

# Hollow Shaft

The hollow drive shaft connected to electric motors or right-angle gear drives to accommodate the solid shaft of the pump is known as a hollow shaft. The hollow shaft allows for impeller adjustment within the bowl assembly and the installation of a non-reverse ratchet in the motor or gear drive.

The rigidity of a hollow shaft is greater than that of a solid shaft of the same weight. The material at the center of the hollow shaft is removed and dispersed out at a great radius. As a result, hollow shafts are stronger than solid shafts of the same weight.

## Characteristics and Benefits of Hollow Shaft

The fundamental benefit of the hollow shaft's distinctive construction is its huge weight savings, which is useful not only for engineering but also for functional ones. Another advantage of the hollow is that it saves space because operating resources, media, or even mechanical elements such as axles and shafts can be accommodated in it or use the workspace as a channel. Furthermore, hollow shafts have a relatively high resonance frequency.

The hollow shaft is an important component of the hollow shaft motor, which is utilized in electrically powered vehicles like trains. Hollow shafts can also be used to build jigs and fixtures and automatic machines.

## Difference between the Hollow Shaft and Solid Shaft

Suppose a hollow and a solid shaft are the same weight. In that case, the hollow shaft includes the same amount of material all at the ends, whereas the solid shaft distributed the material uniformly throughout the shaft leaving little material at the ends. Resistance to bending and resistance to torsion distinguishes them from one another. Following are the difference between a hollow and solid shaft in extensive detail.

- Because the material at the center of the hollow shaft is removed and spread at a vast radius, hollow shafts are stronger than solid shafts of the same weight.
- The rigidity of a hollow shaft is greater than that of a solid shaft of the same weight.
- The hollow shaft is stronger than the solid shaft of the same weight.
- The hollow shaft has a greater natural frequency than a solid shaft of the same weight.
- A hollow shaft is more expensive than a solid shaft.
- The diameter of a hollow shaft is greater than that of a solid shaft, requiring more space.

- Hollow shafts have a higher polar moment of inertia than solid shafts, allowing them to transmit greater torque.
- Although hollow shafts do not convey more power, their power-to-weight ratio is greater than that of solid shafts.
- When subjected to bending, solid shafts are stronger than hollow shafts.

## Advantages of Hollow Shaft

Hollow shafts are significantly lighter than solid shafts and can transmit the same torque as solid shafts of equal diameters. Furthermore, hollow shafts require less energy to accelerate and decelerate. As a result, hollow shafts have a lot of potential in the automotive industry for power transmission. Following are the advantages of hollow shafts over solid shafts.

- It is lighter than a solid shaft of the same diameter.
- The rotational inertia is low.
- Less expensive.
- Due to the low weight, there is a high tolerance to rotational unbalance.
- Because of their low specific mass, hollow shafts are also resistant to high temperatures.

## Disadvantage of Hollow Shaft

Hollow shafts have less torsional rigidity than solid shafts, making them more prone to torsion and torque non-transmission. Following are the disadvantages of hollow shafts over solid shafts.

- Less tolerant of excessive torque.
- Bending prone, especially when subjected to lateral tension.
- Such as a boat propeller shaft.
- It is tolerant of mild imbalance, but this increases as rotational speed exceed the critical limit.

## Differences between a Shaft and an Axle

Although the terms shaft and axle are frequently used interchangeably in daily English, they have distinct features in the context of machinery pieces, notably in terms of functionality. Axles, unlike shafts, do not transmit torque but rather support rotating or oscillating elements. The primary function of any axle is to serve as a bearing for rotating mechanical components. They are often installed in the machine frame and are frequently subjected to high stress levels due to cross forces and bending moments.