# Baldor Electric Company
# Medium Voltage Motors
# Designed for Process Industry Applications

**Rev June 6, 2001**

**Table of Contents**

BALDOR®
A MEMBER OF THE ABB GROUP

# Medium Voltage Motors Designed for Process Industry Applications

## 1.0 Purpose

The intent of this specification is to work with Baldor Electric in a partnership to supply superior quality motors that consistently perform, with highest efficiency, improved life cycle and lowest maintenance cost. The motors shall be built to provide: (1) safe operation; (2) reliability in process industry environments that are typically corrosive and wet, (3) minimum maintenance requirement due to the design and quality of materials and workmanship, (4) lowest noise pollution, (5) greatest energy conservation (when specified).

## 2.0 Scope

### 2.1 Motors Covered by Specification

This specification covers the requirements for all three-phase medium voltage motors 250 HP through 1500 HP Input voltage may be 2300, 4160 or 2300/4160 volts, 60 hertz or 3300 volts 50 Hz. Enclosures may be TEFC Totally-Enclosed Fan-Cooled or Weather-Proof Type II.

### 2.2 Motor Data Sheets

Specific motor information required for quotation will be transmitted as attachments to the release orders on the Motor Data Sheets.

## 3.0 Motor Requirements

### 3.1 Applicable Codes and Regulations

All motors furnished shall be designed, manufactured, and tested in accordance with the latest applicable standards of ANSI, IEEE, ASTM, and OSHA (Safety and Health Standards, 29CFR1910). As a minimum requirement, all motors shall conform to the latest applicable sections of NEMA Standard MG-1.

### 3.2 Enclosures

3.2.1 Preferred motor enclosure type should be TEFC with use of WPII enclosures as allowed by application. All motors will have the wiring box mounted in NEMA F1 position as standard. Other conduit box locations are to be specified.

3.2.2 The frame enclosures shall be of cast iron construction. Frame, end brackets and conduit box shall all be cast iron construction. WPII hoods may be a corrosion-protected steel fabrication.

3.2.3 Motors shall have permanently attached a means for lifting, preferably built into the frame. WPII motors have provisions for lifting by lugs on the frame without removal of the hood.

3.2.4 Motor frames shall have drain openings suitably located for the mounting assembly being provided. Breather drains shall be provided.

3.2.5 Motor nameplate shall be made of 316 stainless steel, mounted on the motor's enclosure with stainless steel fastening pins. Nameplate shall have as a minimum, all information as described in NEMA Standard MG-1-20.60 and overall weight. Motor bearing numbers shall be included. Wiring diagram shall also be included on nameplate or attached to motor and easily readable.

3.2.6 Motors shall be designed such that either rotation may be used.

3.2.7 Any special features required such as lightning arresters, surge capacitors, vibration and speed switches, motor differential CT's and others shall be specified on attached Motor Data Sheets.

## 3.3 Protective Coatings

3.3.1 Motors shall be designed and have corrosion resistant finishes suitable for severe duty operation in the adverse environmental conditions normally encountered in a pulp and paper mill atmosphere.

3.3.2 Protective coating and/or painting for extended life shall consist of a primer and epoxy finish coat of 4-5 mils.

3.3.3 Internal surfaces, shaft, rotor, stator iron, end bells and parts shall be covered with a corrosion resistant coating of epoxy paint or equal material of 2 mils minimum dry film thickness for increased life against paper and pulp mill adverse environmental conditions.

3.3.4 Shaft extension shall be protected with a rust preventive strippable coating capable of being peeled off or unwrapped.

## 3.4 Motor Space Heaters

3.4.1 Wrap-around type motor space heaters shall be provided on all motors securely attached to the motor windings. 120-volt space heaters are standard, 230 volt optional when specified.

3.4.2 Motor space heaters shall be designed to maintain the motor internal temperature above the dew point when the motor is not running.

3.4.3 Space heaters shall be designed for long life, low skin temperature.

## 3.5 Motor Terminal Boxes and Leads

3.5.1 Motors shall be fitted with an oversized, cast iron, main terminal box. The box shall be arranged so that conduit can enter from the bottom. Gaskets shall be supplied between the box and motor frame as well as between the box and its cover. As standard, the box shall be mounted on the right hand side when facing the end of the motor opposite the shaft extension (F1 location). Other locations are optional when specified. The boxes shall come completely assembled to the motor and shall use all cadmium-plated attachments. The conduit box shall be completely rotatable 360° in 90° increments, without obstruction of belt path.

