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SUPERSEDING

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October 29, 1951

FEDERAL SPECIFICATION**MOTOR, ALTERNATING-CURRENT,
(FRACTIONAL HORSEPOWER)**

This specification was approved by the Commissioner, Federal Supply Services, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers fractional horsepower, single-phase and polyphase induction-type motors and single-phase series wound motors for use on nominal 110- or 220-volt, 50- or 60-cycle alternating-current systems in non-tactical equipment.

1.2 Classification.

1.2.1 Types and classes. Motors furnished under this specification shall be of the following types and classes, as specified (see 6.1):

Type I.—Single-phase, squirrel cage.

Class 1a.—Split-phase (capacitor-start).

Class 1b.—Split-phase (resistance-start).

Class 2a.—Capacitor (permanent-split).

Class 2b.—Capacitor (two-value).

Class 3.—Shaded-pole.

Type II.—Single-phase, wound rotor.

Class 4.—Repulsion.

Class 5.—Repulsion-start induction.

Class 6.—Repulsion-induction.

Type III.—Single-phase, series wound.

Class 7.—Universal.

Type IV.—Polyphase induction.

Class 8.—Squirrel cage.

Class 9.—Wound rotor.

1.2.2 Styles. Motors furnished under this specification shall be of the following styles, as specified:

Style A1.—Open.

Style A2.—Drip-proof.

Style A3.—Splash proof

Style A4.—Guarded.

Style A5.—Drip-proof, fully guarded.

Style B1.—Totally enclosed, non-ventilated.

Style B2.—Totally enclosed, fan cooled.

Style B3.—Waterproof.

Style B4.—Explosion proof.

Style B5.—Dust-ignition-proof.

Note: For definitions of the various types, classes, and styles see ASA Standard C42.10.

1.2.3 Duty. With reference to duty requirements, motors shall be classified as follows:

1.2.3.1 Continuous duty. Continuous duty is a requirement of service that demands op-

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eration at a substantially constant load for an indefinitely long time.

1.2.3.2 Short-time duty. Short-time duty is a requirement of service that demands operation at a substantially constant load for a short and definitely specified time.

1.2.3.3 Intermittent duty. Intermittent duty is a requirement of service that demands operation for alternate intervals of (1) load and no-load; or (2) load and rest; or (3) load, no-load, and rest; such alternate intervals being definitely specified.

1.2.3.4 Periodic duty. Periodic duty is a type of intermittent duty in which the load conditions are regularly recurrent.

1.2.3.5 Varying duty. Varying duty is a requirement of service that demands operation at loads, and for intervals of time, both of which may be subject to wide variation.

2. APPLICABLE SPECIFICATIONS, STANDARDS, AND OTHER PUBLICATIONS

2.1 Specifications and standards. The following specifications and standards of the issues in effect on date of invitation for bids form a part of this specification:

Federal Standards:

Fed. Std. No. 102—Preservation, Packaging and Packing Levels.

Fed. Std. No. 123—Marking for Domestic Shipment (Civilian Agencies).

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications, Standards, and Handbooks and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

(Single copies of this specification and other

product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D. C., Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, and Auburn, Wash.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications, Standards, and Handbooks from established distribution points in their agencies.)

Military Specifications:

MIL-C-25—Capacitors, Fixed, Paper-Dielectric, Direct-Current (Hermetically Sealed in Metallic Cases).

MIL-V-173—Varnish, Moisture- and Fungus-Resistant, for the Treatment of Communications, Electronic, and Associated Electrical Equipment.

MIL-V-1137—Varnish, Electrical-Insulating (for Electro-motive Equipment.)

MIL-I-6181—Interference Limits, Tests and Design Requirements, Aircraft Electrical and Electronic Equipment.

MIL-I-11748—Interference Reduction for Electrical Equipment.

MIL-F-15733—Filters, Radio-Interference.

MIL-P-16298—Preservation, Packaging, Packing, and Marking of Electric Machines Having Rotating Parts (Includes Associated Repair Parts).

MIL-I-16910—Interference Measurement, Radio, Methods and Limits; 14 Kilocycles to 1000 Megacycles.

Military Standards:

MIL-STD-108—Definitions of and Basic Requirements for Enclosures for Electric and Electronic Equipment.

MIL-STD-129—Marking for Shipment and Storage.

