

Everything You Need to Know About

# HYDROVAC TRUCKS



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**Hydrovac trucks** are a class of industrial vacuum trucks used primarily for digging and excavation purposes. The operation of these trucks is relatively straightforward—high-pressure water is used to break up the soil, while a high-powered vacuum removes the **slurry** from the site into a debris tank mounted on the truck.

While hydrovac trucks may seem simple, there is more to these machines than meets the eye. Each element is specifically designed to ensure that they are able to perform their duties in the most efficient way possible.

This paper discusses the ins and outs of hydrovac trucking units, including the components of a typical hydrovac truck, the most common hydrovac trucking applications, and how to select the right truck for your needs.



# Main Components of a Typical Hydrovac Truck

Hydrovac trucks vary in design. Different manufacturers may add specific features to their trucks to market them as a selling point. Regardless of the design, all hydrovac trucks consist of the same essential elements. These include:



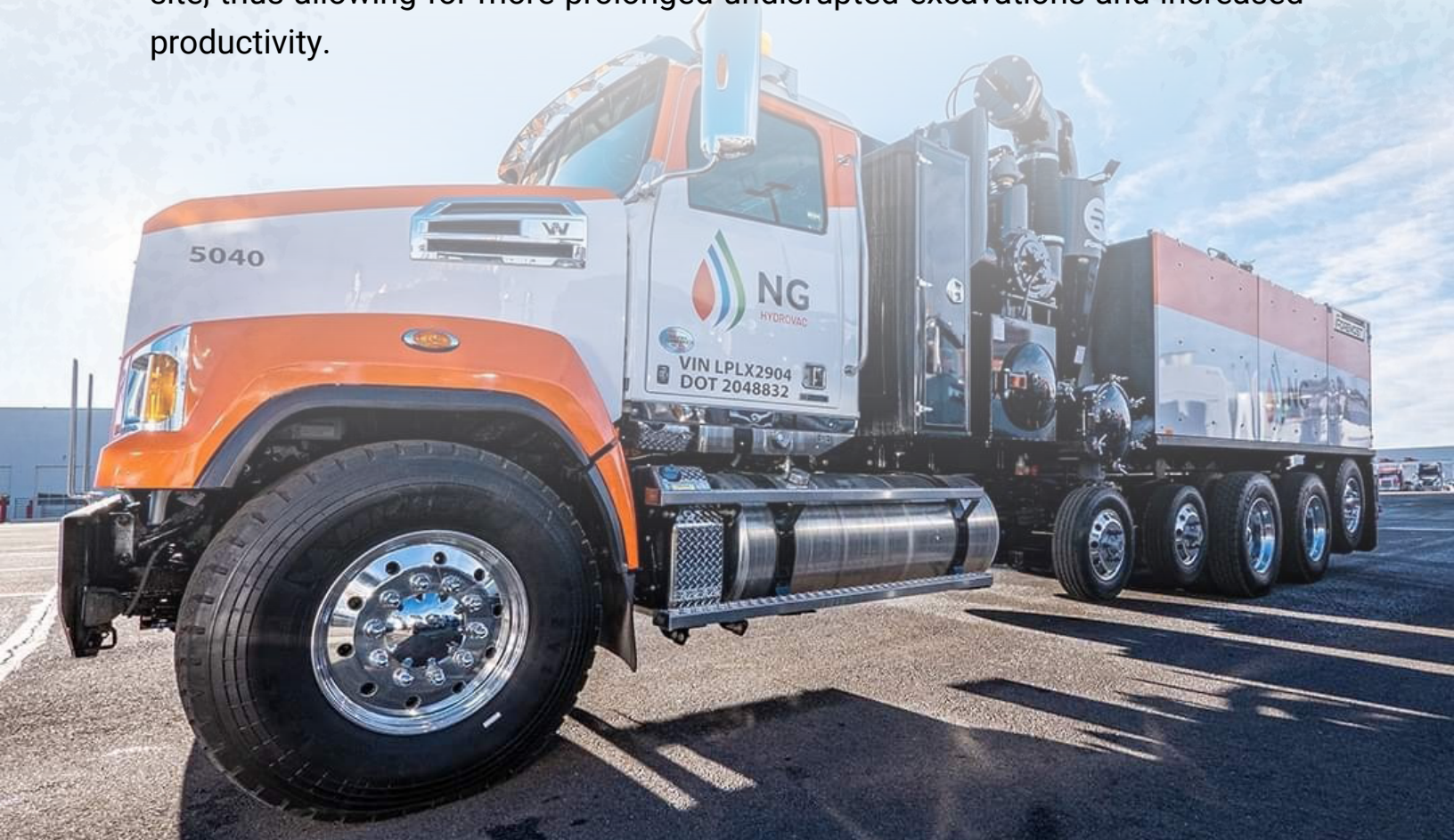


## Debris Tank

The debris tank serves two primary purposes. The first, and most obvious function, is to store the excavated material. Secondly, the debris tank is used to transfer and offload the payload at a predetermined dumpsite. The debris tank on most trucks is equipped with hydraulically operated hoists and doors to facilitate dumping operations.

These tanks can vary in size, depending on the truck type. For example, the capacities of the Rival T7 and T10 hydrovac trucks are 7 and 10 cubic yards, respectively. Some trucks may also have additional features that add several benefits to the excavating process. For example, Rival's line of hydrovac trucks have the ability to "pressure off."

This feature allows truck operators to offload the tank's contents to another vessel for subsequent disposal. This ultimately minimizes trips to the dumpsite, thus allowing for more prolonged undisrupted excavations and increased productivity.





## Water Tank

The water tank stores the water used for excavating. It also provides water for cleaning the debris tank after dumping operations are complete. The location of the water tank varies depending on the tank's design. **Rival's T10 truck** can hold up to 1200 gallons of water. This capacity strikes a balance between productivity and weight restraints.

## Vacuum Pump

The vacuum/suction pump is responsible for removing the soil-water slurry from the excavation site for storage in the debris tank. Through a suction hose attachment, the pump creates negative pressure, which causes atmospheric pressure causing the slurry to be lifted and pushed into the suction hose.