3.5.2 Motor leads in the conduit box shall be sized in accordance with NEC suggested minimum ampacity values using a minimum of 125°C insulated lead wire. The wiring shall be clearly identified every inch or the lead shall have a metal band in accordance with ANSI C6.1, latest revision. Nameplates shall be supplied stating the above data and permanently attached to the motor. Leads are to be numbered for clockwise rotation when facing opposite the shaft end.

3.5.3 Motors shall be provided with a compression type grounding lug, the same size as motor leads, mounted in the conduit box by drilling and tapping into the motor frame or by a double ended silicon bronze cap screw.

3.5.4 A separate cast iron motor mounted terminal box shall be provided for RTDs, bearing relays, space heaters, and any other specified accessories. The accessory conduit box should be rotatable 360° in 90° increments.

## 3.6 Stator and Bearing Temperature Detection

3.6.1 All stock ECP motors (Baldor's Super-E Chemical Processing) 449T frame (~250 hp) and larger shall be supplied with 6 resistance-type detectors (RTD) suitably distributed around the circumference of the stator, 2 per phase, located between coil sides and located in position to sense the highest temperature of the stator. Standard RTDs shall be 100 ohm platinum type. 10-ohm copper or 120 ohm nickel winding RTDs may be supplied as an option. RTD leads shall be supplied from the RTD to the terminal box and securely attached. RTDs should be specified on custom motor orders.

3.6.2 When specified, two resistance-type detectors (RTD) for bearing temperature protection shall be supplied on each bearing. RTD leads to be brought out to a separate terminal box. A terminal strip may be supplied when specified.

## 3.7 Vibration Detection and Monitoring System

3.7.1 When specified, motors requiring vibration monitoring shall have the required type of devices specified on the motor data sheet.

3.7.2 Motors shall be run and vibration checked prior to shipment. Maximum vibration allowed should be 0.15 inches/second velocity measured at the bearing housings.

## 3.8 Electrical and Mechanical Design Requirements

3.8.1 Motors shall be NEMA Design B, 80° C temperature rise at rated load, class F insulation minimum, premium efficiency design, squirrel cage induction type. Where other designs are required, they will be specified on the Motor Data Sheet. Nameplate shall read 1.15 service factor.

3.8.2 Motors shall have normal Design B starting torque per NEMA. If other NEMA Designs or operating conditions are required, specify requirements on the Motor Data Sheet.

3.8.3 Motors shall be wound for three-phase, 60-Hertz operation. Voltage shall be 2300/4160. It is the responsibility of the motor manufacturer to take into consideration the voltage drop normally observed when starting large AC motors. When specified, other voltages and 50 hertz designs are available.

3.8.4 Insulation system shall be class F minimum, non-hygroscopic. Motors shall be capable of carrying full load current continuously in an ambient temperature of 40° C. Such motors shall not exceed 80° C average winding temperature rise by resistance for 1.0 service factor. The insulation shall be built for long trouble-free life in a process industry atmosphere containing excessive amounts of steam, moisture, chemicals, and abrasive materials.

3.8.5 Form wound coils shall be constructed in a way and of materials suitable for VPI treatment. Coils shall be made from heavy fused polyester glass fiber film coated insulated rectangular conductors rated 200° C, unless otherwise specified. Form wound coils shall be made with a full length Nomex slot wrapper rated at 5000 volts minimum which extends well beyond the stator core iron to reduce the possibility of tracking to ground.

3.8.6 Loops shall be made and spread to form coils without damage to the wire or insulation. Application of layer insulation shall be uniformly and tightly applied to eliminate stress points and air voids.

3.8.7 The stator core shall be free of sharp edges and de-burred prior to the insertion of the coils. Insulated coils shall be placed in slots with no damage to the coil insulation. Coils shall tightly fit slots.