MIL-STD-130—Identification Marking of U. S. Military Property.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following publications, of the issues in effect on date of invitation to bid, form a part of this specification:

Underwriters' Laboratories, Inc., Publications:

UL-874(c)—Standard for Motors and Generators, Electric, For Use in Hazardous Locations, Class I, Group D (Part II- Fractional HP).

(Copies may be obtained upon application to their addresses: 161 Sixth Avenue, New York, N. Y.; 207 East Ohio Street, Chicago 11, Ill.; 1655 Scott Blvd., Santa Clara, Calif.)

American Standards Associations, Inc., Standards:

C6.1—Terminal Marking for Electrical Apparatus.

C42.10—Definitions of Electrical Terms; Rotating Machinery.

C50.2—Alternating-Current Induction Motors, Induction Machines in General, and Universal Motors.

C50.8—Dimensions for Motors and Generators.

(Application for copies should be addressed to American Standards Association, Inc., 10 East 40th Street, New York 16, New York).

3. REQUIREMENTS

3.1 Voltage rating. Motors shall be furnished with voltage ratings as specified (see 6.1):

Universal 115 or 230 volts.

Single-phase . . 115, 230, or 115/230 volts.
Polyphase . . . 110, 208 (60 cycle circuits only) or 220 volts.

When a single-voltage rating is specified, a dual-voltage rating may be provided. When motors rated at voltages other than the above are required, the voltages shall be as specified in the invitation for bids (6.1).

3.2 Frequency ratings. Unless otherwise specified, frequency ratings shall be either 50 or 60 cycles, as specified (6.1). If a universal motor is specified, it shall be suitable for operation on direct current as well as on 60 cycles.

3.3 Horsepower and speed ratings. The horsepower and speed ratings for fractional-horsepower induction motors rated 115 and 230 volts, single-phase, and 110, 208, (60-cycle circuits only) and 220 volts polyphase, shall be according to table I.

3.4 Ambient temperature of reference. One standard and one secondary standard ambient temperature of reference are specified for rating purposes, viz:

40°C. ambient (standard)

50°C. ambient (secondary standard)

40°C. will be the ambient temperature of reference, unless otherwise specified (6.1).

3.4.1 40°C. *ambient.* In general and except where otherwise specified, the rating of the equipment shall be based upon an ambient temperature of 40°C. for those installations where the maximum normal operating temperature of the surrounding atmosphere or cooling medium is 40°C. or less.

3.4.2 50°C. *ambient.* In general and except where otherwise specified, the rating of the equipment shall be based upon an ambient temperature of 50°C. for those installations where the maximum normal operating temperature of the surrounding atmosphere or other cooling medium is in excess of 40°C. but is not higher than 50°C.

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3.4.3 Special ambient. Where the maximum normal operating temperature of the surrounding atmosphere or other cooling medium is in excess of 50°C., the rating of the equipment shall be based upon the special ambient temperature specified.

3.5 Electrical insulation. The class of insulation material used in all components of an electrical system, shall conform to one of the following:

Class A—Materials or combinations of materials such as cotton, silk, and paper when suitably impregnated or coated, or when immersed in a dielectric liquid such as oil. Other materials or combinations of materials may be included in this class if by experience or accepted tests they can be shown to be capable of operation at 105°C.

NOTE 1—An insulation is considered to be "impregnated" when a suitable substance replaces the air between its fibers, even if this substance does not completely fill the spaces between the insulated conductors. The impregnating substances in order to be considered suitable must have good insulating properties; must entirely cover the fibers and render them adherent to each other and to the conductor; must not produce interstices within itself as a consequence of evaporation of the solvent or through any other cause; must not flow during the operation of the machine at full working load or at the temperature limit specified; and must not unduly deteriorate under prolonged action of heat.

Class B—Materials or combinations of materials such as mica, glass fiber, asbestos, etc., with suitable bonding substances. Other materials or combinations of materials, not necessarily inorganic, may be included in this class if by experience or accepted tests, they can be shown to be capable of operation at 130°C.

3.5.1 Mixed Insulation. Unless otherwise specified in invitation for bids, nothing in

the foregoing shall be construed as limiting all the insulation on a given machine to a single class. Class B insulation may, if desired, be used on a machine where class A insulation is specified or approved, and the temperature limits applicable to the particular class of insulation used shall be met in every case. When a machine is specified as class A insulated, it shall mean that no insulation having a lower temperature limit than class A is utilized; and when class B is specified, that no insulation having a lower temperature limit than class B shall be used.

