

STANDARD OIL COMPANY
OF CALIFORNIA
ENGINEERING DEPARTMENT
SAN FRANCISCO, CALIFORNIA

SPECIFICATION NO. EG-1824-G
MARCH 9, 1971
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SPECIFICATION NO. EG-1824-G
INDUCTION MOTORS

SECTION A

TECHNICAL REQUIREMENTS

1.0 SCOPE

This Specification covers requirements for fractional and integral horsepower induction motors.

2.0 STANDARDS

- 2.1 Motors shall be designed and fabricated in accordance with the latest edition of NEMA Publication No. MG 1, "Motors and Generators," and applicable sections of the National Electrical Code.
- 2.2 Explosion-proof motors shall comply with the requirements of the Underwriters' Laboratories for Class I, Group D hazardous locations and shall bear their label.

3.0 ENCLOSURES AND MATERIALS

- 3.1 Explosion-proof, TEFC (totally enclosed fan-cooled), TENV (totally enclosed non-ventilated), and WP-I (weather-protected Type I) and WP-II (Type II) motors shall have weather-proof gasketed cast or heavy fabricated steel terminal boxes with threaded conduit entrances, sealed leads between motor housing and terminal box and shaft slingers or rotating shaft seals to prevent entrance of dirt and moisture into bearings. Balance washers shall be of corrosion-resistant material or shall be zinc- or cadmium-plated. Rotors shall be given a corrosion-resistant coating after balancing. Motor finish and external hardware shall be resistant to salt-water washdown and corrosive atmospheres found in the petroleum industry.
- 3.2 TEFC motors shall be Severe Duty type with cast iron housings throughout including cast fan covers.

Fans shall be non-sparking inert plastic, bronze, or corrosion-resistant aluminum.

- 3.4 TEFC and TENV motors shall be provided with a tapped drain hole fitted with a pipe plug or suitable drain plug. Where drains are specified in explosion-proof motors, they shall be provided with an explosion-proof drain plug approved by Underwriters' Laboratories.
- 3.5 Where TEFC or TENV motors are mounted vertically with the shaft extension up, provisions shall be made to prevent the entrance of moisture along the shaft, at end bell fits, or at any other openings in the upper end bell. The drain hole specified in Section 3.4 shall be located at the low point of the motor as mounted.
- 3.6 WP-I and WP-II motors shall have corrosion-resistant treatment on all internal metal parts in addition to requirements of Section 3.1 of this Specification. WP-I and WP-II motors shall have stainless steel screens and moisture-sealed insulation per Section 7.0 of this Specification. WP-II motors shall have provision for future addition of filters and manometers on air inlets.
- 3.7 TEFV (totally enclosed force-ventilated) and TEWAC (totally enclosed water-air-cooled) motors shall be designed and fabricated for severe duty outdoor service.

4.0 FRAME SIZE AND DIMENSIONS

- 4.1 Motor frames for fractional and integral horsepower induction motors shall be assigned in accordance with the latest edition of NEMA Publication No. MG 1.
- 4.2 Motor terminal boxes shall be of adequate size to connect power leads to motor winding leads. On motors with voltage rating greater than 2300 volts, space shall be provided for stress cones or cable terminators. Conduit entrance shall be adequate for rigid steel conduit required for Type THW Aluminum conductor power leads sized in accordance with the National Electrical Code, but not smaller than 3/4 inch.

- 4.3 Motors for in-line pumps shall be NEMA "P" Base In-Line Pump Motors. Mounting and shaft extension dimensions and tolerances shall be in accordance with NEMA MG 1-18.625 (alternate) except as follows:
- a) Frames 254 and 256 shall have 1-5/8-inch diameter shaft extension ("U" dimension).
 - b) Base runout -- 0.004 in. TIR maximum.
 - c) Rabbet runout -- 0.004 in. TIR maximum.
 - d) Shaft runout -- 0.001 in. TIR maximum at end, with motor vertical.
 - e) Shaft end play -- 0.002 in. maximum under 50-lb. reversing thrust.
 - f) Shaft protrusion below base -- $\pm$ 0.015-in. tolerance.
 - g) Motor balance as defined by NEMA Method MG-12.06 -- 0.001 in. maximum, all speeds.

5.0 BEARINGS AND LUBRICATION

- 5.1 Grease-lubricated ball bearings shall be supplied on all motors up to 250-hp except where manufacturer's standard provides oil-lubricated sleeve bearings.
- 5.2 Oil-lubricated sleeve bearings shall be supplied on all horizontal motors larger than 250 hp. Sleeve bearings with split-type housings are preferred.
- 5.3 Ball bearings shall be vacuum-degassed steel, motor quality. Bearings shall be selected for a minimum life, as determined by AFBMA rating method B-10, of three years (25,000 hours) continuous service at rated motor load and 40°C ambient temperature.
- 5.4 Where sleeve bearings are furnished with oil-ring lubrication only each bearing housing shall have a 4-ounce or larger constant-level oiler (Trico "opto-matic") with glass bottle. Recommended oil level shall be marked on the outside of bearing housings by a cast mark or metal tag.

