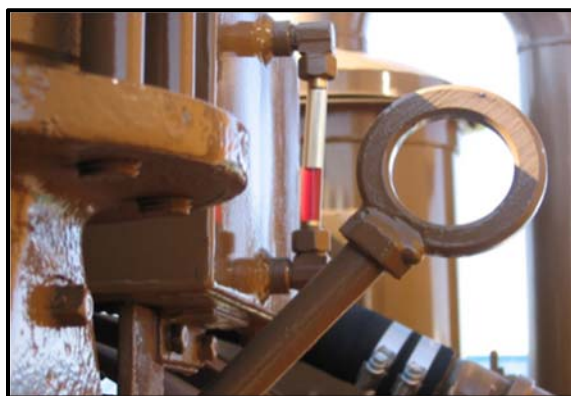
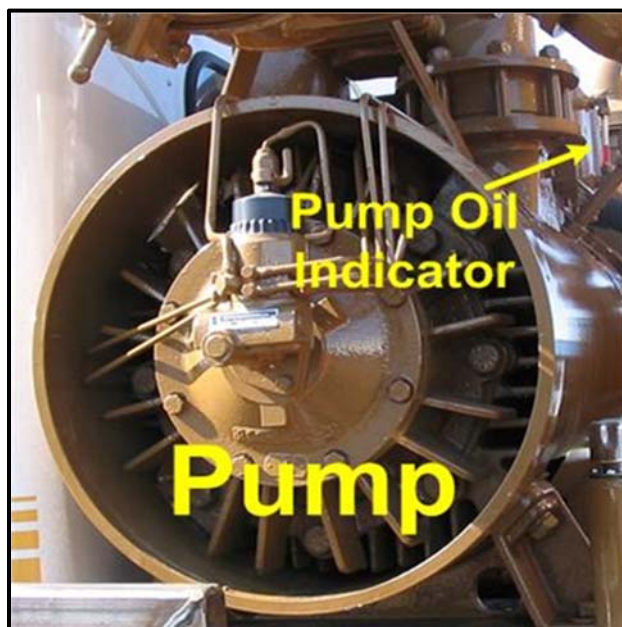


Preventative Maintenance - Pump

In extreme cold, the pump should be run at a reduced speed for the first five (5) minutes to allow it to warm up and for pump oil to circulate. The oil minimizes scuffing on the pump walls. Pump

should remain clean and free from grease at all times. Excessive build-up will contribute to premature wear of the pump.

Pump should be flushed with diesel once a week during warm weather.



Winterization

Due to the cold weather conditions, appropriate winterization of the Wet Vacuum Unit is critical for proper operation. Winterizing of a vacuum pump must be done after the job is completed and/or if the pump will not be used for a period of time. The winterization procedure is as follows:

STEPS TO WINTERIZE SLIDING VANE PUMP		NOTES
1.	Engage PTO System	
2.	Place 3-Way valve in the "Vacuum" position.	
3.	Turn on vacuum system.	✓ Use Idle Speed
4.	Open valve on winterization line leading to the fuel tank.	✓ Creates Vacuum
5.	Remove Fuel Tank Cap or open valve on diesel flush tank	✓ Proceed to #7 if winterizing line is permanently mounted to the fuel tank
6.	Ensure vacuum is present in the line and place line in to fuel tank.	✓ If not equipped with diesel flush tank
7.	Draw fuel into pump for 10 seconds to allow fuel to coat pump vanes.	✓ Proceed to #9 if winterizing line is permanently mounted to the fuel tank.
8.	Remove line from fuel tank.	
9.	Replace Fuel Cap.	



10.	Shut off valve on winterizing line.	
11.	Shut off vacuum system.	
12.	Disengage Power Take-off (PTO)	✓ Winterization Achieved!

	STEPS TO WINTERIZE ALCOHOL POTS	NOTES
1.	Drain off air pressure.	✓ Ensure bleed valve on bottom of alcohol pot is open.
2.	Open drain valve on pot.	
3.	Remove fill nut from top of alcohol pot.	✓ Use wrench
4.	Close drain valve on alcohol pot.	
5.	Fill alcohol pot with brake line antifreeze.	
6.	Reinstall fill nut and tighten.	✓ Use wrench
7.	Close all air bleed valves on system and re-pressurize.	

