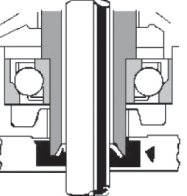


Vertical Motor Features *(continued)*

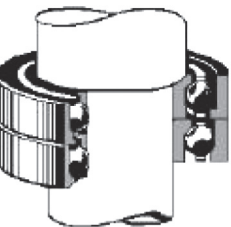


Steady Bushing

3 Steady Bushing

A Steady Bushing is available for HOLLOSHAFT® motors to support the head shaft at the lower end of the motor. This effectively supports the head shaft to prevent whip against the pump seal. When a motor is connected to the pump, the motor shaft, pump shaft and steady bushing all rotate together and have the mechanical stability of a vertical solid shaft motor.

On grease lubricated lower bearings, the shaft slinger is removed and a bushing installed on the HOLLOSHAFT® with the same bore dimensions as the top coupling. Steady bushing kits for field installation are available from 213TP through 5813 frame on WPI motors and 182TP through 447 frame for TEFC motors.

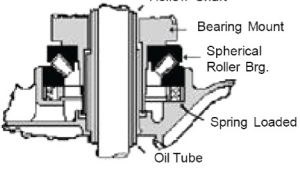


High Thrust Bearings

4 High Thrust Bearings

Angular Contact Thrust Bearings are standard on all high thrust ratings. The amount of thrust capacity for a given bearing is determined by the angle of contact and types used. Turbine Pump motors usually have a 35 to 40° angle. A factor which can influence bearing life is construction of the retainer which guides the balls. Since thrust bearings maintain a continuous load on each ball, any variation in speed must be corrected by the retainer. Angular contact thrust bearings can handle continuous thrust in only one direction.

Angular contact bearings can be stacked for increased thrust capacity. The bearings must be accurately ground so they will share the load. Two bearings will give approximately 175% of the capacity of one bearing. Angular contact bearings can also be stacked back-to-back for upthrust requirements and special end-play tolerance. Also, angular contact bearings are seldom water-cooled.



Spherical Roller Bearings

5 Spherical Roller Bearings

Spherical Roller Bearings are used when higher bearing life or thrust capacity cannot be provided by angular contact bearings. This bearing will take some radial load but only if thrust is applied at all times. Nidec Motor Corporation employs spring loading to insure the bearings will not be damaged during starting and momentary upthrust conditions. These springs push up against the lower race to ensure that it is kept in contact. Since the spring pressure may be several thousand pounds, a considerable load is imposed on the guide bearing during start-up. Care must be taken not to specify life factors that would cause bearing failures due to insufficient loading during normal operation. This includes variable speed applications, where reduced speed can drop the load and the thrust below minimum acceptable levels. This design requires more oil circulation than ball bearings, and is maintained in the design of the motor.

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VERTICAL A.C. MOTORS Rev. 02/14

Vertical A.C. Motors

Innovative, Performance-Focused Design



VERTICAL A.C. MOTORS

VERTICAL MOTOR FEATURES

HOLLOSHAFT® MOTORS



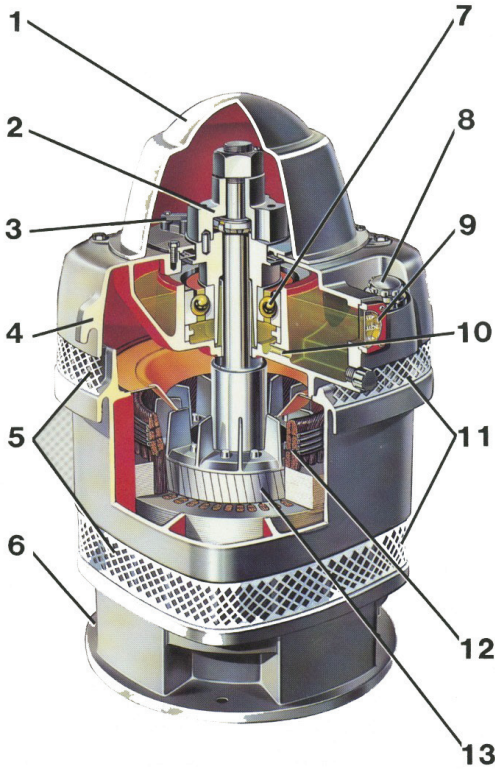
HOLLOSHAFT® Motors Vertical A.C. Motors, High Thrust

Overview

U.S. MOTORS® brand vertical HOLLOSHAFT® motors made their debut in the pumping industry in 1922 and have since become the gold standard in vertical motors. Known for their longevity, reliability and ease of use, the Vertical HOLLOSHAFT® can be configured to satisfy specific application requirements. For instance, enclosures can be designed to minimize the effects of adverse conditions present in turbine, mix flow and propeller pump applications.

