

## SPECIFICATION FOR HYDRO OR PNEUMATIC VACUUM EXCAVATION

### SCOPE

This specification contains the specific operating and safety rules, supervisor and operator qualification and training requirements, specific responsibilities, general equipment operating guidelines, code, regulations and environment guidelines to safely manage and perform hydro or pneumatic vacuum excavation.

Hydro or pneumatic vacuum excavation operations include various types of excavations including; “pot-holing” and “slot trenching” for underground utility locating, shafts and pits, and other types of excavations.

The items listed in this specification are to be used in conjunction with the safe operating procedures found within the owner’s handbook and the Job Hazard Analysis sheets found in Attachment III of this specification.

### DEFINITIONS

Hydro Excavating – The technique for excavating the earth’s surface using water under pressure.

Pneumatic Excavating - The technique for excavating the earth's surface using air under pressure

Vacuum Excavating - The technique for excavating and removing the earth's surface using vacuum

Hydro Vacuum Excavating Unit – Truck or trailer equipped with high-pressure water pumps, vacuum pumps and a separator holding tank to receive excavated spoils

Pneumatic Vacuum Excavating Unit- Truck or trailer equipped with high pressure air compressor, vacuum pumps and a separator holding tank to receive excavated spoils

Qualified Trainer – A person who has satisfactorily completed a training course provided by the manufacturer or owner of the equipment. The training must include equipment operation and safety considerations

Spoils – Excavated material that may include, water, mud, soil and debris.



## CODES, REGULATIONS and ENVIRONMENTAL

- Hydro or pneumatic vacuum excavation shall conform to all applicable federal, state, and local codes, regulations and permit requirements.
- Vacuum truck tanks, pumps, and other equipment shall conform to all applicable codes which would include the Department of Transportation (DOT) and American Society of Mechanical Engineers (ASME) (for pressure vessels).
- Transporting spoils must be managed by site environmental coordinators and comply with all federal environmental and DOT regulations.

## OPERATIONS AND SAFETY RULES

The operation of hydro or pneumatic vacuum excavation equipment shall conform to the following items to ensure a safe and productive work environment:

- Operator(s) must be thoroughly familiar with and follow the operator's procedure and operator's handbook guidelines. Individuals operating the hydro or pneumatic vacuum excavation equipment shall be qualified per this specification and the site's operating procedure.
- All tasks shall be reviewed to insure the proper equipment/attachments for the job are used.
- All employees other than the individuals using the hydro or pneumatic vacuum excavation equipment will maintain a safe distance from the task being performed.
- Employees operating motor vehicles shall have a valid operator permit.
- Employees' driving/riding in the cab of the hydro or pneumatic vacuum excavation truck are required to use a restraint system (seatbelts) when the vehicle is traveling.
- The hydro or pneumatic vacuum excavation equipment must not be used for any purpose other than that for which it was designed. Accessories other than those manufactured for use with the equipment shall not be used without prior approval from the manufacturer and site safety personnel.
- The wheels of the hydro or pneumatic vacuum excavation equipment shall be chocked prior to operating the equipment.
- The hydro or pneumatic vacuum excavation equipment shall not be operated beyond its specified capabilities as outlined in the operator's manual without special approval.
- Steel toe rubber boots, hardhat, hearing protection, ANSI approved safety glasses with rigid side shields, rubber gloves and slicker suit are minimum personal protective equipment to be worn at all times when performing hydro or pneumatic vacuum



excavating operations. The operators of the high-pressure water or air nozzle and the vacuum pipe shall wear face shields. **Note:** Nomex will be required under slicker suit in all Nomex required areas.

- Never leave the hydro or pneumatic vacuum excavation equipment running and unattended.
- A spotter will be required when the view to the rear of the hydro or pneumatic vacuum excavation equipment is obstructed or when positioning/repositioning equipment in highly congested areas.
- Drivers of the hydro or pneumatic vacuum excavation equipment shall follow all applicable aspects of any site excavation specifications, guidelines and procedures around safe vehicle usage.
- Keep the suction line away from your body and especially your face.
- Use caution when making any adjustments on the unit while it is running or operating. Stop the engine and then make adjustments.
- Keep hands away from moving parts.
- Complete a specific job safety analysis sheet identifying all hazards associated with task.
- When working close to the edge of an excavation and a potential fall hazard exists a plan shall be in place and addressed on appropriate site forms.
- Ensure all of the following permits are in place prior to beginning the job:
  - Work permit
  - Excavation permit
  - Confined Space Entry Permit if required.
- A danger/do not operate tag shall be placed on the hydro or pneumatic vacuum excavation equipment, if it is deemed unsafe to operate, until repairs can be made.
- Prior to operating the unit, the operator(s) shall check all items listed in the Operator Daily Checklist (Attachment I).
- At the conclusion of the work shift, the operator shall check all items listed in the Operator Post Job Checklist (Attachment II).