Vacuum pumps in hydrovac trucks are typically either liquid ring or rotary vane pumps. Both kinds of pumps rely on the rotation provided by an eccentrically mounted rotor. In rotary vane pumps, the blades slide in and out to form a seal within the housing bore. In

contrast, liquid ring pumps use moving liquid to form the seal.

Rotary vane pumps are easier to maintain, while liquid ring pumps may be more efficient in some applications. However, the choice of pump eventually boils down to size and capacity. Using the wrong pump size means inefficient suction ability. This, in turn, translates to reduced productivity and possible cost overruns.

## Water Pump

The water pump is responsible for jetting the water, which ultimately breaks up the soil to be excavated. The pump pressure should allow for the extraction of various types of materials, including clays, gravels, silts, and rock.

The majority of nozzles in the hydrovac industry utilize a flow rate of around 6 to 12 GPM with a water pressure of about 3000 psi. **Rival** recommends operating the pumps at 6 to 8 GPM in average soils. One of the benefits of using these sized pumps is that replacement parts are typically cheaper and easier to find than for outsized pumps.



# What Can Hydrovac Trucks Be Used For?

Traditional open-cut tools, such as hand shovels, backhoes, and excavators, involve the use of sharp metal edges. These physical tools are responsible for **dozens of digging accidents** every year. The fact that hydrovac trucks eliminate the use of mechanical tools makes them desirable for performing excavations while minimizing or eliminating the risk of damaging buried utilities.

In addition to their inherent safety, hydrovac trucks are also versatile, allowing them to perform various excavations for different uses. Some of the most common applications hydrovac trucks are used in include:

## Slot trenching

**Slot trenching** is the process of digging relatively narrow trenches for the purpose of installing buried pipelines, cables, conduits, and other underground utilities. The narrow stream of high-pressure water from the truck ensures that the soil is removed only in the areas which need to be excavated. Traditional digging equipment simply does not possess the precision to safely and economically dig narrow soil trenches.



*Figure 1: Hydrovac truck used to create a slot trench*



## Daylighting or utility exposure

As mentioned before, hydrovac trucks use water to break up and remove the soil. The lack of mechanical tools makes hydrovac operations ideal for **daylighting**—revealing the locations of existing underground utilities. If used correctly, the water and vacuum can be used to expose the most sensitive of utilities without causing any damage or disturbance.

## Piling hole excavation

Piling holes are needed for installing piles, poles, and other cylindrical structures. These types of excavations are best performed using methods that are capable of digging with a high level of precision since piles often rely on **skin friction** (pile to soil friction) for uplift resistance. Small diameter piles, in particular, are beyond the accuracy capabilities of most traditional digging equipment. High-precision water jetting from hydrovac trucks allows holes of various diameters and depths to be created without the risk of over-excavation.

## Excavating in frozen ground

In countries with winter climates, hydrovac trucks can be used to excavate in cold or freezing weather conditions. Some traditional digging methods, by contrast, may be restricted by cold weather. Hydrovac trucks, on the other hand, are equipped with features that allow operators to dig with heated water to break down and remove frozen ground material.





# How To Choose the Right Hydrovac Truck for Your Application

Several factors need to be considered when selecting the right truck for a particular application. Below, we discuss the most crucial elements of the standard hydrovac truck and the various selection criteria that should be evaluated during the procurement process.

## Weight

Perhaps the most important and overlooked factor to consider when choosing **the right hydrovac truck** is weight.

Hydro excavations have traditionally been a valuable tool in the oil and gas industry. However, the slowdown of activity in oil and gas has seen an increase in the use of this excavation method in other industries and municipalities.

As the customer base continues to grow, the hydrovac industry is under constant pressure to do more—excavating and removing as much material as possible. This, however, presents operators with a dilemma; how can hydro excavation be done as safely and efficiently as possible without exceeding weight limits?

The increased number of hydrovac trucks on public roads, where weight compliance is a necessity, is higher than ever. Unfortunately, many hydrovac trucks were not designed to optimize payload capacity and weight distribution. As such, the total cost of weight tickets annually can be significant.



## What Affects Weight?

Smaller trucks do not automatically mean better compliance with state weight regulations. Below we discuss some of the factors that should be considered when assessing the weight of a hydrovac trucking unit.

***The quantity and type of material being loaded*** – The total weight of the tank's contents is affected primarily by the density of the excavated material. For example, a tank filled with mud doesn't weigh the same as a tank filled with water. The same concept applies to soil, as the density of soils differs from area to area. It is typically safe to assume a 2,500 to 3,000 lbs per cubic yard density when estimating the weight of hydrovac tanks (12-15 lbs/gallon). For reference, the density of water is 8.3 lbs/gallon and dry soils around 8.6 to 10.7 lbs/gallon.

***Quantity of water in the tank*** – Water storage systems differ by hydrovac truck design. Depending on the type of truck, the water tank may be in front of the debris tank, under the debris tank, or even around the tank. While this may seem trivial, the location and design of the water tank affect the overall weight distribution of the truck. Typically, after a hydrovac job, 100 to 200 gallons of water are kept in the tank for washing out the debris tank at the dumping site.

This water amounts to an approximate additional weight of 830 to 1,660lbs on the unit. The design of the tank, therefore, dictates how this extra weight will be distributed around the chassis and to the individual truck's axles.



***Distribution of weight*** – While the weight of the tank’s contents certainly has an effect on the overall weight of the vehicle, one of the greatest misconceptions revolves around a misunderstanding of weight distribution. In other words, how the overall weight of the truck transferred is to the ground. This goes beyond having more axles or having a smaller tank.

An efficient vehicle design is one that distributes weight such that payload and axle efficiency are optimized.

***Truck weights and regulatory compliance*** - Once the above factors are considered, it is crucial to know the weight restrictions/regulations in your area when selecting a hydrovac truck. For example, it is essential to understand how many loaded axles are considered in your location. For example, some jurisdictions in the U.S. and Canada do not consider lifting axles when assessing the weight of a hydrovac trucking unit.

It is also essential to know how axle spacing affects the distribution since

optimal axle spacing can offer significant weight advantages.

***The Rival Hydrovac Advantage*** - In recognition of the challenges associated with hydrovac trucking weights, Rival has engineered a trucking unit from scratch. The vacuum and water systems, in particular, are designed to eliminate unnecessary components and ensure that weight is distributed optimally through the chassis and axles. As such, payloads are maximized without compromising safety and legal requirements.



## Soil properties

The type of soil at the job site plays a role in the kind of hydrovac truck you will need. For example, clay-based soils are more cohesive and tougher than looser soils (like **silt** and sand). For heavier soils, therefore, a heavier-duty truck will be required.

In addition to the type of soil, hydrovac selection may also be influenced by current ground and weather conditions. For example, if the soil is frozen, hot water from a boiler may be needed to melt the ice.

## Water Systems

The water system will determine how efficient your truck is at cutting through the soil. If the water pressure is too light, the ability of the machine to excavate the soil will be negatively affected. On the other hand, if the pressure is too high, the risk of damaging underground utilities increases. Ensure that the selected truck is capable of achieving the right pressure required for your application.

## Depth of Excavation

Another critical element to consider when selecting the right truck is the depth of your excavation. If the application requires deep excavations, for example, holes to accommodate 20ft deep piling, the truck will need to be equipped with a blower (vacuum pump) capable of providing the required lifting force.

## Price

Last but not least, the price of the unit needs to be considered. After assessing the job site requirements, it is crucial to work closely with a sales representative to ensure that the hydrovac truck meets your project needs while fitting into the overall project budget.



# Hydrovac Truck Safety

Hydrovac trucks were born out of the desire to excavate soils without damaging underground utilities. As a result, most trucks are designed with several safety features to ensure that excavations are done without posing an immediate risk to workers or nearby infrastructure. Some of the most pertinent safety features of many hydrovac trucks include:

## Fall Protection

**Hydrovac excavations**, like regular open-cut excavations, require the implementation of fall protection and fall arrest systems. This is particularly crucial in jobs where excavations exceed the minimum safety requirements stipulated by **OSHA**. Furthermore, there may be times where workers are required to perform work on top of the debris tank. In this case, fall protection systems must also be used.

Some trucks come equipped with various tie-off points that users can use to fasten fall arrest systems, such as harnesses. For example, the top of **Rival Hydrovac's trucks** are designed to act as pedestrian walkways with retractable guardrails to prevent falls.

Additionally, the top of the truck has specially engineered tie-offs, where workers can fasten their harnesses when performing work at high elevations.

## Traffic Protection

Hydrovac trucks, like other heavy machinery, can be challenging to maneuver in high traffic areas. Workers around the truck may also be at risk as they are often tasked with performing excavations near and around high-traffic locations.

Some trucks, therefore, are equipped with camera systems that help to maximize the driver's field of vision. This minimizes the probability of endangering oncoming motorists or nearby construction personnel.



## Protection from Exposed Utilities

Hydro excavation utilizes water, which is a conductor of electricity. Therefore, during hydrovac operations, the risk of electrocution may exist depending on the job site location. It is crucial to ensure that the vacuum tube ends, and the digging nozzle on the truck's boom is composed of materials that restrict the flow of electricity. As an alternative, tubes may be coated with a layer of non-conductive coating.

## Protection from Overhead Lines

In addition to underground electrical utilities, hydro excavations are also susceptible to risks from the presence of overhead electrical utilities. As such, safe distances from overhead lines should be monitored when the boom is in use or during repositioning of the truck. Some trucks are equipped with boom sensors that allow operators to detect and avoid any hazardous overhead obstructions.





# Other Uses of Hydrovac Trucks

As mentioned before, the shift of hydro excavation away from the oil and gas industry has seen the technique expand into other market sectors. The most obvious of these industries is the construction sector. Thus far, we have discussed hydrovac trucks mainly in terms of excavation in the construction industry. However, these versatile trucks are also used in other applications that are not immediately apparent.





**Some of the non-conventional uses of hydrovac trucks include:**

## Spillage clean up

**Hydrovac trucking** units can be used to remove both wet and dry hazardous materials. The vacuum ensures that toxic materials are removed safely from the environment and directly into the debris tanks for proper storage and disposal.

## Disaster clean up

- The high-pressure water jet allows hydrovac trucks to break up solid debris and remove them more efficiently than manual labor. The boom and suc-

tion hose are also designed to remove debris from tight or narrow areas, like storm drains, that can cause flooding after natural disasters.

## Rescue efforts

While not a marketed feature, hydrovac trucks have been used in the past to assist in emergency responses. For example, trench cave-ins, building collapses, and landslides are just some of the scenarios where hydrovac trucks can be used to remove debris and assist with rescue operations.

