

# Submersible Motors Application in Water and Sewage U/L listed, Class 1, Groups C & D

## SPECIFICATIONS FOR SUBMERSIBLE MOTORS:

**1-450 HP  
Submersible Wet Pit  
15 min in air**

**1-150 HP  
Submersible Dry Pit  
Continuous in air**

### **1.0 SCOPE**

This specification details the mechanical and electrical requirements for squirrel-cage induction motors, both single and three phase, designed for wet well and dry well submersible applications in water and sewage.

It is the intent of this specification to define submersible premium quality motors which will provide efficient operation with high mechanical integrity under adverse operating conditions for maximum life and minimum life cycle costs. This specification covers sewage wet well and dry well applications defined by the National Electric Code as Class 1: Division 1, hazardous locations section 501-8 (a) requiring explosion proof construction.

### **2.0 GENERAL**

**2.1** All motors covered by this specification shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, and NEC standards.

**2.2** Motors shall be designed for continuous submerged duty in water and sewage, and minimum 15 minute duty continuous in air under full load operating conditions. Motors used in dry well operation shall be designed for continuous in air under full load operating conditions.

**2.3** Three (3) phase shall be rated 200/400, 230/460 or 575 volt. Single voltage motors will also be available. Single phase motors shall be rated 115/230 volts. Multi-voltage motors shall be final connected for the highest voltage unless specified by customer and designed for easy field reconnection.

**2.4** Ratings will be based on 40 C ambient conditions.

**2.5** Motor construction shall be designed to withstand 100 psi\* water pressure at all seal locations. Maximum submerged depth is 160 feet.

\*Total sum of operating depth and reflected pump pressure

- 2.6** All motors shall be furnished with Class F rated insulation materials or better. Insulation materials rated lower than Class F (Class B or A) are specifically prohibited.
- 2.7** Motors 1 horsepower up to and including 135 horsepower, shall be rated as Class F, 1.15 service factor, Class 1, Groups C& D. Motors under 1 HP shall be rated as Class B, 1.0 service factor, Class 1, Group D.
- 2.8** All motors will be CSA (Canadian Standard Association) and U.L (Underwriters Laboratories) approved and nameplated accordingly.
- 2.9** All motors shall be manufactured in the United States of America. The ability to provide any and all replacement parts, engineering design support, complete dynamometer testing, and U/L rerate capability shall be provided domestically.

**3.0 MECHANICAL**

**3.1.0 Bearings and Lubrication**

- 3.1.1** Bearings shall be ball, single row, deep groove, Conrad type, and shall have a Class 3 internal fit conforming to AFBMA Std. 20. Standard bearing size for 440TY frame is 7222 duplex bearing. Other arrangements are available depending on shaft loading. Please contact your local Baldor representative for assistance.
- 3.1.2** Bearing shall be selected to provide a minimum L10 rating life of 17,500 hours.
- 3.1.3** The motor shall be designed to limit the bearing temperature rise to a maximum of 60 degree C under full load conditions.
- 3.1.4** Motors shall be greased by the manufacturer with a premium moisture resistant polyurea thickened grease containing rust inhibitors and suitable for operation over a temperature range of -25 degree C to + 120 degree C.

**3.2.0 Shaft Seal**

- 3.2.1** Two independently-mounted mechanical face type seals shall be provided. The

inner and outer seals shall be separated by an oil filled chamber. The oil chamber shall act as a barrier to trap moisture and provide sufficient time for a planned shutdown. The oil shall also provide lubrication to the internal seal.

- 3.2.2** Standard Type 21, Type 42, or Type 43, U.L approved seals shall be provided. Carbon rotating faces and ceramic stationary faces are standard. Optional seal constructions are available. See chart 1.

Seal	Description	Application
Type 21 Carbon Ceramic Faces	Standard seal offering. A general purpose seal of stainless steel construction with carbon ceramic seal faces.	Used wastewater applications with relatively clean effluent.
Type 21 Tungsten Carbide Faces	Same type of seal except with tungsten carbide faces. Harder seal faces.	For more demanding applications, more viscous fluid.
Type 21 Silicon Carbide Faces	Same type of seal except with silicon carbide faces.	For the most demanding, slurry type applications.
Hydropad Seal	Special seal design with hydropad scallops to run cooler.	Use in low specific gravity, light lubricity. Never operate in a dry condition.

- 3.2.2a** Buna-N O-rings and elastomers are standard. Viton elastomers are recommended for ambients of 61 C and higher.

- 3.2.3** The outer seal construction shall be designed for easy replacement.

- 3.2.4** The outer seal assembly is selected to prevent the entrance of moisture into the motor oil chamber. The OEM is responsible for protecting the outer seal from exposure to solids and foreign materials (such as banding, ropes, or strings). It is the responsibility of the pump OEM to insure the outer seal is lubricated by the effluent for both 15 minute in air and continuous in air applications.

**3.2.5** In compliance with U/L standards for explosion proof motors, a flamepath shall be proved by a labyrinth slinger in the bottom flange in order to prevent the ignition of ambient gases. Under such conditions the seal design shall allow for pressure relief across either seal face.

### **3.3.0 MOISTURE DETECTOR SYSTEM**

**3.3.1** Warrick type, dual (2) moisture sensing probes are to be provided that extend into the oil chamber to detect the presence of moisture should the outer seal fail.

**3.3.2** The moisture detection system shall be selected by the customer to utilize the Warrick sensing probes. A relay, Warrick type 2810 or equivalent must be provided by others. For additional information on the moisture probes and relay go to [www.gemssensors.com](http://www.gemssensors.com).

### **3.4.0 CAP/CABLE ASSEMBLY**

**3.4.1** The power cable and cap assembly shall be designed to prevent moisture from wicking through the cable assembly even when the cable jacket has been punctured.

**3.4.2** Power and control cable entry into the lead connection chamber shall be epoxy encapsulated for positive moisture sealing.

**3.4.3** A Buna-N power and control cable grommet shall be provided in addition to the epoxy filled leads.

### **3.5.0 ENCLOSURE AND SHAFT**

**3.5.1** The motor enclosure including frame, end brackets, flange and cap assembly shall be cast iron ASTM type A-48, Class 25 or better.

**3.5.2** Motor 180 through 360 frame's construction will not have fins and will be a smooth surface to prevent the clogging of solids and provide for easy cleaning. 440 frames are constructed with finned stator frames and smooth end brackets.

**3.5.3** The top end bracket will include integrally cast provisions for vertical lifting capability.

**3.5.4** All mating frame fits to have rabbet joints with large overlap as well as O-ring shall be Buna-N (nitrile). Viton O-rings may be supplied as an option and are required for ambient conditions of 61 degrees C and higher.

**3.5.5** Motor shaft material is 416 stainless steel. Other materials available as options are 303, 304, 410 stainless steel, 17-4PH, Carpenter 20, Monel, or Nitronic 50.

**3.5.6** All external hardware including the motor nameplate shall be made of stainless steel.

**3.5.7** Motor rotor construction shall be die cast aluminum. Rotors shall be dynamically balanced to NEMA limits per MG1-7.8.2 Table 7-1. Balance weights if required shall be secured to the rotor fan blades by rivets. Machine screws and nuts are prohibited.

**3.5.8** The frame, opposite drive end bracket, and cable cap assembly shall receive an alkyd primer and epoxy ester finish coat of high grade paint to resist rust and corrosion.

**3.5.9** The drive end bracket will have oil fill and drain holes.

## **4.0 ELECTRICAL**

**4.1** All motors shall successfully operate under power supply variations per NEMA MG1-14.30.

**4.2** Motors shall be designed to limit the maximum surface temperature to NEC specifications for Division 1, Class 1, Group D or Class 1, Group C&D for hazardous locations.

**4.3** All motors shall be NEMA Design B or A with torque and starting current in accordance with NEMA MG-1.

- 4.4** Motors shall have copper windings.
- 4.5** Motor insulation system shall be Class F minimum, utilizing material and insulation systems evaluated in accordance with IEEE 117 classification tests.
- 4.6** Motor leads shall be nonwicking type, Class F temperature rating or better and permanently numbered for identification.
- 4.7** The stator insulation system shall be treated with a non hydroscopic epoxy varnish with a dip and bake process.
- 4.8** All motors to include two (2) normally closed thermostats connected in series and embedded in adjoining phases as required by Underwriters Laboratories for motors of 1 HP or higher.
- 4.9** All motors operated on inverter power will be rated as Class 1, Group D with a T2A temperature code.
- 4.10** Each completed and assembled motor shall receive a routine factory test per NEMA MG-1. Tests are in accordance with IEEE Std. 112.



P.O. Box 2400, Fort Smith, AR 72902-2400 U.S.A., Ph: (1) 479.646.4711, Fax (1) 479.648.5792, International Fax (1) 479.648.5895

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6040 Ponders Court, Greenville, SC 29615-4617 U.S.A., Ph: (1) 864.297.4800, Fax: (1) 864.281.2433