- Operator shall secure all connections starting at the source and follow through to the loading site.
- Do not exceed the recommended RPM found in the owner's handbook.
- When changing from "vacuum mode" to "pressure mode" vent tank to "0" Hg first, if required by manufacturer.

## SUPERVISOR AND OPERATOR QUALIFICATIONS

- All personnel involved in hydro or pneumatic vacuum excavation shall be at least 18 years of age and be a full time employee of the company providing the service. They shall satisfactorily complete a training course, provided by Qualified Trainer representing the manufacturer or owner of the equipment, which includes all safety considerations and equipment operation before working on site. The training course shall include the items listed in the Training Requirements Section
- The contractor shall be able to verify the current qualifications of each member of the excavation crew that will be operating the equipment.
- An excavation crew shall be composed of at least two persons. The operator shall be in view of another crewmember at all times.
- Supervisors and Operators shall have at least 500 hours of documented experience in hydro or pneumatic vacuum excavation
- Supervisors and Operators shall successfully complete a written examination to demonstrate an understanding of this operating procedure.
- Supervisors and Operators shall meet one of the following re-certification criterion on an annual basis:
  - Provide documentation of 500 hours of active hydro or pneumatic vacuum excavation supervision or operation over the past year.
  - Successfully complete the Training Requirements

## TRAINING REQUIREMENTS

Each supervisor and operator shall complete a training course before their first hydro or pneumatic vacuum excavation work on site.

Training documentation for each supervisor and operator and shall include the course outline/description and a letter of certification of course completion. The training course shall include, but not be limited to the following:

- The cutting action of the high-pressure water or air stream and its potential hazard to the operator shall be demonstrated. The demonstration shall show the effect of the stream on some suitable material.
- The need for and, limitations of personal protective equipment (PPE) shall be explained. Instructions shall be given as to when and how specific clothing and protective devices must be worn.
- Operation of the high-pressure system, vacuum system, and auxiliaries shall be explained. Training shall include start-up and shut down procedures, potential



equipment problems, and appropriate corrective actions.

- Operation and purpose of all safety devices shall be explained. The importance of not tampering with any safety device, as well as the importance of keeping them functional, shall be stressed.
- The proper method of connecting hoses, including laying-out without kinks, protection from excessive wear, and using proper tools for hookups.
- The trainee shall demonstrate their ability to safely operate the equipment as detailed during the training course.
- The trainee shall demonstrate understanding of the training course by satisfactory completion of a written examination.

### RESPONSIBILITIES

Equipment owners are responsible for ensuring and maintaining current qualifications and certifications of the supervisors and operators.

Supervisors and Operators are responsible for:

- Maintaining familiarity with the operation of the hydro or pneumatic vacuum excavation equipment, being knowledgeable of the operating procedure, operator's handbook and area specific procedures for the safe operating condition prior to use.
- Completing an Operator Daily Checklist (Attachment I) prior to using the hydro or pneumatic vacuum excavation equipment and an Operator Post Job Checklist (Attachment II) upon completion of daily work tasks.
- Pay attention to any unusual noises, vibrations or other indicators during operation and initiate immediate corrective action.
- Ensuring only qualified operators operate the hydro or pneumatic vacuum excavation equipment.
- Ensuring preventative maintenance and inspections are performed in accordance with the manufacturer's recommendations in the owner's handbook.
- Providing documentation to site safety personnel of inspection and maintenance performed on the hydro or pneumatic vacuum excavation equipment.

### OPERATING GUIDELINES FOR HYDRO OR PNEUMATIC VACUUM EXCAVATION EQUIPMENT

When setting up the hose, it is best to take the shortest straight line possible from the vacuum source to the loading area. If the distance encompasses more than 50 feet during "dry" product loading, it is best to run the set-up line with "hard pipe" as long as possible using gradual turns where possible. When the loading area is reached, then a lightweight flexible hose can be used as a "work whip". Refer to owner's handbook on guidelines for hose set-up.



Positioning and maneuvering of the loading hose is a very important task. Proper handling will maximize the performance of the vacuum source. Refer to operator's handbook on specific hose handling tips.

Operators shall follow the guidelines around "loading dusty products and powders" located in the owner's handbook.

Minimum and maximum operating settings for the equipment are as follows:

Water Pressure:	1,500 to 2,500 psig
Water Flow Rate	4 to 10 gpm (hydro excavation rigs) 38 gpm max. (combo rigs)
Vacuum Rate:	2,500 to 4,500 cfm (minimum)
Vacuum Capacity:	14 to 28 inches Hg

The operator(s) of the unit are responsible for equipment care while it is being used and following the guidelines for safe operation when:

- Filling the vacuum pump with service liquid
- Engaging the main vacuum pump
- To engage the auxiliary vacuum pump and hydraulic system
- Operating automatic cyclone clean-out
- To disengage main vacuum pump
- To open the rear door. Refer to rear control panel description
- To close the rear door. Refer to rear control panel description

## RECORDS

All hydro or pneumatic vacuum excavation equipment supervisor and operator training records shall be maintained in the employee's training file and be made available upon request. Supervisors and operators shall also have on their person a valid operator's card.

Maintenance and inspection records shall be kept on file and made available upon request. A qualified manufacturer's representative or an owner's mechanic that is qualified shall perform maintenance on the hydro or pneumatic vacuum excavation equipment (tanks, pumps, valves, etc.).

## REFERENCES

- Hydro excavation equipment operator's handbook
- Vehicle Operator's Rules
- Work Permits
- Excavations
- Vessel and Confined Space Entry

**ATTACHMENT 1**  
**OPERATOR DAILY CHECKLIST (HYDRO EXCAVATION EQUIPMENT MODEL)**

	<b>OK</b>	<b>Initials</b>
Main Vacuum Pump Oil Level Drive End _____ N D End		
Main Vacuum Pump belt Tension (Max. 1" Free Play)		
Main Vacuum Pump Drain Valves Clear		
Main Vacuum Pump Vacuum Relief is Operational		
Main Vacuum Pump Driveline Is Lubricated		
Main Vacuum Pump Idler Bearings Are Lubricated		
Transfer Case Is Filled To Proper Level		
Auxiliary Vacuum Pump Is Full Of Oil		
Auxiliary Vacuum Pump Drive End Bearing Is Lubricated		
Auxiliary Vacuum Are Clean		
Auxiliary Vacuum Pump Muffler is Drained		
Auxiliary Vacuum Pump Changeover Valve Works Freely		
Service Liquid Is Filled To Proper Level		
Service Liquid Is Free Of Sludge And Debris		
Cyclones Are Empty And Clean		
Piping From Cyclones To Tank Are Empty And Clean		
Truck Air Tanks Are Drained And Free Of Moisture		
All Air Valves Are Operating Properly		
Hydraulic Oil Reservoir Is Filled To Proper Level		
All Hydraulic Control Valves Operate Properly		
All Gauges Operate Properly		
Auxiliary Throttle Operates Properly		
Rear Loading And Unloading Valves Operate Properly		
All PTO Bolts Are Tightened Properly		
There Are No Air Leaks		
There Are No Oil Leaks		
There Are No Water Leaks		
*Water Pump Oil End Is Filled To Proper Level		
*Water Pump Strainer Is Clean		
*Water Pump Piping Is Free Of Leaks		
*Transfer Pump Is Properly Lubricated		

\*Indicates optional equipment, which may not be installed on your unit.