3.6 Connections and terminals.

3.6.1 Electrical connections. Pure tin or other solder having an equally high melting point or copper welding shall be used in making all electrical connections on the rotor employing class B insulation. A tin-lead solder may be used on stationary windings and all class A insulated rotor windings. On motors employing either class A or class B insulation, the welding together of stator connections by melting the twisted ends or the use of suitable pressure-type connectors is permissible in lieu of soldered joints.

3.6.2 Securing of connections. All connections which may become loosened by vibration shall be provided with approved, efficient locking devices. All connecting wires and other current-carrying parts shall be so proportioned that no injurious heating will occur when they are worked under the most severe conditions, and such connections shall be secured in a reliable manner to prevent their coming in contact with moving parts or being chafed by contact with stationary parts. All connections shall be properly marked.

3.7 Terminal leads. Unless otherwise specified, motors shall be provided with suitable and accessible leads or terminals for line connection. The method of fastening terminal leads shall be such that strains from the outside cannot damage the connections within the motor frame. When terminal box-

es are provided as part of or as an attachment to the motor, a suitable terminal board shall be provided, or the leads shall be of proper length to afford means of connection within the terminal boxes.

3.8 Flexible leads. All terminal leads shall be made of flexible, stranded, insulated wire.

3.9 Terminal markings. All motor terminals shall be legibly and permanently marked in accordance with ASA C6.1 when more than two are brought out from the motor frame. When terminal markings are not covered by ASA C6.1, a terminal marking diagram shall be permanently affixed to the motor.

3.10 Commutators (where used).

3.10.1 General. Commutators shall be built up of best-quality, hard-drawn, hard-rolled, or drop-forged copper segments or other suitable metals insulated from each other by mica, pressed mica plate, or other suitable material, and from the shell by mica, pressed mica plate, molded insulation, or other suitable material. They shall be either of the metal V-ring or molded-insulation construction. The commutator shall be secured rigidly to the shaft by keying or other approved methods which will positively insure maintenance of alignment with respect to the rotor core slots. In lieu of the foregoing, commutators may be of molded-insulation construction instead of the metal shell type, but shall have mica plates or other suitable material between the commutator segments.

3.10.2 Commutator segments. The commutator segments shall be securely retained in a manner that will best prevent their relative displacement as a result of centrifugal forces and the stresses imposed by repeated expansion and contraction in service. The segments, when worn to the full extent of the wearing depth specified hereunder, shall be of ample section to operate satisfactorily. The minimum wearing depth for commuta-

tors 1½ inches in diameter and larger shall be 1/16 inch, and for commutators of smaller diameter the minimum wearing depth shall be 1/32 inch.

3.10.3 Connections. The connections to the rotor windings shall be efficiently soldered, staked, welded, or joined by other suitable means and, if separate risers are used they shall be mechanically and electrically connected to the commutator bar in an approved manner.

3.10.4 Sealing. After the assembly of the commutator, all crevices or joints at each end between the bars and the retaining flanges shall be completely filled up and sealed over with a high-grade, flexible baking, insulating varnish in a manner that will prevent the entrance of moisture, oil, carbon, or copper dust, or other deleterious substances at these points. Likewise, the short creepage paths from the bare copper bars at each end to the bare metal flanges shall be given a heavy durable coating of flexible baked insulating varnish as a protection against short-circuits and grounds at these points.

3.10.5 Undercutting. Unless paper or similar segment insulation is used, the insulation between bars shall be undercut. The undercutting shall be accomplished by removing all insulation between bars to form a groove not to exceed 3/64 inch in depth.

3.10.6 Curing. All commutators shall be cured at higher than operation temperatures and shall be of such thoroughly solid construction throughout that they will hold their shape in service and obviate the necessity of frequently dressing the commutators on account of high bars or flat spots.

3.11 Brushes (where used). Brushes shall be of sufficient capacity to prevent undue heating when the motor is carrying normal rated load under the most unfavorable service conditions.