Features

- Horsepower: 3 – 5000
- Speeds: 514 – 3600RPM
- Design voltages: Voltages through 6900 volts
- Three Phase – 50 and 60 Hz
- Efficiencies: Standard Efficient, Energy Efficient, Premium Efficient
- Class F insulation, Class B rise at Full Load (standard)
- 1.15 Service Factor – Typical for WPI and WPII Enclosures
- 1.0 Service Factor – Typical for TEFC and Hazardous Location Enclosures
- Maximum 40°C Ambient, 3,300 feet altitude (standard)
- Bearing capacities among highest in industry
- Multiple bearing configurations available for specific bearing requirements.
 - Angular Contact
 - Spherical Roller
 - Tandem Angular Contact
 - Back-to-Back Angular Contact



Typical HOLLOSHAFT® Motor Construction:

- 1. **Lightweight Top Cover**
- 2. **Coupling** is readily accessible
- 3. **Lockbar** holds shaft during adjustments
- 4. **Lifting Lugs** positioned for stability
- 5. **Protected Air Openings** exceed NEMA®† WPI requirements
- 6. **Precision Machined Mounting Base**, ample clearance for mounting bolt installation
- 7. **Rugged Bearing** withstands heavy load thrusts
- 8. **Large Plug** simplifies oil fills
- 9. **Sight Gauge Window** for quick oil level reading
- 10. **Metered Oil Flow** minimizes churning
- 11. **Dual Air Flow** system for uniform cooling of motor top and bottom
- 12. **Windings** protected by new, synthetic materials
- 13. **Solid Die Cast Rotor** with integral fan blades

Nidec Motor Corporation offers U.S. MOTORS® brand vertical motors for all applications at the shortest lead times in the industry today. Whether your application requires 1750 horsepower or above, we strive to continually improve delivery so your project can be up and running on schedule.

Enclosure Types

Weather Protected Type I (WPI) HOLLOSHAFT® (3 – 5000 HP)

Weather Protected Type I (WPI) HOLLOSHAFT® motors are constructed to minimize the entrance of rain, snow and airborne particles. U.S. MOTORS builds in the extra protection needed for rugged outdoor applications so our enclosures exceed NEMA®† requirements. The ventilation system is designed to provide optimum cooling to the thrust bearing and electrical components and is available on all motor sizes. HOLLOSHAFT motors allow easy pump impeller adjustment and maintain alignment of pump base to motor drive clutches. Steady bushings are available to give the mechanical characteristics of a solid shaft motor.

Vertical motors with bearing configurations tailored to your specific needs is a hallmark of the U.S. MOTORS® brand product offering. Engineers select from ball, angular contact, and spherical roller and plate type bearing options to provide maximum bearing life regardless of the thrust conditions.

Weather Protected Type II (WPII) (150 – 5000 HP)

Enclosure offers protection against hostile outdoor environments. The special ventilation system minimizes the entrance of high velocity air, moisture and airborne particles into the motor's passages.

Unique design allows the use of standard internal components. Special enclosures can be adapted with minimum delay.

Totally Enclosed Fan Cooled (3 – 1250 HP) and Hazardous Location (3 – 700 HP)

Non-sparking, non-reverse ratchet design. Available for severe environments where destructive dusts, vapors and other harmful substances are found. Perfect for use in hazardous locations where Underwriters Laboratories (UL®†) approval is necessary.

CORRO-DUTY® (Optional on TEFC & Hazardous Location)

Cast iron CORRO-DUTY® motors are available with external corrosion resistant paint and hardware for extremely harsh environments.



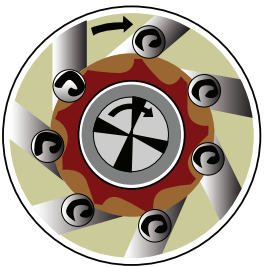
Weather Protected Type I (WPI)



TEFC and Hazardous Location

Vertical Motor Features

1 Non-Reverse Ratchet



BALLOMATIC® Backstop Ratchet

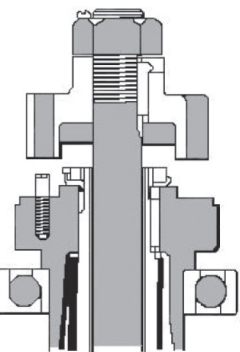
U.S. MOTORS® Non-Reverse Ratchet (NRR) is typically used in deep well applications where water lubricated pump bearings are installed. The Non-Reverse Ratchet provides immediate protection against reversing due to phase reversals or from backspin at shutdown. U.S. MOTORS® standard Non-Reverse Ratchet is for counterclockwise shaft rotation when viewed from the top of the motor. The NRR stops the shaft while the pump water column is receding. As the water flows back into the well and the water level drops below the upper shaft bearings, the pump will operate dry. If allowed to run dry for any period of time, failure would occur. Many oil lubricated pumps use this feature to prevent backflow that could lead to destructive vibration and other application related phenomena.

All U.S. MOTORS® BALLOMATIC® ratchets are good for any depth setting. Non-Reverse Ratchets can be applied to high thrust solid shaft, and hollow shaft motors when required. A special Non-Reverse Ratchet for clockwise rotation is available for WPI units on frames 320 through 9600. U.S. MOTORS® ratchets are non-sparking and do not require special materials for explosionproof applications. Note that a Non-Reverse Ratchet is also available for enclosed motors on 180 frame and larger. Please note that a non-reversing ratchet is not available on 2-pole machines above the 405 frame.

Non-Reverse Backstop Ratchet Design, BALLOMATIC®

- First technology of its kind in the market
- Prevents reverse rotation within 4.5 degrees of rotation
- Unlimited depth setting
- Can be used in certain Hazardous Location applications

2 Self Release Couplings



Self Release Couplings

U.S. MOTORS® Self Release Couplings (SRC) are balanced and mounted on three pins on the thrust bearing mount. This design feature prevents the pump line-shaft from completely unscrewing in the event of a power failure or phase reversal. Should the pump spin fast enough in reverse to begin to unscrew the shaft, the drive coupling will lift up off its pins and spin with the pump shaft. This is a safety feature to keep from damaging the pump and line shaft. In most cases, our customers call for 30% momentary upthrust. This means the coupling must be bolted to handle this condition. The coupling is no longer capable of self-release. If upthrust and non-reversing protection are both required, a Non-Reverse Ratchet should be specified.