- 5.5 Where pressure lubrication is furnished, lubricating oil system shall include the following unless specified otherwise in writing:
- a) Separate motor-driven oil pump, with 230-volt, single-phase, explosion-proof motor.
 - b) Oil pressure controller, and by-pass relief valve if oil pump is positive-displacement type.
 - c) Oil cooler, or sufficient radiating surface on oil reservoir for adequate cooling.
 - d) Duplex filters to permit changing filter element without shutting down. If oil rings and sufficient oil capacity in each bearing housing are provided to permit at least 30-minute operation at rated load with the forced-feed lubrication system inoperative, a single filter is acceptable.
 - e) Oil pressure gage downstream of filter, and an indicating differential pressure switch (explosion-proof) across the filter (Barton or equal).
 - f) Bearing or bearing housing oil temperature indicator for each bearing.
 - g) Sight flow indicator in oil return line to reservoir from each bearing.
 - h) Low oil pressure shutdown and/or alarm switch (explosion proof).
 - i) All piping shall be seamless steel tubing (3/4-inch x .095-inch wall minimum) with Swagelock fittings, and shall be routed to minimize possibility of physical damage.
 - j) Reservoir shall be thoroughly sandblast cleaned and coated with Chevron Rust Preventive, or equivalent as approved by COMPANY, before shipment.
- 5.6 Sleeve-bearing motors will be coupled to driven equipment with limited end-float couplings. Minimum rotor end-float shall be in accordance with NEMA

Standard MG 1-14.38. Rotor end-float limits shall be indicated on motor outline drawings and shall be stamped on the motor nameplate or separate metal tags permanently fastened to the motor, or marked on the motor shaft.

- 5.7 Where vertical motors are required or proposed, bearings may be ball type, either grease- or oil-lubricated. Bearings shall have adequate capacity to handle maximum expected up or down thrust and any radial load imposed by driven equipment, with bearing life per Section 5.3 of this Specification.

6.0 STARTING AND OPERATING CHARACTERISTICS

- 6.1 All polyphase motors shall be designed for full-voltage starting, unless specified otherwise in writing.
- 6.2 Explosion-proof, single-phase motors shall be designed for split-phase or capacitor-start and induction-run. All other single phase motors may be designed according to manufacturer's standard.

7.0 MOISTURE-SEALED INSULATION

Where moisture-sealed insulation is specified, the following sections shall apply.

- 7.1 Random-wound-motor sealed insulation shall be Class B and shall consist of epoxy encapsulation. Encapsulation shall completely enclose end turns and permeate slots and shall be applied by a process that insures void-free insulation.
- 7.2 All 2300-V and higher voltage motors, and all 460-V motors over 150 hp with sealed insulation, shall have form-wound coils. Form-wound motor sealed insulation shall be Class B, shall consist of epoxy-resin-impregnated tape with mica or other additional insulating tapes as required, shall have connections treated to equal coil insulation, and shall have end turns adequately braced. Silicone rubber insulation is not acceptable.
- 7.3 Completed encapsulated random-wound stators, and completed form-wound stators including all connections shall be capable of withstanding

insulation-resistance and voltage tests while immersed in water. In addition, stators shall be capable of withstanding thermal cycling and thermal shock tests.

- 7.4 Moisture-sealed insulation shall be impervious to salt water and hydrocarbons.

8.0 THERMAL DEVICES

Where thermal devices are specified, the following sections shall apply.

- 8.1 Built-in thermal protection for random-wound integral horsepower motors shall be of inherent protection type and shall consist of embedded thermal protectors for both overload and locked-rotor protection. Thermal protectors shall be of the rod-and-tube direct acting type suitable for connection in series with the motor stop button in the magnetic starter control circuit, and shall be hermetically sealed.
- 8.2 Hermetically sealed disc-type thermostats with normally closed contacts suitable for connection in the magnetic starter control circuit shall be supplied for form-wound motor or for motors too small for embedded thermal protectors.
- 8.3 Built-in thermal protection devices shall be set to prevent dangerous overheating of the motors due to overload or failure to start; but devices shall not operate below 120% of full load current for 1.15 service factor motors, or 110% full load current for 1.0 service factor motors, at an ambient temperature of 40C, unless specified otherwise in writing.
- 8.4 Winding temperature detectors, 6 per motor, shall be furnished in all 1750-hp and larger motors, and in smaller motors where specified.
- 8.5 Winding and bearing temperature detectors shall be 10-ohm resistance type, unless specified otherwise in writing. Where specified for use with Edison Omniguard equipment, winding and bearing temperature detectors shall be nickel-resistance type, 120 ohm at 32F, Edison resistance characteristic No. 7.

9.0 SPACE HEATERS

- 9.1 Space heaters shall be for 230-volt operation unless specified otherwise in writing.
- 9.2 Space heaters shall be completely wired, with leads brought to a terminal box separate from the power lead terminal box.
- 9.3 Surface temperature of space heaters shall not exceed 200C when operating at rated voltage.