## ATTACHMENT II OPERATOR POST-JOB CHECKLIST (HYDRO EXCAVATION EQUIPMENT MODEL)

	OK	Initials
Main Vacuum Pump Oil Level Drive End _____ N D End		
Main Vacuum Pump belt Tension (Max. 1" Free Play)		
Main Vacuum Pump Drain Valves Clear		
Main Vacuum Pump Vacuum Relief is Operational		
Main Vacuum Pump Driveline Is Lubricated		
Main Vacuum Pump Idler Bearings Are Lubricated		
Transfer Case Is Filled To Proper Level		
Auxiliary Vacuum Pump Is Full Of Oil		
Auxiliary Vacuum Pump Drive End Bearing Is Lubricated		
Auxiliary Vacuum Are Clean		
Auxiliary Vacuum Pump Muffler is Drained		
Auxiliary Vacuum Pump Changeover Valve Works Freely		
Service Liquid Is Filled To Proper Level		
Service Liquid Is Free Of Sludge And Debris		
Rinse Out Secondary Cyclone or Moisture Trap		
Piping From Cyclones To Tank Are Empty And Clean		
Truck Air Tanks Are Drained And Free Of Moisture		
All Air Valves Are Operating Properly		
Hydraulic Oil Reservoir Is Filled To Proper Level		
All Hydraulic Control Valves Operate Properly		
All Gauges Operate Properly		
Auxiliary Throttle Operates Properly		
Rear Loading And Unloading Valves Operate Properly		
All PTO Bolts Are Tightened Properly		
There Are No Air Leaks		
There Are No Oil Leaks		
There Are No Water Leaks		
Inspect Primary Shut-off Ball/Seat		
Wash Out Tank		
*Water Pump Oil End Is Filled To Proper Level		
*Water Pump Strainer Is Clean		
*Water Pump Piping Is Free Of Leaks		
*Transfer Pump Is Properly Lubricated		

\*Indicates optional equipment, which may not be installed on your unit.





## ATTACHMENT III JOB HAZARD ANALYSIS – HYDRO EXCAVATION EQUIPMENT

Note: Only qualified operators shall operate this piece of equipment

Sequence of Events	Potential Hazards	Elimination of Hazard
1) Check equipment prior to use	Equipment may not be in proper operating condition.	Ensure the “Operator’s Daily Checklist” has been completed prior to start-up. Any deficiencies shall be noted and corrected.
2) Obtain proper permits prior to start of job and identify applicable hazards on JSA.	Work area, etc. Working without the proper permits	A general work permit is always required in addition to the excavation permit. A confined space entry permit may be required for excavations three feet or greater that an employee will have to enter to perform job task. Ensure communication is made to the area clearing the permit if entry into the excavation is required. A JSA shall be filled out specific to the hazards associated with the job task, reviewed and signed by employee prior to beginning work.
3) Bring equipment into area and set up.	Congestion of work area, lifting hazards, placement of vacuum truck presenting a possibility of cave-in.	Ensure a spotter is present to guide/position vacuum truck into designated area. Two people are required to lift/carry hoses six inches or greater in diameter. Place truck where vibration from vacuum truck in conjunction with hydro excavating will not cause a potential problem for cave-in.
4) Prepare area for work to begin.	Other employees in area that may be affected with hazards of hydro-excavation task.	Barricade the excavation work area with rigid barricade material. Use a warning type barricade around equipment to warn others of hazards. Ensure barricades are tagged on all sides as why the barricade was erected.



5) Donning of proper personal protective equipment.	Splash/spray hazard, high noise level, possible heat related issues, flying debris	Employees are required to wear ANSI approved 287.1 safety glasses with rigid sideshields, faceshield, hardhat, slickersuit, rubber boots with steel toe shank, rubber gloves, earplugs at minimum. Note: Nomex shall be worn in "Nomex Required" areas (under slickersuit). Be aware of potential heat related problems that may be present while wearing slickersuit during hot weather conditions. Drink plenty of liquids and take short frequent breaks. If hydro-excavating in a gravel area be aware of potential flying debris (rocks).
6) Begin hydro-excavation job.	Hazards with suction hose, rotating equipment.	Keep suction line away from your body, especially your face. Do not attempt to make any adjustments on the unit while it is running or operating. Keep hands away from moving parts.
7) Placement of hoses, material being excavated from hole.	Slip/trip hazards from hoses and loose dirt, wet dirt, etc. Washout/undermining potential creating a fall hazard for employees performing task.	Be aware of hose placement in relation to personnel at all times. If a potential for fall hazard is present (possibility of employee falling into excavation) a plan shall be in place and addressed on the job safety analysis.
8) Dumping of spoil material.	Potential for environment exposure.	Ensure the environmental portion of the operating procedure is followed.