

GP 16-09-02	AC Motors: Medium Voltage and Low Voltage Over 200 HP (150 kW)	February 2002
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AC Motors: Medium Voltage and Low Voltage Over 200 HP (150 kW)

GP 16-09-02

Scope

- 1) * [I] This Global Practice (GP) covers design and inspection of medium voltage a-c motors, low voltage a-c motors in sizes over 200 hp (150 kW) and all synchronous motors. When specified, this GP may be used for low voltage a-c motors in sizes 200 hp (150 kW) and below.
 - 2) [I] An asterisk (*) indicates that a decision or approval by Purchaser is required or that additional information is to be furnished by Purchaser.
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1. Required References

[I] This Section lists Practices that are generically referenced and assumed to be a part of this document. Unless otherwise specified herein, use the latest edition.

1.1. Global Practices–ExxonMobil Engineering Practices

GP 02-01-01	Plant Noise Design Criteria
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1.2. ExxonMobil Data Sheets

ExxonMobil Data Sheets	ExxonMobil Data Sheet Home Page
T160902C01	AC Motors - Medium Voltage and Low Voltage Over 200 HP (150 kW)

2. Additional Requirements

* [I] The following Practices and Publications shall be used with this Practice as specified by Owner's Engineer.

2.1. Global Practices–ExxonMobil Engineering Practices

GP 03-03-12	Oil Mist Lubrication Systems
GP 10-12-01	Vibration, Axial-Position, and Bearing-Temperature Monitoring Systems for Compressors and Drivers
GP 20-01-01	Inspection of Equipment and Materials

2.2. IEC–International Electrotechnical Commission

IEC 60034	Rotating Electrical Machines
IEC 60072	Dimensions and Output Series for Rotating Electrical Machines
IEC 60085	Thermal Evaluation and Classification of Electrical Insulation

3. Standards for Use in U.S.

1) * [I] This Section lists Standards which shall be used for a-c motors in the U.S., when specified, usually for large critical unsparred motors

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- 2) * [I] For other conditions of purchase and use, the applicable standards of manufacture and test shall be specified by Purchaser.

3.1. ABMA–American Bearing Manufacturers Association

ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings

3.2. ANSI–American National Standards Institute

ANSI C50.10	Rotating Electrical Machinery - Synchronous Machines
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3.3. API–American Petroleum Institute

API STD 541	Form-Wound Squirrel Cage Induction Motors - 250 Horsepower and Larger
API STD 546	Brushless Synchronous Machines - 500 kVA and Larger

* Note: When specified, usually for large critical unsparred motors.

3.4. IEEE–Institute of Electrical and Electronics Engineers

IEEE 43	Recommended Practice for Testing Insulation Resistance of Rotating Machinery (ANSI/IEEE)
IEEE 112	Standard Test Procedure for Polyphase Induction Motors and Generators (ANSI/IEEE)
IEEE 115	Guide: Test Procedures for Synchronous Machines Part I - Acceptance and Performance Testing Part II - Test Procedures and Parameter Determination for Dynamic Analysis
IEEE 522	Guide for Testing Turn-to-Turn Insulation on Form-Wound Stator Coils for Alternating-Current Rotating Electric Machines

3.5. NEMA–National Electrical Manufacturers Association

NEMA MG 1	Motors and Generators
NEMA MG 2	Safety Standard and Guide for Selection, Installation, and Use of Electric Motors and Generators

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4. Definitions

Term	[I] Description
"Determination of"	A calculated determination of the quantity at rated conditions, based on tests of that or other quantities at other than design conditions (usually reduced voltage).
Explosion-proof machine	A totally-enclosed machine whose structure is designed and constructed to withstand an explosion of a specified gas or vapor which may occur within it, and to prevent the ignition of the specified gas or vapor surrounding the machine by sparks, flashes, or explosions of the specified gas or vapor which may occur within the machine casing.
"Measurement of"	Measuring the actual quantity, at design voltage, load, and the like, as applicable.
Motor continuous overload capability/service factor	A multiplier which, when applied to the rated horsepower, indicates horsepower loading which may be carried continuously without exceeding, by more than 10°C at continuous overload/service factor loading, rated temperature rise per NEMA MG 1 or IEC 60034-1, if rated voltage and frequency are maintained. When the motor is operated at any service factor greater than 1.0, it may have efficiency, power factor and speed different from those at rated horsepower, but the locked rotor torque and current and breakdown torque will remain unchanged.
Totally-enclosed air-to-air-cooled machine	A totally-enclosed machine which is cooled by circulating the internal air through a heat exchanger which, in turn, is cooled by circulating external air.
Totally-enclosed fan-cooled guarded machine	A totally-enclosed fan-cooled machine in which all openings giving direct access to the fan are limited in size by the design of the structural parts or by screens, grilles, expanded metal, etc., to prevent accidental contact with the fan. Such openings shall not permit the passage of a cylindrical rod $\frac{3}{4}$ in. (20 mm) in diameter, and a $\frac{1}{2}$ in. (12 mm) diameter probe when penetrated 4 in. (100 mm) shall not contact the blades, spokes, or other irregular surfaces of the fan.
Totally-enclosed fan-cooled machine	A totally-enclosed machine equipped for exterior cooling by means of a fan or fans integral with the machine but external to the enclosing parts.
Totally-enclosed machine	A machine so enclosed as to prevent the free exchange of air between the inside and the outside of the case but not sufficiently enclosed to be termed air-tight.
Totally-enclosed non-ventilated machine	A totally-enclosed machine which is not equipped for cooling by means external to the enclosing parts.