3.12 Fungus control of electrical com-

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ponents. When specified in the invitation for bids, motors shall be treated to resist growth of fungus as follows:

3.12.1 Motor windings. The motor windings shall be given 2 impregnating coats of varnish conforming to type M, grade BB or grade CB, and one sealer coat conforming to type M, grade CA, of MIL-V-1137. The coats shall be applied by one of the following methods of impregnation:

- Immersion
- Vacuum-pressure
- Centrifugal
- Pulsating-pressure
- Built-up
- Brushing or spraying (for sealer coat only)

(a) The vacuum-pressure method is the preferred method. It shall consist of an arrangement for heating the windings in a vacuum chamber, at the temperature and for the period of time necessary to provide for the evacuation of all entrapped moisture and air, and then, without breaking the vacuum, allowing the liquid insulation (heated to the proper temperature) to flow into the windings under graduated pressure. This process shall be followed by necessary draining and baking.

(b) The immersion method shall consist of first heating the windings to the temperature and for the period of time necessary to thoroughly dry them out, and then completely immersing the windings in insulating material for the period of time necessary for thorough penetration. The baking may be omitted in the case of windings where the conductor insulation does not employ hygroscopic material such as cotton or asbestos and is of synthetic resinous material. This method will not be given approval if less than two dips and bakes have been applied. All dips and bakes on the individual coils during the process of manufacture as well as the final dipping and baking may be used in

determining the total number of dips and bakes.

(c) The centrifugal method is a pressure-impregnation method, the pressure being the effect of centrifugal force due to the rotation of the chamber containing the insulating material and the windings to be impregnated.

(d) The pulsating-pressure method is a pressure-impregnation method consisting of repeated applications of pressure for suitable periods of time alternating with zero pressure.

(e) The built-up method shall consist of the impregnation and curing of the insulation at each step in the building up of the windings.

(f) The brushing or spraying method is not considered as an adequate method, in itself, of applying insulating material to electrical windings. The use of this method shall be limited to the sealer (final) coat of varnish applied to windings previously impregnated by one of the other methods outlined in the foregoing paragraphs.

3.12.2 Circuit elements. When specified in the invitation for bids, circuit elements, such as cable, wire, terminal blocks, condensers, coils, etc., which operate normally at a temperature of 200°F. or lower, shall be coated with a fungus-resistant varnish conforming to MIL-V-173, except those elements which are fabricated of materials inherently inert to fungus attack or which have been rendered resistant to fungus attack by approved treatments.

3.13 Radio-interference suppression.

3.13.1 Air Force. For Air Force purchases, the motors, except the induction squirrel-cage type which require no suppression treatment or test, shall meet the requirements of MIL-I-6181; however, the an-

tenna shall be located a distance of five feet from the test specimen.

3.13.2 Army. For Army purchases all motors, except the induction squirrel-cage type which require no suppression treatment or tests, shall be equipped for radio-interference suppression in accordance with MIL-I-11748, class IIIa, unless procurement is under an end-equipment specification in which a less stringent end equipment suppression requirement may apply. Conformance to MIL-I-11748 requirements will be determined by authorized representatives of the contracting officer using Government test equipment. The Army testing agency will furnish the contracting officer a report of the model tested, including details of the suppression system applicable for production units and recommendations for quality control of production. Upon approval by the contracting officer and provided all other requirements of this specification are met, the contractor shall examine each production unit to determine that it conforms to the report of the contracting officer and the approved suppression system of the preproduction sample or first unit of production, as applicable.

3.13.2.1 The contracting officer should arrange for the interference-suppression tests to be made by the Signal Corps in accordance with MIL-I-11748. Upon approval by the contracting officer, and provided all other specification requirements have been met, the tested model shall be used as a model for all production units.

3.13.3 Navy. Unless otherwise specified in the purchase specification applicable to the motor driven equipment, the radio-interference requirements below only apply to the following types: Series wound, universal, repulsion, repulsion-induction, and repulsion-start-induction.

3.13.3.1 Interference minimization shall be considered in the basic design of the equipment. Motors shall be of such design and construction that when operated at no-load,

half-load, or at full-rated-load with no filtering, the indicated quasi-peak conducted interference shall not exceed 5000 microvolts within the frequency range of 0.15 to 20 megacycles (mc.). The equipment in operation shall also comply with MIL-I-16910.

3.13.3.2 Where motors covered by this specification are required to comply with minimum values of capacitance (0.1 microfarad or less), or limiting values of current between any exposed metal parts of the equipment and earth ground, and fall within the definition of portable electric equipment, the general limits of MIL-I-16910 increased by a factor of 10 or 20 decibels shall be applicable.

3.13.3.3 Radio interference filters or capacitors employed for the reduction of interference shall be Navy approved types in accordance with MIL-F-15733 for filters and MIL-C-25 for capacitors.

3.13.3.4 Interference reduction networks other than filters, such as are sometimes used for special applications, including portable electric tools, need not be submitted separately for qualification approval as a filter but must be capable of conforming to any requirement concerning operation, heating, dielectric, and capacitance for a particular motor in which the network may be installed.

3.13.3.5 Motors which are identical with those which were previously tested in accordance with this specification, found satisfactory, and accepted will not require further testing unless otherwise specified in the invitation for bids (6.1), or by the Naval inspector. A copy of the previous test report, or reference thereto with an adequate abstract, shall be forwarded by letter to the Bureau or Agency concerned to verify the previous test results.

3.13.3.6 The manufacturer shall furnish either directly in his own plant or through the facilities of an acceptable commercial

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laboratory all facilities for performing the interference tests including test equipment, a suitable location for the performance of tests, and qualified technical personnel. Tests shall be performed on not less than one representative motor of each design.

3.14 Bearings and shafts. Bearings and shafts shall be designed to prevent the escape of the lubricant, when applicable. A shaft extension, with keyway (including key) or flat, shall be provided for the driven apparatus.

3.14.1 Bearings, horizontal motors. Horizontal motors may be furnished with either sleeve or ball bearings, unless one particular type is specified in the invitation for bids. Where sleeve bearings are used, ample bearing surface shall be provided and the bearing shall be efficiently lubricated.

3.14.2 Bearings, vertical motors.

3.14.2.1 Vertical motors may be furnished with either sleeve or ball bearings, unless one particular type is specified in the invitation for bids.

3.14.2.2 Where sleeve bearings are used, ample bearing surface shall be provided and the bearing shall be efficiently lubricated. One of the sleeve bearings, or a separate device, shall have adequate thrust capacity to support the weight of the motor rotor and, where directly connected to the driven unit, the thrust transmitted from the connected unit, as specified in the invitation for bids.

3.14.2.3 Where ball bearings are used, the bearing shall be efficiently lubricated and shall have adequate thrust capacity to support the weight of the motor rotor and, where directly connected to the driven unit, the thrust transmitted from the connected unit, as specified in the invitation for bids.

3.14.2.4 In the case of vertical motors, the requirements of 3.14 shall apply with special emphasis.

3.15 Base or feet. Unless otherwise specified, when motors are purchased unattached to any equipment, the motor shall be provided with a base or feet, having a mounting surface substantially parallel to the centerline of the shaft and drilled or slotted for hold-down bolts.

3.16 Drain plugs. The housings of all waterproof motors shall be provided with suitable drain plugs at accessible points and so located that they will drain all pockets in the motor housing. In case aluminum alloy housings are used for small waterproof motors, the drain plugs shall be of corrosion-resisting steel.

3.17 General construction. End shields shall be held in place by close-fitting rabbet joints with not less than two machine screws or bolts of suitable size and strength. When so specified, the design of the end shields on horizontally mounted motors shall provide for, and the accuracy of machining shall be such, as to permit the rotation of the bearings through 90 degrees to 180 degrees in either direction, to allow for the mounting of the motor on the ceiling or underside of the apparatus. Machine screws or bolts shall be either hexagon-headed or furnished with screwdriver slots; those necessary to be removed for maintenance shall be screwed into metal.

3.18 Enclosing covers. Enclosing covers, where used, shall be attached to the motor frame or end shields in a suitable manner. They shall be readily removable. In the case of waterproof motors, the contact surfaces between the enclosing covers and the motor frame shall be free from fins, burrs, and other imperfections detrimental to waterproofness and shall be provided with suitable gaskets, suitably secured and treated on the exposed surface to prevent sticking.

3.19 Balance. Motors shall run well-balanced at all speeds and loads within the

maximum service range. All motors and separable fans shall be accurately balanced by drilling or other suitable means. Uninsulated balancing wedges may be used in rotor slots provided that not more than two wedges, separated at least by 1/8 inch, are fitted in any slot and the length of each wedge does not exceed 30 percent of the length of the rotor core. Maximum peak-to-peak displacement, when tested in accordance with 4.4.2, shall not exceed 0.002 inch, for rigidly mounted motors and 0.003 inch for resiliently mounted motors.