Troubleshooting

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION(S)
Loss/ reduction of vacuum Loss/ reduction of pressure	Plug in vacuum hose	✓ Check for obstruction in hose. Reverse hose if necessary (not vacuum) ✓ Complete CEDA work order and submit unit for maintenance
	Air leaks in hose due to bad gasket, missing gasket or missing ear on cam lock fitting	✓ Clean/ replace gaskets as necessary
	Pump oil is low	✓ Check pump oil and add as necessary. Ensure proper oil is used
	Microscreen is plugged	✓ Clean Microscreen
Loss of hydraulic functions	Hydraulic fluid is low	✓ Add fluid
	Leaking or loose hoses	✓ Check hose and replace
	Leaking or loose fittings	✓ Check fittings and replace
Air leaks	Air leaks in hose due to bad gasket, missing gasket or missing ear on cam lock fitting	✓ Clean/replace gaskets as necessary



Leaking valves	Debris in valve seat	✓ Clean/replace valves as necessary
Leaking door	Debris in door gasket	✓ Clean/replace gaskets as necessary
PTO not engaging	Low air pressure	✓ Wait until air pressure is sufficient to engage PTO
Tank in down position but raised indicator light still lit	Bad limit switch	✓ Ensure tank is in lowered position ✓ Write maintenance order at first opportunity



Multiple Choice Questions (Technical Quiz)

Complete the following test, and have it graded by your assessor. If any questions are answered incorrectly, your assessor will explain what the correct answer is, and why it is correct. Once you understand the correct answer, both the assessor and students initials are required to indicate that mentoring or coaching has taken place.

Question	Assessor's Initials	Student's Initials
1. The trucks fluid levels must be checked each shift. a. True b. False		
2. All work must be completed in accordance with applicable Municipal, Provincial, & Federal Acts & Regulations. a. True b. False		
3. Wet Vacuum operations are always completed by a Two person crew regardless the scope of work. a. True b. False		
4. Most materials removed or transported by a Wet Vacuum Unit are: a. Slurry Materials/Fluids b. Flammable and Combustible Oi-based Fluids. c. Sewage from Systems d. Hazardous Materials/Caustics. e. All of the above.		
5. If there is a Loss/reduction of vacuum, the following could be causes: a. Vacuum pump issues. b. Missing or damaged gasket. c. Broken Cam-lock on a hose. d. All of the above.		
6. No material /fluids over ____ °F should be loaded due to risk of burning the seals. a. 200 °F b. 100 °F c. 500 °F d. 1000 °F		
7. The cargo Tank on a Wet Vacuum Unit is considered a confined space and all confined space entry rules apply. a. True b. False		
8. Which of the following PPE is <u>NOT</u> required to operate a Wet Vac? a. Tyvek Suit b. Rubber Gloves c. Hearing Protection d. Safety Glasses/Face Shield		
9. The Operator is responsible to complete the pre-trip and post trip inspection a. True b. False		



10. When engaging the PTO, the unit must be placed in neutral with the park brake applied a. True b. False		
11. The Wet Vac only requires grounding when vacuuming flammable liquids or material. a. True b. False		
12. What is required by an Operator when operating a Wet Vac: a. Never get back in the cab when loading/unloading b. Complete a walk around prior to moving the truck. c. Ensure hoses are strapped down before moving d. All of the above		
13. When should the moisture trap be drained: a. Daily b. Every Load. c. Weekly. d. Never.		
14. What is the maximum that a Wet Vac Tank should be filled to: a. 40% b. 100% c. 80% d. 60%		
15. The vacuum unit is most efficient when it is operating between -15 to -20 HG. a. True b. False		
16. An operator should never walk under the tank door unless the door prop is in place. a. True b. False		
17. Never move the Wet Vac with the tank raised. a. True b. False		
18. The work area should be flagged off with tagging and signage placed to alert others working in the area. a. True b. False		
19. The Bowie Pump is a vacuum pump. This pump creates the vacuum required to operate the unit a. True b. False		
20. The maximum tank pressure should not exceed 50 PSI. a. True b. False		

Practical Assessment – Wet Vacuum Operations

This form is to be filled out by the assessor as they observe the student successfully demonstrate these items in order to be deemed competent.