Term	[I] Description
Totally-enclosed pipe-ventilated machine	A totally-enclosed machine except for openings so arranged that inlet and outlet ducts or pipes may be connected to them for the admission and discharge of the ventilating air. This air may be circulated by means integral with the machine or by means external to and not a part of the machine. In the latter case, these machines shall be known as separately- or forced-ventilated machines.
Totally-enclosed water-air-cooled machine	A totally-enclosed machine which is cooled by circulating air which, in turn, is cooled by circulating water. It is provided with a water-cooled heat exchanger for cooling the ventilating air and a fan or fans, integral with the rotor shaft or separate, for circulating the ventilating air.
Watertight enclosure	An enclosure into which there shall be no leakage after 5 minutes under test with a water hose from a distance of 10 ft (3 m) in any direction.
Weather-protected (Type II) machine	An open machine with its ventilating passages at both intake and discharge so arranged that high-velocity air and air-borne particles blown into the machine by storms or high winds can be discharged without entering the internal ventilating passages leading directly to the electric parts of the machine itself. The normal path of the ventilating air which enters the electric parts of the machine shall be so arranged by baffling or separate housings as to provide at least three abrupt changes in direction, none of which shall be less than 90 degrees. In addition, an area of low velocity not exceeding 600 fpm (3 m/s) shall be provided in the intake air path to minimize the possibility of moisture or dirt being carried into the electric parts of the machine. Its ventilation openings shall be so constructed as to prevent the passage of a cylindrical rod $\frac{3}{4}$ in. (20 mm) in diameter.

5. Documentation

- 1) * [I] [T160902C01](#) provides a Technical Data Sheet for Purchaser's requirements and Manufacturer's data. Motor data, including the following, shall be furnished by Vendor with all proposals. All the same data shall be furnished with final drawings and data corrected to apply to the actual motor furnished. Guaranteed or published values are acceptable for motors that do not require certified test reports.
 - a) Rated horsepower (kW).
 - b) Rated full-load speed.
 - c) Rated voltage.
 - d) Full load current at rated voltage.
 - e) Efficiency at $\frac{1}{2}$, $\frac{3}{4}$, and full load and by what method determined.
 - f) Power factor at $\frac{1}{2}$, $\frac{3}{4}$, and full load.
 - g) Rated temperature rise.

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- h) Continuous overload capability/service factor (may be omitted if standards of manufacture do not provide for continuous overload capability/service factor).
- i) Locked rotor current at rated voltage.
- j) Allowable time at locked rotor with rated voltage applied for the following conditions:
 - i) Motor starting cold (at design maximum ambient temperature).
 - ii) Motor starting hot (motor having attained allowable full load temperature rise at design maximum ambient temperature).

Note: In Items i) and ii) above, design maximum ambient temperature is 40°C unless otherwise specified.
- k) Bearing-type and lubrication system type.
- l) For horizontal sleeve bearing motors, calculated value of the maximum axial force to constrain the motor rotor at either limit of its end float with motor operating at rated voltage.
- m) Note: This data is required to permit Purchaser to check capacity of driven equipment thrust bearing. Data shall be furnished immediately after order placement.
- n) L_{10} rating life per ABMA 9 and ABMA 11 for vertical motor anti-friction bearings (other than in-line pump motors) and the thrust load on which rating life is based.
- o) Locked rotor power factor.
- p) Locked rotor torque at rated voltage.
- q) Motor weight (lb) [kg] and, rotor weight and inertia (Wk^2 , lb-ft²) [GD^2 , kg-m²].
- r) Motor type—(horizontal/vertical).
- s) Enclosure type—(WP, TEFC, EX-P, etc.).
- t) Rotation, viewed from coupling end—(cw/ccw).
- u) Rotor endfloat—mils (mm).
- v) Thrust bearing mounting—(face-to-face, back-to-back, tandem).
- w) Vertical motors—maximum allowable thrust up/down.
- x) For unsparred critical motors, and motors larger than 1500 hp (1100 kW):
 - i) Complete coil makeup and dimensional data.
 - ii) Rotor bar material and dimensional data.
- 2) * [I] Test reports (five certified copies) shall be submitted to Purchaser for each motor for which inspection is specified. Reports for low voltage motors shall be supplied only when specified.
- 3) * [I] Outline drawings (five certified copies) showing principal dimensions, mounting and shaft dimensions shall be submitted to Purchaser for each motor. Drawings shall also show motor manufacturers or bearing manufacturer's identification.
- 4) * [I] Motor and driven equipment data referenced by Sections 8 and 12 of this GP shall be submitted to Purchaser at the time motor proposal is submitted. Typical data for identical or similar proven motor designs may be submitted at proposal time. If this is the case, however, it shall be clearly stated in the bid proposal, and data for the specific design required shall be furnished as soon as it is available.
- 5) * [I] At time of bid, motor and/or driven equipment Vendor shall provide the following for antifriction bearings:

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