3.20 Noise. Motors shall operate without objectionable noise at all loads and speed within the service range. Any degree of noise which is comparatively greater than that which is inherent in that type and size of motor shall be considered objectionable and cause for rejection.

3.21 Explosion-proof motors.

3.21.1 Standard of Underwriters' Laboratories, Inc., UL-674 (c) for electric motors and generators for use in hazardous locations shall apply to all purchases of explosion-proof motors.

3.21.2 The bidder shall submit with his bid evidence that the explosion-proof motors he proposes to supply under this specification conform to the Standards of Underwriters' Laboratories, Inc. as regards fire and casualty hazards. The listing of Underwriters' Laboratories, Inc. for explosion-proof motors will be accepted as evidence that the manufacturer can supply such motors conforming with this requirement. Such listing shall be cited in the bid for each type and size of explosion-proof motor offered, or, in lieu thereof, the bid must be accompanied by a certified test report from an independent testing laboratory stating that tests, conducted in substantial accordance with tests outlined in Underwriters' Laboratories, Standard for Electric Motors and Generators for Use in Hazardous Locations show that the sizes and types of motors offered con-

form to Underwriters' Laboratories, Standard.

3.21.3 Compliance of explosion-proof motors with all requirements of Underwriters' Laboratories, Standard for Electric Motors and Generators for Use in Hazardous Locations for the types and sizes of motors offered is necessary. The labels of Underwriters' Laboratories, Inc., for electric motors for hazardous locations may be accepted as evidence of such compliance, or compliance may be determined by laboratory tests, but this does not absolve the bidder from complete compliance with the additional requirements of the specification in order to secure the acceptance of his explosion-proof motors.

3.22 Gear motors. When so specified, motors shall be equipped with gears to supply the specified revolutions per minute of the power shaft.

3.23 Type II, class 7 universal motors.

3.23.1 Rotor speed. Rotors shall be readily removable and in no case shall the no-load speed exceed 25,000 r.p.m., except that rotors of 1-5/8-inch diameter and less, shall not exceed 30,000 r.p.m.

3.23.2 Brushes. Motors of 1/2 hp. and larger, shall have brushes of the rectangular type, fitted in suitable brush holders provided with spiral or helical springs and flexible copper shunts.

3.23.3 Momentary torque. Motors within the group shall have a momentary torque not less than 200 percent of the full-load torque no matter which type of duty is specified.

3.23.4 Horsepower and speed ratings. The horsepower and speed ratings for universal motors shall be 10, 15, 25, 35 millihorsepower and 1/20, 1/12, 1/8, 1/6, 1/4, 1/3, 1/2, 3/4, and 1 horsepower at a rated speed of 5000 r.p.m. or above.

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3.24 Unless otherwise specified, the following requirements shall conform to ASA Standard C50.2:

- (a) Variation from rated voltage.
- (b) Variation from rated frequency.
- (c) Combined variation of voltage and frequency.
- (d) Locked-rotor torque.
- (e) Breakdown torque.
- (f) Dielectric strength.
- (g) Temperature rise.*
- (h) Nameplate data.

* For 50°C. ambient temperature, the maximum observable temperature rise shall be 10°C. less than the values specified for 40°C. ambient temperature.

3.25 Unless otherwise specified, mounting dimensions and tolerances shall conform to ASA Standard C50.8.

3.26 Plans with bids.

3.26.1 *General.* In the case of motors to be purchased solely as motors (not a part of other apparatus), each bidder shall submit with his bid sufficient information in duplicate to enable the activity concerned to obtain a clear understanding of the apparatus offered before making recommendation of award of contract. This information may be in the form of blueprint plans, photographs, or typewritten or printed descriptive specification, in such arrangement as the bidder may prefer.

3.26.2 *Information required.* The information contained in any plans with bids shall clearly show the following:

Outline, over-all and principal dimensions
Weights

Complete rating (voltage, frequency,
horsepower, speed, full-load current, and
locked-rotor current)

In addition, when specifically called for in the invitation for bids, the guaranteed performance, including motor efficiency and power factor at 3/4 and full rated load, shall be indicated; also 1/2 load and idling, when required.

3.27 *Finishing.* The motor enclosure shall be neatly finished and suitably protected against corrosion.

3.28 *Suitability.* In the case of motor-driven apparatus where the motor is furnished as part of a complete operating unit, the motor shall possess those particular characteristics, as specified in the invitation for bids, which render it inherently suitable for and adapted to the purpose for which it is being used; and shall, also, comply with all parts of this specification which are not in conflict with these particular requirements. The capacity of the motor shall be sufficient to safeguard it against overload when driving the specified equipment at normal output under the most unfavorable service conditions to which the equipment may be subjected.

3.29 *Identification marking.* The motor shall be marked for identification in accordance with MIL-STD-130.

3.30 *Enclosures (Navy only).* Enclosures shall conform to MIL-STD-108.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 *Supplier responsibilities for inspection.* The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirement.

4.2 *Sampling.* If any department or independent establishment requires laboratory tests in addition to the statements and certified reports referred to in 3.21.2, 3.21.3 and 4.1, one sample of each type and rating of

motor purchased shall be supplied to the testing laboratory specified by the contracting officer.

4.3 **Inspection.** Each motor shall be subjected to a thorough examination to ascertain that the material, workmanship, and design (type, degree of enclosure, lubrication, etc.) are in accordance with the requirements of this specification.

4.4 Tests.

4.4.1 **General.** Unless otherwise specified, motors selected in accordance with 4.2 shall be subjected to the tests necessary to determine compliance with the requirements of 3.24. The tests shall be conducted as specified in ASA C50.2.

4.4.2 Balance.

4.4.2.1 Place the motor on an elastic mounting so proportioned that the up and down natural frequency shall be at least as low as one fourth of the operating speed of the motor. To accomplish this, it is required that the elastic mounting be deflected downwards at least by the amounts shown below, due to the weight of the motor. When a flexible pad is used, the compression should in no case be more than one-half the original thickness of the flexible pad, otherwise, the supports may be too stiff. (The required deflection is inversely proportional to the speed squared.)

R.P.M.	Compression (inch)
900	1
1800	1/4
3600	1/16
7200	1/64

4.4.2.2 It is understood that a reliable vibration indicator will be employed.

4.4.2.3 The amplitude of vibration shall be measured at no load on the bearing housing, in any direction, with the motor running at

normal voltage and frequency, and the axis of the shaft in normal position. The motor shall be balanced with one-half a standard key in the keyway, that is, a key of full length, flush with the top of the keyway. Series and universal motors shall be checked at operating speed.

5. PREPARATION FOR DELIVERY

(For civil agency procurement, the definitions and applications of the various levels of packaging and packing protection for supplies and equipment shall be as specified in Fed. Std. No. 102).

5.1 **Preservation and packaging, level A and C.** The motors shall be preserved and packaged in accordance with level A or C of MIL-P-16298, as specified.

5.2 **Packing, level A, B, and C.** The motors shall be packed in accordance with level A, B, or C of MIL-P-16298, as specified.

5.3 Marking.

5.3.1 **Civil agencies.** Unless otherwise specified in the contract or order, shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.3.2 **Military agencies.** Interior packages and shipping containers shall be marked in accordance with MIL-STD-12.

6. NOTES

6.1 **Ordering data.** Purchasers should exercise any desired options offered herein, and procurement documents should specify the following:

- (a) Title, symbol, and date of this specification.
- (b) Type, class, and style of motor (1.2.1 and 1.2.2).
- (c) Duty (continuous, short time, etc.) (1.2.3).
- (d) Voltage and frequency ratings (3.1 and 3.2).

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- (e) Horsepower and speed ratings (3.3).
- (f) Ambient temperature of reference (3.4).
- (g) Insulation class (3.5).
- (h) Desired direction of rotation, when applicable.
- (i) Fungus-preventative treatment, if required (3.12).
- (j) Radio interference suppression, if required (3.13).
- (k) Bearing type (3.14).
- (l) Vertical thrust requirements (3.14.2.2 and 3.14.2.3).
- (m) Frame No.
- (n) Type of mounting (horizontal or vertical).
- (o) Method of mounting (feet, flange, etc.) (3.15).
- (p) Output gears, if required (3.22).
- (q) Motor characteristics, if different from those specified (3.25).
- (r) Performance guarantee, if desired (3.26.2).
- (s) Type and No. of shaft extension.
- (t) Spare parts and special tools, if any.
- (u) Minimum efficiency and power factor of the motor when source of power is small portable or semi-portable generator.
- (v) Suitability when supplied as a part of a complete operating unit (3.28).
- (w) Administrative provisions for inspection records (4.1).
- (x) Laboratory tests, if desired (4.2).
- (y) Tests, if other than specified (4.4).
- (z) Preservation, packaging, and packing levels (5.1 and 5.2).
- (aa) Special marking, if required (5.3.1).

6.2 Proper selection of apparatus. Extreme care should be used in the proper selection of apparatus in order that successful operation and good service will result. When

in doubt, the exact type of service should be specified. Where the apparatus is subjected to unusual risk, manufacturers should be consulted, especially where the apparatus is used under the following conditions.

- (a) Exposed to chemical fumes (specify chemical).
- (b) Operated in damp places.
- (c) Operated at excess speed (specify maximum if possible).
- (d) Exposed to combustible or explosive dust.
- (e) Exposed to gritty or conducting dust.
- (f) Exposed to lint.
- (g) Exposed to steam.
- (h) Operated in poorly ventilated spaces.
- (i) Operated in pits, or where entirely enclosed in boxes.
- (j) Exposed to inflammable or explosive gases or vapors.
- (k) Exposed to temperatures below 10°C.
- (l) Exposed to temperatures above 40°C.
- (m) Exposed to oil vapor.
- (n) Exposed to salt air.
- (o) Exposed to abnormal shock or vibration from external sources.
- (p) Where the departure from rated voltage or frequency is excessive (specify limits).
- (q) Exposed to liquid sprays (specify liquid).
- (r) Operated at high elevation (specify elevation).
- (s) Momentarily submerged in water.
- (t) Operated in air current, as when driving fans.

It is suggested that the text of 1.2 through 1.2.3.5 be scanned closely and the proper choice under each individual paragraph be made so that the summation of all the choices or options will give an adequate description of the desired motor.

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6.3 Transportation description. Transportation description and minimum weights applicable to this commodity are:

Rail:**Motors, Electric, NOIBN**

Carload minimum weight 30,000
pounds.

Motor:**Motors, Electric, NOI**

Truckload minimum weight 30,000

pounds, subject to Rule 115, National Motor Freight Classification.

Notice: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

TABLE I - HORSEPOWER AND SPEED RATINGS

	60-Cycle synchron- ous r.p.m.	All motors except shaded pole and perma- nent-split capacitor	Shaded- pole motors	Perma- nent-split capacitor motors	50-Cycle synchron- ous r.p.m.	All motors except shaded pole and perma- nent-split capacitor	Shaded- pole motors	Perma- nent-split capacitor motors
		Approximate full-load r.p.m.				Approximate full-load r.p.m.		
1, 1.5, 2, 3, 5, 7.5, 10, 15, 25, and 35 milli- horsepower	3600 1800 1200 900	3450 1725 1140	3000 1550 1050 800	3000 1550 1050 800	3000 1500 1000	2850 1425 950	2500 1300 875	2500 1300 875
$\frac{1}{16}$, $\frac{1}{8}$, and $\frac{1}{4}$ horse- power	3600 1800 1200 900	3450 1725 1140 850	3000 1550 1050 800	3250 1625 1075 825	3000 1500 1000	2850 1425 950	2500 1300 875	2700 1350 900
$\frac{1}{8}$, $\frac{1}{4}$, and $\frac{1}{2}$ horse- power	3600 1800 1200 900	3450 1725 1140 850	3250 1625 1075 825	3000 1500 1000	2850 1425 950	2700 1350 900
$\frac{1}{4}$ horsepower	3600 1800 1200	3450 1725 1140	3250 1625 1075	3000 1500 1000	2850 1425 950	2700 1350 900
$\frac{1}{2}$ horsepower	3600 1800	3450 1725	3250 1625	3000 1500	2850 1425	2700 1350
1 horsepower	3600	3450	..	3250	3000	2850	..	2700

MILITARY INTERESTS:

Army—E O Q Sig T

Navy—Sh Y

Air Force—SAAMA

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SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004
INSTRUCTIONS		
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).		
SPECIFICATION		
ORGANIZATION (of submitter)		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity)		DATE