10. NOISE

- 10.1 Maximum sound pressure levels 3 feet from any motor shall not exceed the following values, unless specified otherwise in writing:

<u>Octave Band Center Frequency, Hz</u>	<u>Maximum SPL dB re 0.0002 Microbar</u>
31	97
63	93
125	89
250	85
500	82
1000	82
2000	82
4000	82
8000	82

- 10.2 The sound pressure level indicated for each octave band is the maximum for any single reading (at any location 3 feet from the motor) in the octave band. Measurement procedures shall in general be guided by the provisions of ANSI S1.2 - 1962, "Physical Measurement of Sound," or IEEE No. 85, "Test Procedure for Airborne Noise Measurements on Rotating Electrical Machinery," using equipment meeting the

standards of ANSI S1.4 - 1961 and ANSI Z24.10 - 1953 or equivalent.

- 10.3 Supplier shall provide evidence of compliance with noise limits for all motors. This requirement may be satisfied by submitting noise test data obtained on a unit of identical design and construction running under normal load conditions in an existing plant, or certified noise test data obtained at Supplier's plant. Acceptable shop test procedures are set forth below.
- 10.4 If noise test data obtained on a unit of identical design and construction, either in an existing plant or in shop tests as described herein are not available, noise tests shall be made on Supplier's shop floor, in an open area relatively free from nearby equipment. Maximum noise levels measured at any location three feet from the motor and three feet or more from the floor and any nearby reflecting surfaces shall not exceed the values listed in Subsection 10.1 above.
- 10.5 Motors under 200 hp may be tested under no-load conditions only. Motors 200 hp and larger shall be tested and shall comply with the noise levels specified above, under both no-load and loaded conditions in the same location and under the same ambient conditions. The tests must be conducted in such a way that extraneous noise does not invalidate the motor noise test. This may require acoustic isolation of the loading device (and coupling) and/or shutting down other shop facilities.
- 10.6 If shop tests are necessary to satisfy the requirements of Subsections 10.3, 10.4 and 10.5, such tests may be witnessed at COMPANY's option. Cost of such tests shall be quoted separately as required by Section B "General Requirements," Subsection 2.7. Supplier shall notify COMPANY three weeks before tests are scheduled to be made.

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INDUCTION MOTORS

SECTION B

GENERAL REQUIREMENTS

1.0 SCOPE

This Section covers general requirements relating to purchasing.

2.0 INSTRUCTIONS TO VENDOR

- 2.1 VENDOR'S proposal shall be in strict accordance with this Specification and the Motor Data Sheet.

IF VENDOR wishes to take exceptions or propose alternates to this Specification or the Motor Data Sheet, he shall describe the deviations he proposes and shall indicate the adjustment to his proposed price applicable to each deviation should COMPANY elect to accept individual deviations.

- 2.2 VENDOR shall submit a tabulation of those motor characteristics not included in the Motor Data Sheet.
- 2.3 VENDOR shall recommend design for motors driving centrifuges, large blowers, conveyors and other high-inertia loads. Built-in thermal protection is required for such motors.
- 2.4 VENDOR shall include dimension "AC" in addition to NEMA frame size with motor tabulation. For motor frames not covered by NEMA standards, VENDOR shall furnish all comparable dimensions.
- 2.5 VENDOR shall furnish terminal box dimensions for all motors larger than 100 hp.
- 2.6 VENDOR shall submit details of quality Control procedure and immersion, thermal cycling and shock tests for moisture-sealed insulation systems.

2.7 VENDOR shall quote, as a separate item, the extra cost of any special test that may be required.

3.0 GUARANTEE

VENDOR guarantees that the equipment furnished hereunder meets the requirements set forth in this Specification and the Agreement to which it is attached and is free of defects in design, materials and workmanship for a period of one year after the date the equipment is placed in operation (but not more than eighteen months after date of delivery).

If any item of equipment does not meet the above guarantee or the guarantee in this paragraph and VENDOR is notified thereof, VENDOR shall, at its own expense and as promptly as possible, make such alterations, repairs and replacements as may be necessary to meet this guarantee with the least overall loss of operating time to COMPANY; provided, however, that transportation costs for and risk of loss of replacement parts shall be allocated in accordance with the same terms as set forth in the Agreement for the original equipment furnished hereunder. All such alterations, repairs and replacements shall be guaranteed for a period of one year from the date the corrected equipment is placed back in operation (but not more than eighteen months after the date of completion of corrective work). If VENDOR'S proposed method of correction is for any reason not satisfactory to COMPANY, COMPANY may at its option select another method of correction and VENDOR shall perform corrective work in accordance with COMPANY'S method; provided, however, that if the COMPANY-selected method would result in a greater cost to VENDOR than the method suggested by VENDOR to achieve a satisfactory correction with the least overall loss of operating time to COMPANY, COMPANY will pay the difference between such greater cost and the cost which would have been incurred if VENDOR-suggested method of correction had been used; and provided further that VENDOR'S obligations shall not (except as to extra cost) be changed by the fact that the COMPANY-selected method of correction was used.

The guarantee period under each paragraph above with respect to each item of equipment furnished hereunder or part thereof shall be extended by the number of days on which such item cannot be operated as a result of a failure to meet this guarantee.