Assessment Check List

#	Locate the following...	Trainee Initials	Assessor Initials
Tank Components			
1	- Cargo Tank (Identify tank temperature and pressure ratings) - Tank Level Indicator, Overflow shutoff ball and Basket - Rear Door and Dorr Prop - Wing Nuts		
2	Intake Line / Valve		
3	Intake Valve Switch		
4	Deflector Plate		
5	Isolation Valve		
6	Moisture Traps		
7	Micro-Screen		
8	Vibrator		
9	Discharge Line / Valve		
10	Discharge Valve Switch		
11	Bleeder Valves		
12	Sliding Vane / Rotary Lobe Pump		
13	3-Way Valve		
14	Hydraulic Bank		
15	Emergency Use Only and Isolation Valve Switches		
16	Vacuum Gauge		
17	Grounding Cables		
18	Bowie Pump		
19	Oil Pressure Gauge		

#	Demonstrate...	Trainee Initials	Assessor's Initials
Pre Job			
1	Obtain work permit.		
2	Complete daily pre-job checklist.		
3	Don required PPE.		
4	Completed a Proper Pre-Trip Inspections and notes issues		
Troubleshooting			
1	Describe troubleshooting problems for leaks on hoses and pumps.		
2	Describe troubleshooting problems for over and under pressure		



3	Describe troubleshooting problems if pump will not engage		
Operation (Loading)			
1	Drive to area of work and positions the unit correctly		
2	Install wheel chocks		
3	Walk down of work area and completes a through FLHA of the hazards		
4	Flag & Tag the area of work, Installed signage and pylons		
5	Rig in hoses, secures all camlock fittings and positions spill containments.		
6	Connect vent line		
7	Ensure equipment is grounded		
8	Engage Power Take Off (PTO)		
9	Position spill containment devices		
10	Bleed system using bleeder valve		
11	Remove Intake valve cap & connect hoses		
12	Ensure pump is in the proper mode (vac) and engage pump		
13	Open intake valve and begin vacuuming		
14	Monitor vent exhaust		
15	When $\frac{3}{4}$ full, removes hoses from material and vacuums it out		
16	Closes intake valve , disconnect hoses and install intake valve cap		
17	Shutdown pump & idle down truck & disengages PTO		
18	Removes flagging and tagging, Signage & Pylons, stow hoses and wheel chocks		
Operation (Unloading)			
1	Reviews work and waste disposal permits		
2	Positions the equipment safely on level ground.		
3	Ensures wheel chocks are installed and all necessary flagging, tagging, pylons and signage is in place before work begins		
4	Rig in hoses if required and positioned spill containment device		
5	Ensure equipment is properly grounded		
6	Engages PTO		
7	Places the 3-way valve in the proper mode		
8	Bleed discharge valve before removing cap		
9	Remove discharge valve cap & connect hoses		
10	Open discharge valve		
11	Tilt Cargo Tank		
12	When empty, remove hose and material		
13	Engage pump and vacuum out the hoses		
14	Close discharge valve, disconnect hoses & install discharge valve cap		
15	Shut down PTO		
16	Rig out, stow and secure hoses and grounding cable		
17	Completes any housekeeping necessary		
18	Removes all flagging, tagging, pylons and signage		
19	Sign off permits as required		
Winterization of the Wet Vacuum Air System (Alcohol Pots)			



1	Drain off air pressure		
2	Open drain valve on pot		
3	Remove fill nut from the top of the alcohol pot		
4	Close drain valve on the pot		
5	Fill pot with brake line antifreeze		
6	Replace fill nut		
7	Close all air bleed valve on system and re-pressurize		
Winterization of the Wet Vacuum Pump System			
1	Engage PTO system		
2	Ensure 3-way valve is in the vacuum position		
3	Turn on vacuum system		
4	Open valve on winterizing line leading to the fuel tank		
5	Draw fuel into the pump for approximately 10 seconds to allow fuel to coat pump vanes.		
6	Take line out of fuel tank		
7	Replace fuel cap		
8	Shut off valve on winterizing line.		
9	Shut off vacuum system		

Assessment Sign Off

All boxes must be completed before signing an employee competent.

- ☐ Expectation Letter Signed
- ☐ Minimum 100 hours of on the job training completed
- ☐ On the Job Practical Assessment Completed by an approved Assessor
- ☐ Has reviewed and understands the operator manuals for the Wet Vacuum Units
- ☐ Reviewed and understands Procedures and Safety Documentation
- ☐ Technical review and Knowledge Exam complete
- ☐ Training documentation sent to CEDA Training Department

Assessor

I, _____ have taken the below named employee through this Assessment, and he/she has successfully demonstrated competence in the areas identified.

Signature Date

Student

I, _____ have completed this competency, including the on-job demonstration, practical assessment and multiple-choice questions. I understand the information presented and agree to follow all of the rules and procedures set out by CEDA.

Signature Date



Revision Log

Revision Date	Section Affected	Changes Made
October 21, 2021	All	Updated Template, multiple changes throughout.



Training Change Request Form

Date: _____

Location: _____

Name: _____

Contact information: _____

Email/Phone number

Description

Please use the back of this sheet to make additional comments.

Section Name: _____

Page Number: _____

Description of Problem/ Suggested Resolution:
