



MN-PV-CIS-121

Semi-Vac Competency Manual

MN-PV-CIS-121 – Semi-Vac Competency Manual
Rev 2

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Training Expectation Letter

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





Objective

Welcome to CEDA Semi-Vac 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:

- 121.01 Review Semi-Vac Operations
- 121.02 Operate Semi-Vac Unit
- 121.03 Maintain/ Care for Semi-Vac Unit

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 Steamer 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
- CEDA Wet Vac Training
- 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.

- Unit Specific Manufacturer's Operating Manua
- Daily Pre-Job Checklist for Semi-Vac
- 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.

Renewal Period

The entire Module must be redone after:

- Leaving the employ of CEDA for a 6-month period,
- Leaving the Semi-Vac operations for a period of 6 months, or
- As deemed required by CEDA.

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 Semi-Vacuum unit, employees must have and utilize the following personal protective equipment (PPE):

- CSA Certified Hard Hat with Face Shield
- 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



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

Vacuum Trucks - General

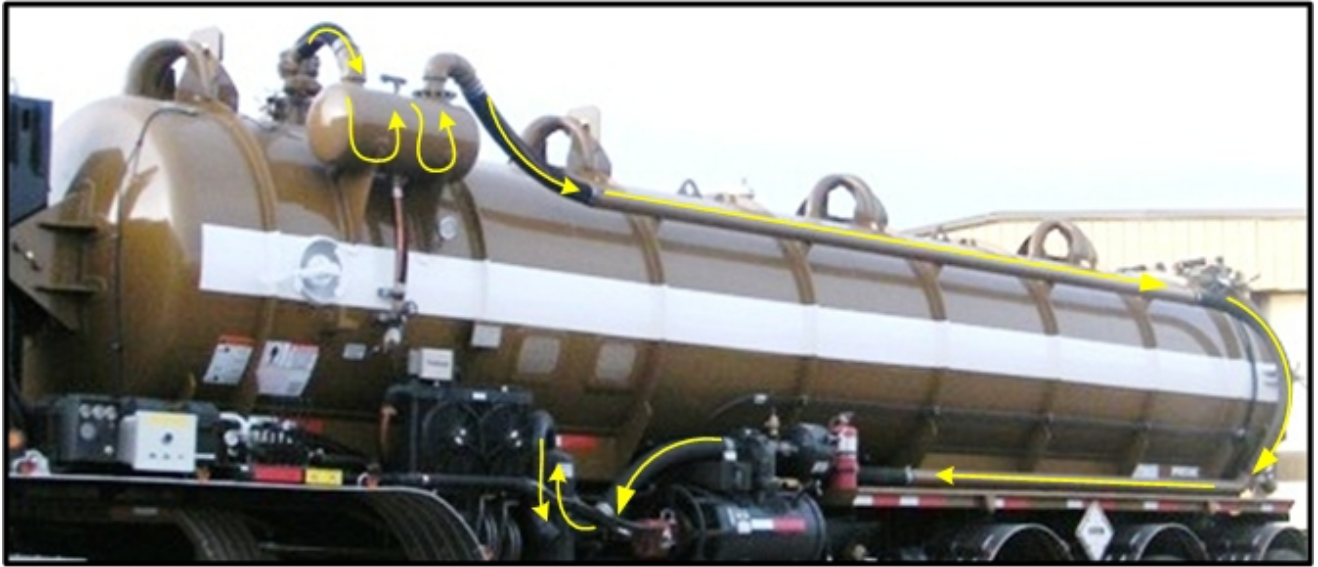
Vacuum trucks are used to transport wet materials from one site to another. Most of the vacuum operations include removing sewage from septic systems, transportation of slurry materials, flammable and combustible hydrocarbon liquids, caustics, and hazardous materials. Materials are commonly removed from oil tanks and catch basins. Typical vacuum truck operations in the petroleum industry include product removal during tank and vessel cleaning operations, spill recovery and material transfer.

Once these materials are collected, they are offloaded either at the client site or at an approved facility capable of processing the materials.

Vacuum operations performed at CEDA utilize a two man crew; an operator and a laborer. The operator is responsible for maintaining the operation of the vacuum unit and the laborer is responsible for the physical removal of material with the vacuum hose.

CEDA uses vacuum units provided by several different vendors and each unit may make use of controls that are slightly different than those found on other units. CEDA exercises every caution to ensure that controls are consistent on each unit. However each operator must be aware of all controls (including **safety** controls) and the operating limits of the particular vacuum unit in operation. The subsequent training materials contained in this learning module describe the general operating overview and is not intended to replace the manufacturers' Operator Manual for any given vacuum unit. Every effort has been made to ensure that key elements of vacuum operations have been included. The following section identifies and describes the general components found on the Semi-Vac unit. The illustrations in this element have been provided for a Presvac unit. Please refer to the appropriate Manufacturer's Operator Manual for more detail, as necessary.

Air Flow



Air Flow – Negative Pressure

The above diagram illustrates the direction of airflow when the tank is under negative (vacuum) pressure. 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.

The airflow is reversed when the tank is under positive pressure (as seen below).



Air Flow – Positive Pressure



Major Components of the Semi-Vac

A semi-vac is a transportable vacuum system consisting of the following:

1. vacuum cargo tank
2. moisture trap (overflow tank)
3. microscreen
4. pump
5. hydraulic system
6. hydraulic engine
7. coolant and heater system

Each of these components will be discussed in more detail below.

1. Vacuum Cargo Tank

Pressure tested vacuum cargo tanks are used to collect and transport hydrocarbon liquids and hazardous wastes. The cargo tanks are made of carbon steel and have a capacity of 25,000 L or roughly 6,600 US gallons.



Rear Door

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

Semi-Vac units are subject to corrosive conditions, extra care must be taken to ensure that all wingnuts on the rear door are properly maintained. Before starting a job, it is the operator's responsibility to grease all wingnuts on the rear door.



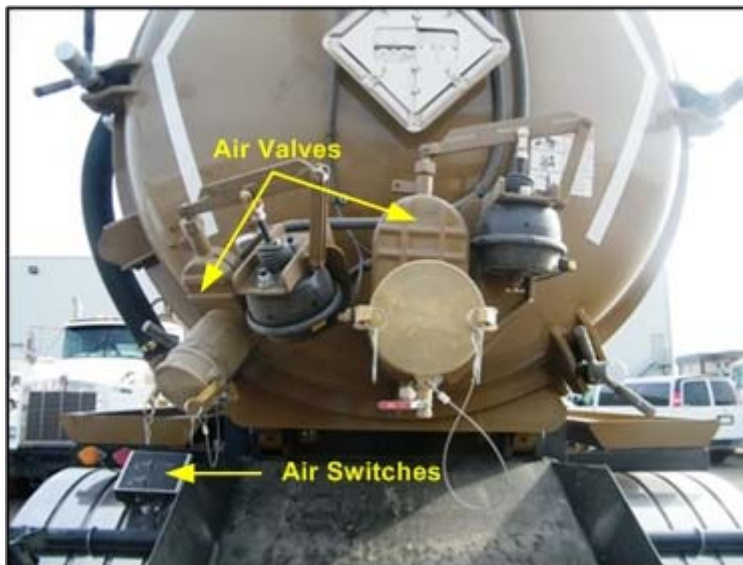
Wingnut

Intake and Discharge Lines

The rear of the tank is where the operator/ laborer attach the hoses for intake or discharge. Both lines are air actuated for opening and closing the lines.

The intake line is used for uploading materials into the tank during routine vacuum operations and the discharge line is used for offloading.

Both lines are controlled by an air actuated valve. The air actuated valve will only open when the Emergency Use Only switch is in the open position.



To operate the air actuated valves the operator must use the air switches panel (shown to the left). Problems may arise during vacuum operations when the air actuated valve do not properly close (see images above). 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.

The image below demonstrates how a properly closed valve might appear.



Air Actuated Valve Partially Open



Properly Closed Valve

The bleeder line is 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.

Door Prop

The rear door is sealed to the tank with a rubber gasket and is raised when access to the tank interior is necessary or when dumping occurs. The semi-vac must never be moved with the rear door partially or fully opened. This may result in hinge failure.

Remember that the door prop must always be used when access to the tank is necessary. The door prop must be securely positioned in the recessed pockets mounted to the outside of the tank and the rear door.

If for some reason the door prop is not available, use extreme care when working around the raised rear tank door. Always remain outside of the line of fire. If this is the case, ensure an Incident Report Form is completed and submitted to your HSE Advisor/ Manager ensuring replacement of the door prop.

On the interior of the tank the intake line extends vertically. When the rear door is closed, the intake line will extend above the collected materials.

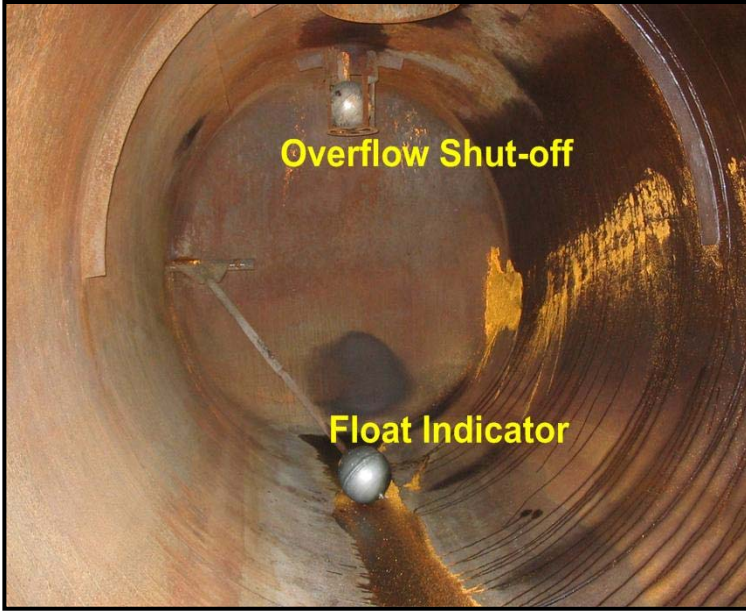
At the top portion of the intake is the deflector plate. This deflector plate redirects debris to the bottom of the tank and prevents materials from entering the vacuum intake line at the top of the tank.



Bleeder Line



Intake Line with Deflector Plate



Tank Interior

The inside of the tank contains the 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 (below).



Exterior Tank Level Indicator



Overflow Shut-Off Ball and Basket

The overflow shut-off ball (pictured left) is contained inside a 'basket' directly below the vacuum line intake.

The ball inside the basket, like the indicator float, is also hollow. As the material inside the tank rises, so too does the ball.

When too much material is drawn into the tank, the ball automatically seals the vacuum line intake, preventing materials from entering the moisture trap and pump.

The isolation valve is located on exterior top of the tank and it is air actuated. 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. This valve must be in the 'open' position during loading and unloading of tank.

Mounted beneath the tank is the vibrator. This device is used during offloading and helps to 'shake out' particulate debris 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.

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.

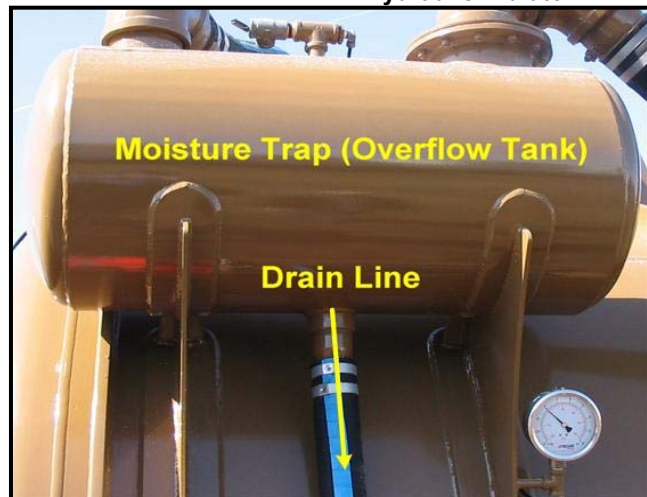


Hydraulic Vibrator

2. Moisture Trap (Overflow Tank)

The moisture trap is a small auxiliary tank that is used to collect moisture and other debris that may 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 premature wear on the pump and must be removed from the system.

The moisture trap condenses moisture, and also acts as a secondary shut-off complete with a stainless steel float ball and an o-ring seal.



Moisture Trap and Drain Line

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 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. On this unit the drain line ends in a two inch male camlock fitting located below the block the valve. A two inch camlock hose must be installed to drain the moisture trap into a spill pan daily.

3. Microscreen

The microscreen is another device designed to remove debris from the system. The microscreen prevents large particles that may have escaped the moisture trap from entering the pump. The microscreen should be inspected prior to starting the pump and must be cleaned at the end of each job.



Closed Microscreen Chamber

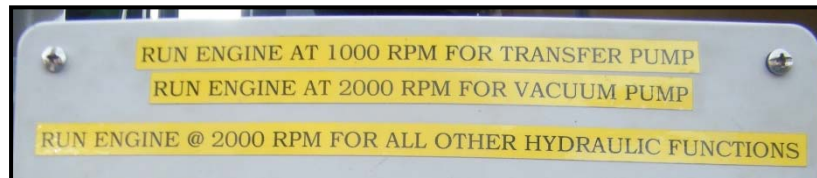


Open Microscreen Chamber

4. Pump

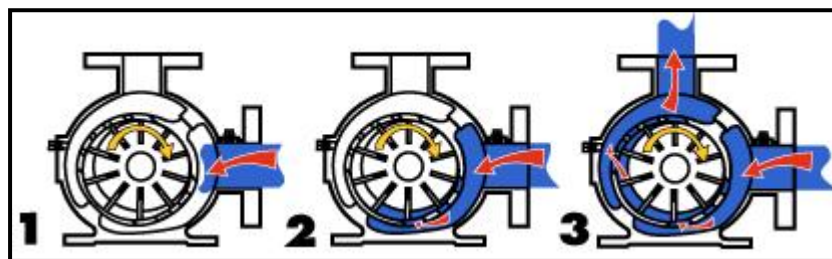
Semi-Vacs may utilize one of three types of vacuum pumps; sliding vane, liquid ring, or rotary lobe. This particular unit utilizes a sliding vane pump.

Sliding vane vacuum pumps typically operate at speeds of up to 2,000 rpm. Each vacuum unit will have the recommended operating limits posted inside the cab of the vehicle or on they hydraulic control panel as seen below.



Sliding Vane Pump (refer to the image below)

Sliding vane pumps usually have fiber vanes that are attached to 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). As the ring rotates the air is trapped in the compartment between the vanes and the pump housing. The air is then compressed and forced out through the discharge connection at the top of the pump.



Flow Through a Basic Sliding Vane Pump

The pump is powered by the hydraulic engine.

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.

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.

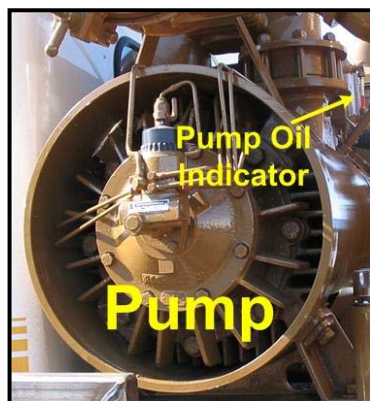
When temperatures are extremely cold, the pump should be allowed to operate at reduced speed for the first five minutes. This will allow the oil to circulate and minimizes the scuffing of the pump walls.



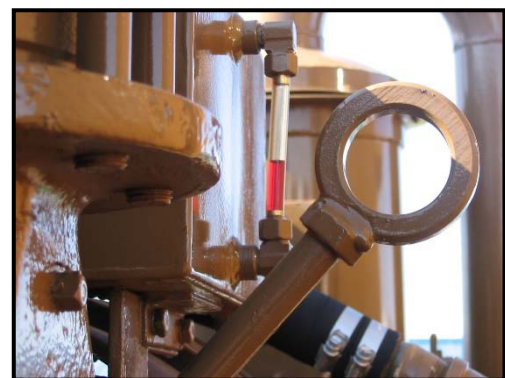
Pump Oil Crank



Inspection Window



Pump and Pump Oil Indicator



Pump Oil Indicator in Reservoir

The pump should remain clean and free from grease. Excessive buildup on pump will prevent proper heat loss and contribute to premature wear.

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.

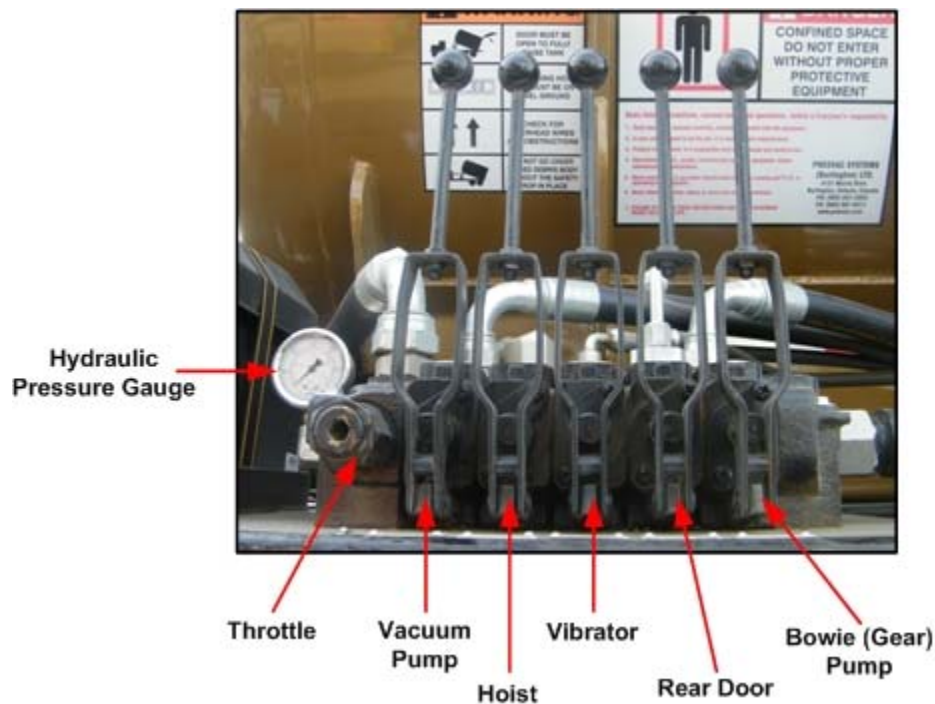


3-Way Valve in ‘Neutral’ Position

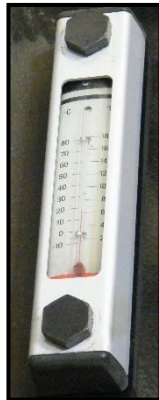
Also, moving the valve into the neutral position is the simple way to remove positive or negative pressure from within the tank (venting). The valve should be moved slowly to help prevent excessive wear.

5. Hydraulic System

The hydraulic bank is where the operator can control various functions of the unit. From this location the operator controls the throttle, vacuum pump, hoist, vibrator, and rear door and Bowie (gear) pump.



The hydraulic reservoir located on the passenger side of the semi-vac houses the hydraulic fuel for all hydraulically operated functions of the unit. A temperature gauge mounted on the reservoir measures the temperature within the hydraulic system. The temperature should be maintained at 180°F (80°C).



Hydraulic Reservoir

6. Hydraulic Engine

The hydraulic engine located at the front of the semi-vac provides the necessary power to the hydraulic pump, which will power various systems on the semi-vac. Essentially, the tractor can be disconnected from the semi-vac trailer and the trailer can be operated as a stand alone unit.

It is important to note that located on the front of the engine is a selector switch. The position corresponds with the mode the unit is being operated in. This could be either detached as a stand-alone unit or attached to the tractor.



Selector Switch



Hydraulic Engine

6. Coolant System

The semi-vac unit has an auxiliary coolant system located beside the hydraulic reservoir on the passenger side of the unit. Glycol is used to heat up the rear valves

on the unit. This is performed through the use of a diesel powered heater, located underneath the tank and bolted on the frame. The heater switch is located on the control panel mounted to the frame.



Coolant Tank



Auxiliary Equipment

Grounding System

One of the most important elements of the semi-vac unit is the grounding system. The semi-vac relies on the Posiground system.



Bad (Open) Connections



Good Connection



Posiground Cables

Safety Switches

There are two main safety switches mounted below the hydraulic bank; **Isolation Valve** and **Emergency Use Only** switches. The operator may activate these in case of an emergency.

The isolation valve switch opens and closes the air actuated safety valve at the top of the tank.



Isolation Valve and Emergency Use Only Switches



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.

Secondary Moisture Trap and Vent Line

The secondary moisture trap is used to collect moisture and exhaust from the pump. Moisture will enter the pump during routine operations and mix 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.

Note that extension hoses fastened to the vent line will vary from job to job.

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.

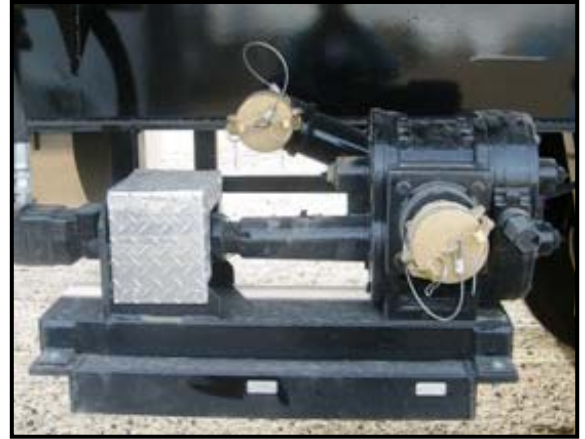


Bowie Pump

Located on the side of the semi-vac is the Bowie (or gear) pump. This pump can be used for loading, offload and transferring 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.



Bowie Pump

It is very important to empty the pump after use during cold weather conditions because frozen water inside the pump can cause significant damage to internal moving parts. 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.

Auxiliary Diesel Tank

This unit is equipped with a diesel tank (right) that provides fuel for the hydraulic engine, coolant heater and to flush the vacuum pump.

Air Bags and Air Bags Dump Valve

The semi-vac is equipped with air bags that equalize the weight in the tank. The air bag dump valve is mounted on the debris slide located on the driver's side of the rear tank. When activated, this switch dumps the air bags. This will allow the tank to be angled downward to facilitate draining.



Auxiliary Diesel Tank



Air Bag Dump Valve

Landing Gear

As mentioned previously, the semi-vac can be detached from the tractor part of the unit. In these instances, the landing gear must always be lowered using the crank (located on the passenger side of the unit). Always ensure the landing gear is in the 'up' position before transporting.



Principles of Operation

The efficiency of a vacuum truck can be determined by the amount of airflow that it creates and is measured in Cubic Feet per Minute (CFM). Generally, the more air volume that can be moved per minute, the greater the efficiency of the truck.

A second method used to determine the efficiency of a vacuum truck is by measuring the amount of pressure (often referred to as suction) produced at the suction head and is measured in inches of mercury.

Operating Limits

It is important to operate the Semi-Vac unit within the specified parameters set forth by the manufacturer. Failure to do so will likely result in premature equipment failure.

Physical Limits	Consequences of Deviations
25-30 inches of mercury (max)	<i>Equipment wear/ damage Personal injury Overflow of materials Blow-out of seals</i>
Hydraulic engine	<i>Wrong RPM can cause damage to the unit components</i>
Operate on level ground for loading and dumping	<i>Vehicle could shift</i>
800 – 2,000 rpm (as per manufacturer's recommendation)	<i>Excessive wear on the pump might occur</i>
200°F maximum material temperature	<i>Burning of seals</i>



Daily Pre-Job Checklist for Semi-Vac Unit



DAILY PRE-JOB CHECKLIST FOR SEMI-VAC UNIT

DATE: _____ JOB LOCATION: _____ UNIT #: _____

DISPATCHER NAME: _____ DIVISION: _____

	YES	NO	N/A
FLUID LEVELS:			
1) ENGINE OIL – TRACTOR			
2) ENGINE OIL – TRAILER			
4) HYDRAULIC SYSTEM			
5) VACUUM PUMP OIL			
6) COOLANT			
7) FUEL LEVEL ON TRAILER			
SEALS:			
1) BACK DOOR SEAL			
2) TOP HATCH SEAL			
3) VALVE CAP SEALS			
4) OVERFLOW TANK SEAL			
5) CYCLONE DUMP PORT			
MISCELLANEOUS:			
1) LEVEL INDICATOR GAUGE WORKING			
2) ALL VALVES IN GOOD WORKING CONDITION			
3) TRAILER AIR BAG SYSTEM IN CORRECT POSITION			
4) ARE ALL CAPS CHAINED AND IN PLACE			
5) ENSURE PUMP IN PROPER MODE FOR APPLICABLE TASK			
6) COOLANT HEATER IN CORRECT POSITION			
7) ENSURE MICROSCREENS IS CLEAN AND IN GOOD CONDITION			
8) ENSURE THAT BACK DOORS ARE TIGHT			
9) ARE ENGINE AND VACUUM GAUGES IN GOOD WORKING ORDER			
10) ENSURE PRESSURE RELIEF VALVES ARE IN GOOD WORKING ORDER AND INTACT			
11) ENSURE ALL CAMLOCK FITTINGS ARE IN GOOD WORKING ORDER AND INTACT			
12) ARE TANK AND REAR DOOR SAFETY PROPS ON UNIT			
13) CHECK FIFTH WHEEL LOCKED/ UNLOCKED			
14) CHECK LANDING GEAR UP/ DOWN			
EQUIPMENT TO PERFORM TASK:			
1) SPOTTER VEST			
2) HOSES			
3) REDUCERS TO PERFORM TASK			
4) POSIGROUND SYSTEM			
5) PROPER P.P.E.			
6) JOB PROCEDURES			
7) EXTRA PUMP OIL			



DAILY PRE-JOB CHECK FOR SEMI-VAC UNIT (CONTINUED)

	YES	NO	N/A
EQUIPMENT TO PERFORM TASK CONTINUED:			
8) GREASE GUN AND GREASE			
9) EXTRA GASKETS AND CAMLOCKS			
10) WHEEL CHOCKS			

By signature below, I acknowledge that I have completed this document by verifying each item

OPERATOR: Print: _____ Sign: _____

CEWMEMBERS Print: _____ Sign: _____

Print: _____ Sign: _____

Print: _____ Sign: _____

Print: _____ Sign: _____

Print: _____ Sign: _____

Print: _____ Sign: _____

Print: _____ Sign: _____

Print: _____ Sign: _____

Any item not shown as "YES" must be explained below.

Perform Semi-Vac Operations

Precautions:

Eye protection must be worn when loading and off-loading the semi-vac. Also, exercise caution when handling hot liquids and materials. Inhalation of material may pose respiratory risks.

Ensure you are aware of all the hazards associated with the materials you are handling. Ensure proper PPE is worn. When unsure, please refer to the MSDS or speak to your job supervisor.

Only individuals who have received tetanus and hepatitis A and B immunization are permitted to handle sewage. When starting a vacuum truck ensure the pump is set to the correct mode: either 1 – vacuum or 2 – pressure.

Do not over-pressurize tank (beyond 12 psi).

ACTION	NOTES
Pre-Start	
1. PARK unit on level ground...	... ensure ground is stable.



2. FLAG/ TAG area.	
3. COMPLETE FLHA and Pre-Job Checklist for Semi-Vac.	
4. ENSURE vehicle is properly grounded...	<i>... use grounding cable to prevent static discharge.</i>
Loading	
1. ENSURE 3-way valve is in correct position...	<i>... in "V" position.</i>
2. ENGAGE hydraulic engine.	
3. ENGAGE hydraulics on control panel.	
4. ENGAGE pump...	<i>... using pump handle.</i>
5. ADJUST throttle to efficient working rpm...	<i>... between 800 – 2,000 rpm (according to manufacturer specifications). ... depending on pump – check for label on dash.</i>
6. OPEN bleed line.	
7. REMOVE cap.	
8. CONNECT hoses.	
9. CHECK vacuum gauge...	<i>... ensure gauge reading is approximately - 12mmHg.</i>
10. CHECK for leaks.	
11. CHECK for wing nuts...	<i>... ensure wingnuts are tight.</i>
12. OPEN load valve.	
13. LOAD product...	<i>... fill truck to $\frac{3}{4}$ maximum or DOT regulations.</i>

ACTION	NOTES
Shutdown	
1. CLOSE load line valve.	
2. REMOVE hose from product.	
3. RE-OPEN load line valve...	<i>... to remove product that might still be in hose. ... to prevent spillage.</i>
4. VACUUM-out line.	
5. CLOSE load line valve...	<i>... 1 and 2 valves.</i>
6. DISCONNECT hose from truck and stow...	<i>... ensure stowed hoses are properly secured.</i>
7. SECURE caps on load line.	
8. REDUCE idle...	<i>... to approximately 600 – 800 rpm.</i>
9. SHUT DOWN pump.	
10. DISENGAGE hydraulics.	
11. SHUT DOWN hydraulic engine.	



12. DISENGAGE grounding cable.	
13. PERFORM unit walk around...	<i>... ensure spill pans, hoses and wheel chocks are properly stowed.</i>
14. PROCEED to dumping location.	
Unloading (Gravity Flow Offloading)	
1. PARK unit on level ground...	<i>... ensure ground is stable. ... ensure designated dumping area has been identified.</i>
2. FLAG/ TAG area.	
3. DUMP air bags.	
4. ENSURE vehicle is properly grounded...	<i>... use grounding cable to prevent static discharge.</i>
5. OPEN bleed line prior to removing cap...	<i>... when dumping through bottom valve. ... ensure spill container is placed below bleed line to catch debris.</i>
6. ENSURE 3-way valve is in the neutral position.	
7. UNLOAD product.	
8. CLOSE all valves and recap.	



ACTION	NOTES
Unloading (Pressure Offloading)	
1. PARK unit on level ground...	<i>... ensure ground is stable. ... rig in hoses if required.</i>
2. FLAG/ TAG area.	
3. ENSURE vehicle is properly grounded...	<i>... use grounding cable to prevent static discharge.</i>
4. DEPRESSURE tank using 3-way valve...	<i>... ensuring 3-way valve is in "P" position.</i>
5. REMOVE cap from the discharge line ...	<i>... ensure no one is the line of fire.</i>
6. HOOK-UP hoses...	<i>... ensure whip checks are in place at every connection. ... camlock ears must be wired shut to prevent them from blowing off.</i>
7. OPEN any valves between the truck and the pressure receptacle...	<i>... ensure there is sufficient room for the product in the tank. ... leave discharge valve closed. ... if pressuring off into the atmosphere ensure the hose discharge is secured.</i>
8. START UP engine.	
9. ADJUST throttle to efficient working rpm...	<i>... between 800 – 2,000 rpm (according to manufacturer specifications).</i>
10. OPEN discharge valve.	
11. UNLOAD product.	
12. MONITOR pressure gauge...	<i>... do not exceed 10 psi.</i>
13. CLOSE tank valve.	
14. DISENGAGE pump...	<i>... ensure vent line has not been hooked into a vent scrubber.</i>
15. RELEASE pressure from vent line...	<i>... place 3-way valve into neutral position.</i>
16. POSITION mode selector to "Vacuum".	
17. ENGAGE vacuum pump.	
18. DISCONNECT hose from tank...	<i>... ensure the tank valve is open.</i>
19. VACUUM liquid from the hose into the tank...	
20. CLOSE all valves and recap.	
21. STOW all hoses.	
22. DISCONNECT all grounding equipment.	
23. TIGHTEN back wing nuts...	<i>... must be done anytime positive pressure is applied.</i>



ACTION	NOTES
Unloading (Using Bowie Pump)	
1. PARK unit on level ground...	<i>... ensure ground is stable.</i>
2. FLAG/ TAG area.	
3. ENSURE vehicle is properly grounded...	<i>... use grounding cable to prevent static discharge.</i>
4. CONNECT hose(s) from tank discharge line to bowie intake...	<i>... use reducers.</i>
5. CONNECT hose(s) to bowie discharge.	
6. OPEN tank discharge valves.	
7. ENGAGE bowie pump and offload tank.	
8. DISENGAGE bowie pump once offloading is complete.	
9. DISCONNECT lines...	<i>... use spill pans at connections to contain debris.</i>
10. CLOSE discharge valves on tank.	
11. DISENGAGE grounding cable.	
12. PERFORM unit walk around...	<i>... ensure spill pans, hoses are properly stowed.</i>

Maintain/ Care for Semi-Vac Unit

As with any equipment used regularly, all components of the vacuum truck must receive the appropriate preventative maintenance in order to properly operate. It is important to identify the following components and perform the required maintenance for routine operation.

Part/ Device	Required Maintenance	Frequency
Moisture traps	Drain into spill pan	Daily
Micro screen	Clean as necessary	Daily
Pump oil/engine oil	Determine appropriate level	Daily
Diesel tank level	Ensure proper level	
Valve seats	Clean	Daily
Hydraulic oil level	Ensure proper level	Daily
Coolant level	Ensure proper level	
Release valve	Ensure proper operation	Daily
Roll-over protection valve	Ensure proper operation	Daily
Shut-off ball	Ensure proper operation	Daily
Bleed valve between gate valve and end cap	Ensure proper operation	Daily



Wing nuts	Grease	Daily
Airflow shut-off ball and basket	Visually inspect	Daily
Level indicator and float	Visually inspect	Daily

Winterization

Due to the inclement weather conditions, appropriate winterization of the Semi-Vac Unit is critical for proper operation. Winterizing of a vacuum pump must be done after the job is completed and the pump will not be used for a period of time. The winterization procedure is as follows:

ACTION	NOTES
Pump Winterization	
1. ENGAGE hydraulic engine.	
2. ENGAGE hydraulic system.	
3. ENSURE 3-way valve is in the vacuum position.	
4. ENGAGE vacuum pump...	<i>... use idle speed.</i>
5. OPEN valve on winterizing line leading to fuel tank...	<i>... to allow vacuum.</i>



ACTION	NOTES
Pump Winterization continued	
6. REMOVE cap from fuel tank...	<i>... proceed to Step 7, if winterizing line is permanently mounted to fuel tank.</i>
7. ENSURE vacuum is present in line and place hose into fuel tank/ can.	
8. DRAW fuel into pump for approximately 10 seconds to allow fuel to coat pump vanes...	<i>... proceed to Step 9, if winterizing line is permanently mounted to fuel tank.</i>
9. TAKE line out of fuel tank.	
10. REPLACE fuel cap.	
11. SHUT OFF valve on winterizing line.	
12. SHUT OFF vacuum system.	
13. SHUTDOWN hydraulic engine...	<i>... pump is winterized at this point. ... when pump is re-engaged, ensure pail is placed under pump exhaust to catch any residual fuel.</i>
Air System Winterization (For Units Utilizing Alcohol Pots)	
1. DRAIN-OFF air pressure...	<i>... ensure bleed valve on bottom of alcohol pot is open.</i>
2. OPEN drain valve on pot.	
3. REMOVE fill nut from top of alcohol pot...	<i>... use wrench, if necessary.</i>
4. CLOSE drain valve on pot.	
5. FILL pot with brakeline antifreeze.	
6. REPLACE fill nut...	<i>... use wrench to tighten.</i>
7. CLOSE all air bleed valves on system and repressurize.	

Use the standard CEDA Work Order Form (next page) and provide the required documentation to initiate required maintenance.

[illegible]

As with any equipment used regularly, all components of the vacuum truck must receive the appropriate preventative maintenance in order to properly operate. It is important to identify the following components and perform the required maintenance for routine operation.

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION(S)
Loss/ reduction of vacuum...	Plug in vacuum hose	Check for obstruction in hose. Reverse hose if necessary (not vacuum).



Loss/ reduction of pressure....	Veins in pump are worn	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.
	Vacuum filter is plugged	Clean filter.
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.

Bowie Pump Troubleshooting Chart

Problem	Possible Cause	Solution
Bowie pump will not engage...	Frozen Pump	Use steam supply to thaw.
Low Discharge Pressure when pumping off...	Leaking Packings	Adjust packing nut or generate work order for pump inspection/ repair.
	Pump is worn	Generate work order for pump inspection/ repair.