3.8.8 Coils shall be secured to surge ring or treated rope and laced to one another as necessary to prevent distortion and expansion. Felt blocking shall be placed between coils, top and bottom, to secure the coils. The surge ring and blocking shall be designed and installed in such a manner as to restrain the coils during multiple starting conditions.

3.8.9 The winding and lead connections shall be made by a crimped connection, then silver-soldered after thoroughly cleaning the connection. After the connection is complete, it shall be cleaned of all flux. The connection shall be insulated using materials recommended by the varnish manufacturer and compatible with the VPI process and shall be completely sealed. Connections shall be staggered and separated from the winding by an additional Nomex or felt pad. Lead and winding connections shall be securely blocked and laced such that during repetitive starts the winding shall be held in place.

3.8.10 After completion of stator winding and connections, the entire stator shall be given a vacuum-pressure impregnation using a polyester varnish and oven cured. An epoxy overcoat is then applied to prevent chemicals, caustic, or fungus corrosion. The stator is then

oven cured to be positive of a completely sealed total insulation system.

3.8.11 The insulation resistance of the stator winding shall be greater than 1000 meg-ohms when measured at 25° C with a megohm bridge having 2500-volts direct current and shall have a dielectric absorption ratio of no less than two.

3.8.12 The insulation varnishes shall be capable of passing a 24-hour caustic immersion test without deterioration.

3.8.13 Bearings shall be normally anti-friction type. All motors shall have anti-friction vacuum-degassed steel ball bearings, electric motor quality, with extended pipe greaser fitting and 1/2-lb relief fitting for external lubrication while machine is in operation.

3.8.14 The bearings shall have a rated fatigue life of L-10 (B-10) 150,000 hours for direct-coupled applications and 50,000 hours for belted applications minimum.

3.8.15 A high quality bearing seal or Forsheda shaft slinger shall be provided to prevent moisture from entering the shaft end into the bearing. This shall be supplied in addition to tight mechanical bearing housing fits.

3.8.16 If sleeve type bearings are recommended, it shall be stated in the proposal. Where sleeve bearings are used, the magnetic center shall be indicated by permanent markings. Split end shields shall be provided where appropriate to facilitate inspection and reduce downtime.

3.8.17 When specified, insulated bearings, ceramic shaft coating or shaft grounding system may be provided to prevent shaft currents.

3.8.18 Rotors shall be copper-bar type. Brazing on rotor bars shall be silver copper brazing alloy.

3.8.19 Run-out on the shaft shall be checked and in no case shall they exceed 0.001 inch measured with a precision indictor with the reading taken at the end of the normal-length shaft extension.

3.8.20 Vertical motors may require special features that will be described on Motor Data Sheets.

3.8.21 Maximum vibration allowed shall be 0.15 inches per second velocity measured at the bearing housings.

3.8.22 Material used throughout the motor design shall be the best available materials and methods available to achieve highest efficiency and power factor operation.

## 4.0 Sliding Base Requirements

### 4.1 Application

When specified on the Motor Data Sheet, sliding bases of the heavy-duty type shall be furnished for V-belt drives.

### 4.2 Fabrication

4.2.1 Base construction shall be fabricated from heavy steel to withstand vibration and corrosive atmosphere. Base is to be of single unit construction with a double-supported slide and two adjusting bolts.

4.2.2 Base is to have the same coating as the motor. See Section 3.3.2 above.

## 5.0 Vendor Drawings and Data

### 5.1 Motors

The following information shall be furnished in addition to motor prints and regularly supplied data:

5.1.1 The supplier shall furnish backup data clearly identifying model and/or catalog number.

5.1.2 Motor full load current.

5.1.3 Horsepower (or kW), RPM, frame data.

5.1.4 Maximum KVAR capacitance allowed for power factor correction.

5.1.5 Locked rotor current at rated voltage.

5.1.6 Induction motor time constants.

5.1.7 All special options in the motor.

5.1.8 Speed torque calculations across the line staring from zero speed to synchronous speed.

5.1.9 Internal winding connection of the motor.

5.1.10 Outline drawings with all the details including nameplate data.

5.1.11 Approximate time in seconds that motor can safely withstand locked rotor conditions initiated when motor is operating at rated temperature and also cold start at ambient conditions (40° C).

5.1.12 Motor thermal withstand curves - both locked rotor and motor running.

5.1.13 Bearing size and type data.

5.1.14 Number of repetitive starts (hot and cold) permitted under $WK^2$ data supplied.

5.1.15 Accelerating time and curves under $WK^2$ data supplied.

5.1.16 Motor weight.

5.1.17 Guaranteed efficiency and power factor at 100%, 75%, 50%, 25% and 0% load per IEEE 115-1965.

5.1.18 Motor "A" weighted scale sound power levels, measure in accordance with IEEE "Test Procedure for Airborne Sound Measurements on Rotating Electrical Machinery," Publication No. 85, 1973. Specify the allowable noise level on the motor data sheet.

5.1.19 Maximum allowable misalignment.

5.1.20 Vibration in velocity measured at the bearing housings while under test at the factory.

5.1.21 The customer's purchase order number, equipment number and motor ID number shall be used to identify all motor drawings, information and data sheets.

## 5.2 Slide Rails

When slide rails are specified on the Motor Data Sheet, complete dimensional drawings shall be provided.

## 6.0 Shipment

All motors shall be packed and/or securely fastened to a hardwood skid or pallet for fork truck handling and shall be covered for protection against dirt and moisture during transit and outdoor storage. The motor container shall be clearly identified with permanent ink. Large motors shall have the rotors blocked to prevent movement and thrusting (standard practice on sleeve bearings – optional on anti-friction bearings). The outside of the container shall be supplied with the equipment number ID number, HP, RPM and frame.

## 7.0 Proposal Data

The bill of material to be quoted is a preliminary listing made prior to detail design. The manufacturer is to quote the bill of material per item and total bill of materials.

## 8.0 Limited Warranty

Baldor Electric Company and its employees are proud of our products and are committed to providing our customers and end users with the best designed and manufactured motors, drives and other Baldor products. This Limited Warranty and Service Policy describes Baldor's warranty and warranty procedures.

**Comments and Questions:** We welcome comments and questions regarding our products. Please contact us at:

Customer Service
Baldor Electric Company
P.O. Box 2400
Fort Smith, Arkansas 72902
Telephone: 501-646-4711
Facsimile: 501-648-5792
Website: www.baldor.com

**Scope of Warranty:** All Baldor standard motors are warranted against defects in Baldor workmanship and materials.

**Warranty Period:** Most Baldor motors are warranted for 18 months from the date of shipment to Baldor's customer from Baldor's district warehouse or, if applicable, from Baldor's factory. Baldor Super-E® premium efficient motors are warranted for 36 months. IEEE 841 motors are warranted for 60 months.

**Warranty Service Center Locations:** Warranty service is available for all Baldor products from Baldor's Customer Service Center in Fort Smith, Arkansas, and from Baldor Authorized Service Centers. A list of Baldor's Authorized Service

Centers is available in catalog #505 from any Baldor District Office or by contacting us at the above location.

**Procedure to Receive Warranty Service:** Customers should take or ship prepaid the Baldor product requiring warranty service to a Baldor Authorized Service Center. Please include an explanation of the defect or problem, a description of the way in which the Baldor product is used, and your name, address and telephone number.

**Repair by Other than a Baldor-Authorized Service Center:** Customers who are unable to take or ship the Baldor product to a Baldor Authorized Service Center, or who desire a repair to be made by other than a Baldor Authorized Service Center, should contact the local Baldor District Office. Baldor must approve a repair by anyone other than a Baldor Authorized Service Center in advance.

**Repairs or Replacement Within the Scope of the Warranty:** If a Baldor product is defective due to Baldor workmanship or materials and the defect occurs during the warranty period, then Baldor will either repair the product or replace it with a new one, whichever Baldor believes to be appropriate under the circumstances. Baldor is not responsible for removal and shipping of the Baldor product to the service center, the reinstallation of the Baldor product upon its return to the customer, or any incidental or consequential damages resulting from the defect, removal, reinstallation, shipment or otherwise.

**Repairs Outside the Scope of the Warranty:** Problems with Baldor products can be due to improper maintenance, faulty installation, non-Baldor additions or modifications, or other problems not due to defects in Baldor workmanship or materials. If the Baldor Authorized Service Center determines that the problem with a Baldor product is not due to defects in Baldor workmanship or materials, then the customer will be responsible for the cost of any necessary repairs. Customers not satisfied with a determination that a problem is outside of warranty coverage should contact the Baldor District Office for further consideration.

**Intended Use:** Baldor products are designed for industrial, commercial and agricultural use rather than household, family or personal use.

**Product Specifications:** All product specifications, applications and other information provided in Baldor’s catalog and publications are subject to correction and change without notice and should be confirmed with the Baldor District Office prior to ordering.

**Extended Warranties:** Extended warranties are available for certain Baldor products. These warranties are described in Baldor’s catalog and other sales literature. Extended warranties are subject to the terms and procedures of this

Limited Warranty and Service Policy as modified by the additional terms of the extended warranty.

**No Other Warranties and Liability Limitation:** This Limited Warranty and Service Policy represents Baldor's sole and exclusive warranty obligation with respect to Baldor products. Baldor's liability to a customer or any other person shall not exceed the Baldor's sales price of the applicable Baldor product. BALDOR DISCLAIMS ALL OTHER EXPRESS AND IMPLIED WARRANTIES INCLUDING THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY.

BALDOR
A MEMBER OF THE ABB GROUP

# Large AC Induction Motor Data Sheet

District Office: _____ Contact: _____

Req Set: _____ Order No: _____

Customer: _____ Contact: _____

End User: _____ Contact: _____

Industry: _____

Type of equipment: _____

Application: _____

_____

_____

**Site Data**
**Location:** City _____ State _____

Elevation □ less than 3300 ft / 1000 m Other – Specify _____

Ambient temperature Min _____ °C Max _____°C

Humidity Min _____ % Max _____%

Motor location □ Indoor □ Outdoor □Heated □Unheated
□Roof over motor □No roof over motor

**Special conditions:**

_____

_____

_____

_____

**Motor Performance Requirements:**

**HP** _____ **kW** _____

**Poles:** _____ **RPM** _____

**Speed** _____ □ Fixed speed

□ Adjustable speed □ Variable torque □ Constant torque

Min Speed _____ Max speed _____

Volts _____ 3-phase □ 60Hz □ 50Hz

NEMA Design: □ Design B □ Design C □ Design D
Efficiency level □ Super-E™ Premium □ High Efficiency
Rotor design: □ Standard □ Fabricated copper bar
Service Factor: □ 1.0 □ 1.15
Insulation Class: □ F □ H
Temperature rise: □ Class B (80°C) at F.L.
□ Class F at F.L.
□ Class B (80°C) at F.L.; Class F at S.F.
Torque (Full Load) _____ Torque (Pull-up % Flt) _____
Torque (Breakdown % Flt) _____ Torque (Locked Rotor % Flt) _____

**Enclosure:**
□ TEFC
□ TEBC
□ ODP
□ WPI
□ WPII
□ No filter
□ Galvanized steel filter
□ Aluminum mesh filter
□ Stainless mesh
□ Differential pressure switch
□ Explosion Proof - Class _____Group _____ Zone _____
□ Division 2 – Temperature code _____

**Mounting:**
□ NEMA □ IEC
□ Horizontal □ Vertical
□ F1 □ F2 □ Top □ Other _____
□ C-face □ D-flange
□ P-base - specify flange diameter _____

**Shaft:**

Drive end shaft
Diameter _____ Length _____ Key _____

Opposite drive end shaft
Diameter _____ Length _____ Key _____

Special shaft machining – specify or supply drawing _____

_____

_____

_____

**Material:**

□ Standard (1045 thru 5000 frame; 4140 5800 frame – up)
□ 4140
□ Stainless – type _____
□ Step-forged shaft

**Special Standards:**

□ NEMA MG1
□ IEEE 841
□ API 541 – data sheets attached
□ CSA approval
□ IEC
□ Other _____

**Baldor product family:**

□ Chemical Process
□ Crusher Duty
□ Dirty Duty
□ Other _____

**Bearings** □ Anti-friction: □ Ball □ Roller
□ Coupled □ Belted (data sheet attached)
□ Sleeve – Renk insert-type (horizontal - coupled only)

**Thrust:** Horizontal: □ Towards motor _____ □ lbs or □ kg
□ Away from motor _____ □ lbs or □ kg
Vertical: □ Down Continuous _____ □ lbs or □ kg
Maximum _____ □ lbs or □ kg
□ Up Continuous _____ □ lbs or □ kg
Maximum _____ □ lbs or □ kg

**Lubrication:** □ Self lubricated □ Oil Mist □ Force lubricated
Special grease or oil _____

**Bearing protection:** □ None
□ Forsheda® type □ Both ends
□ Inpro/Seal® VBX □ Both ends
□ Contact seal □ Both ends

**Bearing electrical protection:** □ Shaft grounding brush
□ Electrically isolated bearings

**Bearing temperature monitoring:** □ RTDs - Qty. 6 – 2 per phase
□ 100 ohm platinum
□ 10 ohm copper
□ 120 ohm nickel
□ Thermistor - Brand _____

**Bearing vibration monitoring:** □ Robertshaw 365 Vibraswitch® □ Both ends
□ Bentley-Nevada □ 2 probes each bearing
□ 1 probe each bearing
□ 2 probes one bearing
□ 1 probe one bearing
□ Provisions for 2 probes/bearing

**Vibration level** □ < 0.015 in/sec □ <0.010 in/sec □ _____ in/sec deflection

**Sound level** Max sound pressure level _____dBA at _____ ft or _____ m, NL.

**Motor Starting / Drive**

□ Full voltage
□ Reduced voltage specify _____
□ Electronic soft start specify _____
□ Loaded □ Unloaded

**Load WK² at Shaft:**

□ ≤ NEMA MG1-1998-20.11
□ Specify reflected load inertia _____

**Number of starts:**

□ NEMA MG1-1998 –20.12.1
□ Additional _____ Cold _____ Hot

**Drive Requirements**

□ Inverter

□ Vector □ Vector – open loop
□ Baldor □ Quote Baldor with motor
□ Other – brand / model _____

**Feedback:**

PPR _____ Voltage _____
□ Optical Encoder
□ Magnetic pulse generator – # of pickups _____
□ Specific brand / model _____

**Special Options and Accessories**

**Winding Temp. Device:**

□ Thermostats – normally closed
□ RTDs - Qty. 6 – 2 per phase
□ 100 ohm platinum
□ 10 ohm copper
□ 120 ohm nickel
□ Thermistor - Brand _____
□ Separate conduit box (required for medium voltage)

**Space Heaters:**

□ 120 volt □ 230 volt
□ Separate conduit box (required for medium voltage)

**Surge Protection:**
(mounted in self-standing enclosure)

□ Lightning arrestors
□ Surge capacitors
□ Differential current transformers
□ 3 Current balanced current transformers
□ 1 Current balanced transformer

**Special items:**

□ Deferred warranty / long term storage provision
□ Export crating

## Special Testing

□ Routine □ Unwitnessed □ Witnessed

Each motor will be tested per NEMA MG1-12 or MG1-20.47 as required.
Tests include:

1. Measure winding resistance.
2. Measure no load current, power and speed at rated voltage and frequency.
3. Insulation resistance.
4. High potential test per NEMA MG1-20.48.
5. Mechanical balance and vibration.
6. Measure motor starting current.

□ Complete □ Unwitnessed □ Witnessed

1. Routine tests above.
2. Measure efficiency at 100%, 75%, 50% and 25% of full load.
3. Measure power factor at 100%, 75%, 50% and 25% of full load.
4. Temperature rise test.
5. Measure locked rotor current.
6. Measure breakdown and starting torques.

□ Sound test □ Unwitnessed □ Witnessed

per IEEE 85

□ Speed torque test □ Unwitnessed □ Witnessed

Provide curves of motor speed-torque and speed-current at specified input voltage and frequency

□ Bearing temperature □ Unwitnessed □ Witnessed

Determines the stabilized bearing temperature at no load. Specify minimum test duration time on order.

□ Matched Performance™ □ Unwitnessed □ Witnessed

Baldor Matched Performance™ temperature rise test using Baldor motor control. Operate motor to Class F rise to establish operating envelope for the motor.

□ Other _____ □ Unwitnessed □ Witnessed

_____

_____

_____

_____

_____