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. Why is the semi-vac equipped with air bags? a. The air bags serve no purpose and are not required to be used. b. The air bags equalize the weight in the tank. c. The air bags protect the tank from collisions. d. None of the above		
2. The glycol heater receives fuel from the tractor. a. True b. False		
3. The semi-vac uses a _____ vacuum pump. a. liquid ring b. rotary lobe c. sliding vane d. None of the above		
4. The semi-vac should be grounded only when handling flammable materials. a. True b. False		
5. The semi-vac can operate as a stand alone unit. a. True b. False		
6. Engaging the vibrator for an extended period of time may cause the welds on the bottom of the tank to crack. a. True b. False		
7. What is the picture illustrating?  a. Positive Air Flow Pressure b. Heating System c. Winterization d. Negative Air Flow Pressure		
8. For any hydraulic functions, the pump must not exceed ____ RPM. a. 1000		



	b. 1500 c. 2000 d. 2500		
9.	Both intake and discharge lines are manual and air actuated. a. True b. False		
10.	When disconnecting the trailer from the tractor the landing gear needs to be in what position? a. Up b. Down c. No landing gear required d. It does not matter		
11.	Hydraulic temperature should be maintained at _____. a. 125°F b. 150°F c. 200°F d. 225°F		
12.	The semi-vac should be serviced by a mechanic every: a. 100 – 150 hours b. 200 – 250 hours c. 300 hours d. after each job		
13.	The wing nuts on the rear door should be greased: a. daily. b. weekly. c. monthly. d. after each job.		
14.	_____ should be used to winterize the pump. a. Gasoline b. Diesel c. Gear oil d. None of the above		
15.	Microscreens should be inspected: a. monthly. b. weekly. c. daily. d. None of the above		
16.	Which of the following requires daily inspection: a. pump oil. b. release valves. c. roll over protection valve. d. All of the above		

Practical Assessment – Semi-Vac 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

Section 1			
The following items must be identified and their purpose, inspection requirements, and preventative maintenance must be explained. Failure to successfully explain inspection and maintenance requirements does not constitute a FAIL, but will require a mentorship agreement to bring the employees level of knowledge to an acceptable level.			
ITEM		YES	NO
1	Intake / Discharge Valve Switches		
2	Coolant Tank		
3	Coolant Heater		
4	Hydraulic Engine		
5	Air Bag Dump Valve		
Section 2			
The following tasks must be completed in the prescribed sequence. Any exceptions must be noted in the comments section with justification. Assessor will check YES column if the item was actioned satisfactorily, or circle the number in the NO column if it was not. If enough demerits are accumulated to warrant a fail, or employee performs an unsafe or dangerous action, the assessment may be terminated immediately. If necessary, all near-miss/incident reporting requirements must be met.			
<i>*Copies of the completed Daily Inspection, FLHA and Procedure must be attached to the assessment.</i>			
TASK		YES	NO
Pre-Start			
1	Don proper PPE for vacuuming operation: - approved safety "hard hat", approved safety footwear and glasses, "Nomex" coveralls, rubber and/ or leather work gloves, hearing protection.		
2	Review job specific procedures.		
3	Complete Daily/ Pre-Job Checklist, FLHA.		



4	Check general job conditions: - visual inspection of complete job site. - acknowledge performance parameters.		
Operation			
5	Demonstrate familiarity with the semi-vac unit - no hesitation or inability to locate controls, gauges, components, etc.		
6	Perform effective start up according to procedure.		
7	Ensure complete and proper prime: - recognize signs like proper intake and load pressures, sound, etc.		
8	Use proper and efficient operating techniques: - remain within job specific procedures and parameters. - remain within equipment design limits as stated in the operator's manual(s).		
9	Apply smooth operation of controls.		
10	Perform ongoing and sufficient checks of all equipment: - throughout each shift - e.g. fuel and engine oil pressures.		
11	Recognize problem symptoms: - load changes, blockage, vibrations, visual cues.		
12	Ability to effectively troubleshoot equipment: - if and when required - anytime throughout operation.		
13	Respond to problems in a timely and effective manner.		
14	Use effective communication with team members throughout operations.		
15	Correctly follow procedures (observed throughout the observation period).		
Shut Down			
16	Follow proper shut-down procedure.		
17	Winterize the pump in a safe manner (if required).		
18	Follow safe shut down procedures.		
19	Observe safety considerations: - shut down equipment during inspection. - follow all CEDA procedures.		



Pump Winterization			
1	Engage hydraulic engine		
2	Engage hydraulic system.		
3	Ensure 3-way valve is in the vacuum position.		
4	Turn on vacuum system.		
5	Open valve on winterizing line leading to fuel tank.		
6	Remove cap from fuel tank.		
7	Ensure vacuum is present in line and place into fuel tank.		
8	Draw fuel into pump for approximately 10 seconds to allow fuel to coat pump vanes.		
9	Take line out of fuel tank.		
10	Replace fuel cap.		
11	Shut off valve on winterizing line.		
12	Shut off vacuum system.		
13	Disengage hydraulic engine.		
Air System Winterization (for units utilizing alcohol pots)			
1	Drain-off air pressure.		
2	Open drain valve on pot.		
3	Remove fill nut from top of alcohol pot.		
4	Close drain valve on pot.		
5	Fill pot with brakeline antifreeze.		
6	Replace fill nut.		
7	Close all air bleed valve on system and re-pressurize.		
Comments:			



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
- ☐ 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
January 10, 2023	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:
