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SUPERSEDING
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MILITARY SPECIFICATION

COMPRESSORS, RECIPROCATING AND ROTARY, AIR, ELECTRIC MOTOR DRIVEN

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers electric motor-driven, garage type, reciprocating and rotary air compressors.

1.2 Classification. The compressors shall be of the following types, classes, and sizes as specified (see 6.2).

Type I - Reciprocating.
Type II - Rotary.
Class 1 - Tank-mounted.
Class 3 - Caster mounted.
Class 4 - Base-mounted.
Size - 5 cfm at 175 psig.
Size - 15 cfm at 175 psig.
Size - 25 cfm at 175 psig.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: USA Belvoir Research and Development Center, ATTN: STRBE-DS, Fort Belvoir, VA 22060-5606 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 4310

SPECIFICATIONS

FEDERAL

W-C-586	- Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical: Cast Metal - for Shore Use.
CC-M-1807	- Motors, Alternating Current (Fractional and Integral Horsepower, 500 HP and Smaller).
FF-C-88	- Casters, Rigid and Swivel, Industrial, Heavy-Duty.
GG-G-91	- Gages, Tire Pressure, Self-Contained and Inflator-Gage, Pneumatic Tire.
WW-C-566	- Conduit, Metal, Flexible.

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MIL-V-173	- Varnish, Moisture-and-Fungus-Resistant (for Treatment of Communications, Electronic, and Associated Equipment).
MIL-P-514	- Plate, Identification, Instruction and Marking, Blank.
MIL-T-704	- Treatment and Painting of Materiel.
MIL-F-3541	- Fittings, Lubrication.
MIL-C-3600	- Compressors, Rotary, Power-Driven; and Compressors, Reciprocating, Power-Driven: Air and Gas (Except Oxygen and Refrigerant), Packaging of.
MIL-G-3859	- Grease Guns, Hand-Operated, Lever, Push and Screw Type.
MIL-G-10924	- Grease, Automotive and Artillery.
MIL-B-11040	- Belt, V: Drive.
MIL-S-12514	- Starters, Motor; Across-the-Line and Reduced Voltage Types, A-C Induction, 3/4 to 100 HP, Manual and Electric.
MIL-C-13486	- Cable, Special Purpose, Electrical: Low-Tension, Heavy Duty Single Conductor and Multiconductor.
MIL-G-20241	- Gasket Material, Wool Felt, Impregnated, Adhesive, Pressure-Sensitive.
MIL-G-23827	- Grease, Aircraft and Instrument, Gear and Actuator Screw.
MIL-C-46168	- Coating, Aliphatic Polyurethane, Chemical Agent Resistant.
MIL-S-81733	- Sealing and Coating Compound, Corrosion Inhibitive.

STANDARDS

FEDERAL

FED-STD-H28	- Screw-Thread Standard for Federal Services.

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MIL-STD-130	- Identification Marking of US Military Property.
MIL-STD-209	- Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment.
MIL-STD-838	- Lubrication of Military Equipment.
MIL-STD-889	- Dissimilar Metals.

HANDBOOK

MILITARY

MIL-HDBK-113	- Guide for the Selection of Lubricants, Fluids, Preservatives and Speciality Products for Use in Ground Equipment Systems.

(Copies of specifications, standards, and drawings required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Boiler and Pressure Vessel Code, Section VIII.
Performance Test Code 9 - Displacement Compressors, Vacuum Pumps and Blowers.

(Application for copies should be addressed to the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J492 - Rivets and Riveting.
SAE J833 - USA Human Physical Dimensions, Recommended Practices.

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ICS Enclosures for Industrial Controls and Systems.

(Application for copies should be addressed to the National Electrical Manufacturers Association, 155 East 44th Street, New York, NY 10017.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

B15.1 - Mechanical Power Transmission Apparatus, Safety Standard for.

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT.

Rule 442 - Usage of Solvents.

(Application for copies should be addressed to the South Coast Air Quality Management District, 9150 Flair Drive, El Monte, CA 91731)

UNDERWRITERS LABORATORIES (UL)

UL6 - Rigid Metal Conduit.
UL514 - Nonmetallic Outlet Boxes, Flush Device Boxes, and Covers.
UL1242 - Intermediate Metal Conduit.

(Appliction for copies should be addressed to the Underwriters Laboratories, 333 Pfingsten Road, Northbrook, IL 60062.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Description. The air compressor shall be of the commercial classification "garage type" and shall consist of either an air-cooled, piston compressor unit or air-oil cooled, rotary compressor unit, both types with an air reservoir, airhose and power unit.

3.2 First article. The contractor shall furnish one or more compressors for examination and test within the time frame specified (see 6.2), to prove prior to starting production that his production methods and choice of design detail will produce compressors that comply with the requirements of this

specification. Examination and tests shall be as specified in section 4; and, unless otherwise specified herein, all examination and tests shall be conducted by the contractor subject to surveillance and approval by the Government (see 6.3). When specified (see 6.2), the Government may conduct any or all of the first article examinations and tests, as specified (see 6.2).

3.3 Material. Material shall be as specified herein. Materials not specified shall be selected by the contractor and shall be subject to all provisions of this specification (see 6.9).

3.4 Material deterioration and control. The air compressor shall be fabricated from compatible materials, inherently corrosion and deterioration resistant or treated to provide protection against the various forms of corrosion and deterioration that may be encountered in any of the applicable storage and operating environments to which the air compressor may be exposed.

3.4.1 Dissimilar metals. Dissimilar metals, as defined in MIL-STD-889, shall be electrically insulated from one another to minimize or prevent galvanic corrosion. Insulation may be provided by an insulating barrier such as a corrosion inhibiting sealant conforming to MIL-S-81733 or chromate tape conforming to MIL-G-20241. Protection against corrosion could also be obtained by exclusion of the electrolyte if feasible.

3.4.2 Identification of materials and finishes. The contractor shall identify the specific material, material finish or treatment for use with components and sub-components, and shall make information available, upon request, to the contracting officer or designated representative.

3.4.3 Recovered materials. For the purpose of this requirement, recovered materials are those materials which have been collected from solid waste and reprocessed to become a source of raw materials, as distinguished from virgin raw materials. The components, pieces and parts incorporated in the air compressor may be newly fabricated from recovered materials to the maximum extent practicable, provided the air compressor produced meets all other requirements of this specification. Used, rebuilt or remanufactured components, pieces and parts shall not be incorporated in the air compressor.

3.5 Operating temperature. The compressors shall perform as specified herein in any ambient temperature from 120° F to minus 25° F.

3.6 Safety and human factors.

3.6.1 Safety. All rotating or reciprocating parts and other parts subject to high operational temperatures that are of such a nature or are so located as to be a hazard to operating personnel, shall be guarded or insulated to the extent necessary to eliminate the hazard. Protective devices shall not impair the operating functions.

3.6.2 Human factors. The characteristics of the compressor shall provide for operation by personnel ranging from the small man (5th percentile), through the

large man (95th percentile), in accordance with SAE J833, including arctic clothed personnel.

3.7 Maintainability. The compressor shall operate as specified herein without repair or maintenance other than the contractor's recommended normal scheduled adjustments and servicing, as established by a maintenance schedule prepared and submitted by the contractor prior to test. All major assemblies and installed attachments shall be accessible for maintenance repair and replacement without removal of other major assemblies and installed attachments not normally removed. Cover plates which must be removed for component adjustment shall be equipped with quick-disconnect fastenings. All fasteners shall be of corrosion-resistant material or shall be treated to be corrosion resistant. All screw threads shall be in accordance with FED-STD-H28. Maximum use shall be made of interchangeable hardware and fastening devices. Use of self-tapping screws shall not be permitted. Means for drainage of lubricants, and condensate traps shall be in an accessible location and shall drain to a container without splashing on any component or on operating personnel. The drain outlets shall be so located to facilitate complete drainage. Each maintenance, assembly or disassembly operation performed as a result of testing shall be accomplished by not more than two men using common tools and special tools furnished with the compressor.

3.8 Airhose. The airhose shall be the commercial heavy duty type 5/16 inch ID, minimum working pressure shall be no less than 200 pounds per square inch (psi) and unless otherwise specified (see 6.2) shall be not less than 50 feet long. Air hose couplings shall be internal swivel fitted, having a 1/4-inch, standard, straight-pipe thread and a 30-degree tapered seat and shall be fitted at one end with an inflator gage conforming to GG-G-91, type III.

3.9 Intake air filter and silencer. The compressors shall be provided with a dry-type combination intake air filter and silencer.

3.10 Lubrication. All surfaces requiring lubrication shall be provided with a means for lubricating.

3.10.1 Lubricants. The compressors shall operate as specified herein when lubricated with military lubricants (see 6.4).

3.10.2 Lubrication fittings. Lubrication fittings shall conform to MIL-F-3541, type I, II or III. Fittings shall be located in protected positions. Fittings shall be accessible to a grease gun conforming to MIL-G-3859, type II. Accessibility to fittings shall be provided without the removal or adjustment of accessories or parts. Panels and plates equipped with hand-operable, quick-disconnect fasteners may be removed to provide accessibility to lubrication fittings.

3.10.3 Pressure-release device. A pressure-release device shall be provided where the use of pressure lubricating equipment will damage grease seals or other parts.

3.10.4 Enclosures with integral reservoir of lubricant. Enclosures, such as gear cases and transmission housings which contain a reservoir of lubricants for the lubrication of the parts enclosed, shall be equipped with dipsticks, check plugs not less than 1/2-inch pipe size, or sight gages to determine the level of the lubricant. Each enclosure shall be equipped with a drainplug. Each enclosure shall be equipped with a means for filling the enclosure with lubricant. The drainplug shall be located so that removal of the drainplug will result in complete drainage of the lubricant from the enclosure. Drainage shall be to a container when the compressor is in its normal position. Tubes may be used to convey the lubricant from the drain to a container. Accessibility to the drainplug, the filling means, and the lubricant-level checking device shall be obtained without the removal or adjustment of accessories or parts.

3.10.5 Delivery lubrication service. When delivered, all components, except those for which preservatives are specified in 5.1, shall be lubricated. Grease lubrication, excluding lubrication of sealed bearings, shall be with greases conforming to MIL-G-10924 or MIL-G-23827. Unless otherwise specified herein, all components shall be filled to the operating level with military oils designated for use in the temperature range as specified herein. Each lubricated component shall be tagged in a conspicuous place to indicate the temperature range and grades of oils and greases used.

3.11 Fungus and moisture resistance. The electrical circuitry, including all components and connections except as specified below, shall be protected from the effects of moisture and fungus growth by an overall treatment with a varnish conforming to MIL-V-173, composition I or II as applicable, 7 percent salicylanilide (by weight) based on the nonvolatile content of the varnish:

a. Components or circuit elements that are inherently fungus and moisture resistant or which are hermetically sealed need not be treated.
b. Components or circuit elements whose functions will be adversely affected by the varnish coating shall not be treated.

When used, the varnish shall be applied by spray, brush, or a combination of both to give a minimum dry-film thickness of 1 mil to component or element surfaces previously cleaned and prepared so that the surfaces are free from all foreign matter which would interfere with the adherence or function of the varnish.

3.11.1 Composition. Composition II shall be used only in the case when local air pollution regulations in the application of varnish precludes the use of composition I. When composition II is used, the contractor shall provide evidence to the Government that the use of composition II is required, and shall certify that composition II material complies with Rule 442 - Usage of Solvents.

3.12 Identification marking. The compressor shall be identified in accordance wtih MIL-STD-130. The marking shall be applied to the compressor on identification plates conforming to MIL-P-514, type I, style 1, composition C, of type I, grade A, class 1 material. Plates shall be attached by screws, bolts or rivets in a conspicuous protected location.

3.13 Instruction plates. Each compressor shall be equipped with instruction plates or diagrams, including warnings and cautions, describing any special or important procedures to be followed in assembling, operating or servicing the compressor. Instruction plates shall conform to MIL-P-514, type III, composition C, of type I, grade A, class 1 material. Plates shall be attached by screws, bolts or rivets in a conspicuous protected location.

3.14 Treatment and painting. The compressor, components, and parts painted in commercial practice shall be cleaned, treated and painted in accordance with MIL-T-704, type F, or G as applicable. Unless otherwise specified (see 6.2), top coat color shall be camouflage green 383 conforming to MIL-C-46168.

3.15 Type I, reciprocating.

3.15.1 Compressor. The type I compressor shall deliver the capacities of free air (see 6.5) specified in table I at a pressure of 175 pounds per square inch gage, (psig) as determined by the ASME Performance Test Code 9 - Displacement Compressors, Vacuum Pumps, and Blowers. The components of the compressor shall be balanced so that when the compressor is operated in conjunction with the electric motor, vibration shall be minimized. The compressor shall produce rated capacity at rated pressure for 500 hours in operating periods of not less than 4 hours. Operating periods of not less than 4 hours (see 4.6.2.4), during high and low temperature tests may be counted (see 4.6.2.5 and 4.6.2.6). The compressor shall not exceed the contractor's recommended continuous operating speed. The compressor shall be air cooled. The cylinder heads or cylinder assembly (if cast integrally) shall be removable. The intake and exhaust valves shall be removable. A fan shall be provided for cooling.

TABLE I. Compressor characteristics.

Size	Minimum capacity (free air)	Maximum operating pressure	Rated discharge pressure
(cfm)*	(cfm)	(psig)	(psig)
5	5	200	175
15	15	200	175
25	25	200	175

* cfm - cubic feet per minute.

3.15.2 Intercooler and aftercooler. When a multiple-stage compressor is furnished, an intercooler shall cool the air between the pressure stages and shall be located so as to be cooled by the airblast from the fan. A spring-loaded-type, pressure-relief valve shall be installed between the pressure stages to protect the low-pressure cylinder in case of failure of the high-pressure cylinder valves. The temperature measured at the discharge of the air receiver shall not exceed ambient plus 100° F at a pressure of 200 psig. If necessary to meet the temperature requirements specified herein, an aftercooler may be provided between the last stage of the compressor and the air receiver tank. Aftercoolers shall be air cooled.

3.15.3 Pressure tubing and fittings. All pressure tubing and fittings shall be rated to withstand 1-1/2 times their normal working pressure.

3.15.4 Drive. The drive shall consist of matched multiple V-belts and grooved pulleys on the power unit and compressor unit. All drive belts shall conform to MIL-B-11040. A means for belt removal and adjustment shall be provided.

3.16 Type II, rotary.

3.16.1 Compressor. The type II compressor shall deliver the capacities of free air specified in table I at a pressure of 175 psig as determined by the ASME Performance Test Code 9 - Displacement Compressors, Vacuum Pumps, and Blowers. The components of the compressor shall be balanced so that when the compressor is operating in conjunction with the electric motor, vibration shall be minimized. The compressor shall produce rated capacity at rated pressure for 500 hours in operating periods of not less than 4 hours (see 4.6.2.4). Operating periods of not less than 4 hours during high and low temperature tests may be counted (see 4.6.2.5 and 4.6.2.6). The compressor shall not exceed the contractor's recommended continuous operating speed. The compressor unit shall be positive displacement and air cooled. A means shall be provided to remove and recover the oil from the discharge air. When a filter-type separator is used, it shall be accessible for examination, cleaning and replacement without removal of other parts or components. To prevent hydraulic lock upon starting, a means shall be provided in the stator assembly to allow accumulated oil to pass into the sump. The rotors, stators, and blades for any one size compressor shall be inter- changeable among all compressors of that type, class and size furnished by that manufacturer. A pressure gage shall be provided between the compressor unit and the separator discharge to indicate the pressure in the compressor. A nonreturn valve shall be provided either in the oil separator or in the discharge from the separator to prevent reverse flow of air from the receiver.

3.16.2 Pressure tubing and fittings. All pressure tubing and fittings shall be rated to withstand 1-1/2 times their normal working pressure.

3.16.3 Drive. The type II compressor shall be either direct drive or multiple V-belt drive. The multiple V-belt drive shall conform to 3.15.4. When a direct drive is used, a flexible coupling shall be installed between the power unit and compressor unit. The mounting base for the power unit shall have a means for belt removal and adjustment when V-belt drive is used.

3.17 Class 1, tank-mounted. The compressor unit and power unit shall be mounted on a base attached to the air-receiver tank.

3.17.1 Air-receiver tank. The air-receiver tank for the class 1 compressor shall be of the horizontal type and shall be constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII. The receiver shall bear the ASME stamp and no welding or other actions shall be permitted after the receiver has been certified. Unless otherwise specified (see 6.2), the capacity of the

air-receiver tanks for the 5-cfm shall be not less than 20 gallons and for the 15-cfm and 25-cfm compressors shall be not less than 80 gallons. Unless otherwise specified (see 6.2), the air-receiver tank fittings shall include a globe discharge valve, a drain cock and a 0-psig to not less than 250-psig pressure gage having 10 psig or smaller increments. The air-receiver tanks shall include a pressure relief valve conforming to ASME Boiler and Pressure Vessel Code. The receiver shall be provided with a steel base of not less than four mounting feet for horizontal mounting. When equipped with a steel base, openings shall be provided to permit insertion of forklift tines. Each opening shall be not less than 11 inches by 3 inches in size; openings shall be located such that the center of gravity of the compressor falls between the centers of forklift openings. A means shall be provided on the receiver for securing the airhose.

3.18 Class 3, caster-mounted. The compressor unit and power unit shall be mounted on a steel base attached to a horizontal-type, air-receiver tank. The air-receiver shall be constructed as specified in 3.17, except the tank shall be mounted on four casters conforming to FF-C-88. Two type II (swivel) casters shall be mounted on the compressor end, and two type I (nonswivel) casters shall be mounted on the motor end.

3.18.1 Caster installation. The casters shall be mounted so that the compressor will not overturn when pushed or pulled about on a horizontal surface or when tilted 15 degrees from the horizontal in any direction. The casters shall be attached to steel mounts on the bottom side of the receiver tank and located near each end of the tank. The distance between the centerline of the casters (measured side to side) shall be not less than 6 inches greater than the maximum diameter of the air-receiver tank.

3.18.2 Handle and storage rack. The class 3 compressor shall be equipped with a combination handle and storage rack. The handle and storage rack shall be removable, and similar to that shown on figure 1 (see 6.6). The handle shall be positioned not less than 30 inches and not more than 40 inches from the floor. The storage rack shall hold the airhose specified in 3.8 and 50 feet of No. 10 AWG, type SO, 3-conductor cable. The storage rack shall be located so that neither hose nor cable, when stored on the rack, will contact any component of the compressor subject to high temperatures.

3.18.3 Tilt requirement. The compressor shall deliver rated capacity when operated at rated speed and pressure, tilted 15 degrees from the horizontal in any plane.

3.19 Class 4, base mounted. The compressor unit and power unit shall be mounted on a base attached to a horizontal-type air-receiver tank. The air-receiver tank shall be constructed as specified in 3.17.

3.19.1 Toolbox. A toolbox made of No. 14 gage sheet steel shall be furnished with the lid edges formed to overlap the top edges of the box to prevent the entry of dirt, snow, and rain. The toolbox shall be of sufficient size to hold the canvas cover, all maintenance tools, inflator gage and publications.

3.19.2 Lifting attachments. The base-mounted 15-cfm compressor shall be equipped with permanently affixed lifting attachments conforming to MIL-STD-209 that will enable the compressor to be lifted in its normal travel position.

3.20 Electric-motors. Motor wiring and control systems shall conform to the provisions of American National Standards Institute (ANSI) Standard B15.1.

3.20.1 Electric motor. Unless otherwise specified (see 6.2), each compressor shall be driven by a style A2 (dripproof) electric motor conforming to CC-M-1807. The electric motor shall have the continuous horsepower rating as specified in table II. The horsepower required by the compressor when performing at 200 psig shall be not more than the continuous horsepower rating, including the service factor, of the motor. The motor shall have all electrical equipment connected for operating on a power supply having the characteristics as specified (see 6.2).

TABLE II. Electric motor ratings.

Compressor size (cfm)	Minimum horsepower rating (hp)
5	2.0
15	5.0
25	10.0

3.20.2 Starter. A starter shall be furnished conforming to MIL-S-12514, type I, class 2, and shall be provided with a NEMA type 12 (dripproof) and dust tight enclosure. The class 2 starter shall be magnetically operated by a pressure switch. The starter shall be reset by an externally operable switch mounted in motor starter enclosure. The maintained contact stop-start switch and reset shall be located in an accessible location.

3.20.2.1 Low-voltage protection. A low-voltage protective device shall be provided to open all ungrounded line conductors whenever voltage fails or drops below a predetermined level or after the operation of the overload protective device. After the operation of the overload protective device, the reset switch shall require actuation before the motor can be restarted. The overload protective device shall be removable and replaceable. The holding coil may be regarded as the low-voltage protective device. Certification shall be provided demonstrating conformance to this requirement. Certification shall be made available for review by the contracting officer or contracting officer's representative.

3.20.3 Conduit. Wiring shall be installed in conduit conforming to WW-C-566, UL6, UL514, or UL1242, as applicable. Conduit outlets shall conform to W-C-586.

3.20.4 Pressure regulation. Each compressor shall have an adjustable, pressure-actuated electric control. The control shall be adjusted to stop the motor when the pressure has risen to 200 psig, plus 0 psig, minus 10 psig, and

to start the motor when the pressure has dropped to 175 psig, plus or minus 10 psig. A device shall be provided to protect the motor from starting against tank pressure.

3.20.5 Electrical conductive casters. Class 3, compressor shall be provided with electrical conductive casters.

3.20.6 Wiring. The cable for wiring the electrical system shall be in accordance with MIL-C-13486, low-temperature (minus 25° F), type and size as applicable. The wires shall be enclosed in a loom and clamped neatly to the structural members.

3.21 Pulley, 5-cfm compressors. When a V-belt drive is used, the drive pulley shall be provided with an inner hub which clamps to the shaft by moving axially along a taper in the outer hub. The mechanical clamping shall be accomplished by the use of a screw member or members for mounting and removal of the pulley.

3.22 Interchangeability. All parts having the same part number shall be functionally and dimensionally interchangeable. Interchangeable parts are defined as two or more parts possessing such functional and physical characteristics as to be equivalent in performance and durability and capable of being exchanged one for the other without alteration of the parts themselves or of adjoining parts, except for adjustment, and without selection for fit or performance.

3.23 Workmanship. All parts, components and assemblies of the compressor including castings, forgings, molded parts, stampings, bearings, seals, machined surfaces, and welded parts shall be clean and free from sand, dirt, fins, pits, sprues, scales, or any damaging extraneous material. The compressor shall be free of any defect that could impair its operation and serviceability.

3.23.1 Fabrication. Steel and aluminum used in the fabrication of the compressors shall provide original quality surface finish and shall be free from kinks and sharp bends. The forming of the material shall be done by methods that will not cause damage to the metal. Shearing and chipping shall be done neatly and accurately. Corners shall be square and true, and sharp edges and burrs shall be removed. Flame-cutting may be employed instead of shearing and sawing. Burned surfaces of flame-cut material shall be ground or machined sufficiently to remove ash and cooling checks. Precautions shall be taken to avoid overheating, and heated metals should be allowed to cool slowly. All bends of a major character shall be made with metal dies or fixtures to insure uniformity of size and shape.

3.23.2 Welding. The surfaces of parts being welded shall be free of scale, paint, grease, and other foreign matter. Welds shall transmit stress without permanent deformation or failure when the parts connected by the welds are subjected to proof and service loading.

3.23.3 Bolted connections. All boltholes shall be accurately punched or drilled and shall have the burrs removed. Washers or lockwashers shall be

provided where necessary. All bolts, nuts, and screws shall be correctly torqued and shall have full thread engagement. Matching thread areas securing bolts or capscrews shall be of sufficient strength to withstand the tensile strength of the bolt.

3.23.4 Riveted connections. Rivets shall fill the holes completely. The upset rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member and shall be in accordance with SAE J492.

3.23.5 Machine work. Tolerances and gages for metal fits shall conform to the limitations specified herein.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Component and material inspection. The contractor is responsible for insuring that components and materials used are manufactured, examined and tested in accordance with referenced specifications and standards.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.3).
b. Quality conformance inspection (see 4.4).
c. Inspection comparison (see 4.7).
d. Inspection of packaging (see 4.8).

4.3 First article inspection.

4.3.1 Examination. The first article compressor shall be examined as specified in 4.6.1. Presence of one or more defects shall be cause for rejection.

4.3.2 Tests. The first article compressor shall be tested as specified in 4.6.2.1 through 4.6.2.12 as applicable for the class compressor to be furnished. Failure of any test shall be cause for rejection. A first article test log (see figure 2) shall be furnished.

4.4 Quality conformance inspection.

4.4.1 Examination. Each compressor shall be examined in accordance with 4.6.1.

4.5 Tests.

4.5.1 Individual. Each compressor shall be tested as specified in 4.6.2.12. Failure of a test shall be cause for rejection.

4.6 Inspection procedure.

4.6.1 Examination. The compressor shall be examined for the following defects:

Major

101. Material not as specified (see 3.3).
102. Materials not resistant to corrosion and deterioration or treated to be made resistant to corrosion and deterioration (see 3.4).
103. Dissimilar metals not in accordance with MIL-STD-889 (see 3.4.1).
104. Material and material finish or treatment information not available (see 3.4.2).
105. Used, rebuilt or remanufactured components, pieces, or parts incorporated in the compressor (see 3.4.3).
106. Safety devices or guards missing or not as specified (see 3.6.1).
107. Human factors not as specified (see 3.6.2).
108. Maintainability not as specified (see 3.7).
109. Airhose not as specified (see 3.8).
110. Intake air filter and silencer not as specified (see 3.9).
111. Lubrication not as specified (see 3.10).
112. Lubricants not as specified (see 3.10.1).
113. Lubrication fittings not as specified (see 3.10.2).
114. Pressure-release device not as specified (see 3.10.3).
115. Enclosures with integral reservoir of lubricant not as specified (see 3.10.4).
116. Delivery lubrication service not as specified (see 3.10.5).
117. Fungus and moisture resistance not as specified (see 3.11).
118. Composition not as specified (see 3.11.1).
119. Identification marking not as specified (see 3.12).
120. Instruction plates not as specified (see 3.13).
121. Treatment and painting not as specified (see 3.14).
122. Color not as specified (see 3.14).
123. V-belts and pulleys not as specified (see 3.15.4 and 3.16.3).
124. Handle and storage rack not as specified (see 3.18.2).
125. Toolbox not as specified (see 3.19.1).
126. Base-mounted compressor not as specified (see 3.19).
127. Electric motor not as specified (see 3.20.1).
128. Starter not as specified (see 3.20.2).
129. Low-voltage protection not as specified (see 3.20.2.1).
130. Conduit not as specified (see 3.20.3).
131. Wiring not as specified (see 3.20.6).

132. Pulley, 5-cfm compressors not as specified (see 3.21).
133. Interchangeability not as specified (see 3.22).
134. Workmanship not as specified (see 3.23).
135. Fabrication not as specified (see 3.23.1).
136. Welding not as specified (see 3.23.2).
137. Bolted connections not as specified (see 3.23.3).
138. Riveted connections not as specified (see 3.23.4).
139. Machine work not as specified (see 3.23.5).
140. Electrical conductive casters not as specified (see 3.20.5).

4.6.2 Tests.

4.6.2.1 Test conditions. The compressor shall operate as specified herein without maintenance other than the contractor's recommended normal scheduled maintenance as established by a maintenance schedule prepared and submitted by the contractor prior to test. The compressor shall be lubricated with military oils and greases. A first article test log similar to figure 2 shall be furnished tabulating all appropriate test data and observations. Safety and human factor considerations shall be evaluated throughout testing.

4.6.2.2 Air-receiver tank. The air-receiver tank for the compressor shall be tested in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII. Failure of any ASME tests shall constitute failure of this test. Presence of the ASME official code U-symbol stamped or marked on the receiver and the furnishing of a copy of the ASME data sheet (Form U-1) may be accepted as evidence that the receiver conforms to the ASME Boiler and Pressure Vessel Code.

4.6.2.3 Capacity and performance. The compressor capacity shall be determined in accordance with the method specified in the ASME Performance Test Code 9 - Displacement Compressors, Vacuum Pumps, and Blowers. This test shall be performed in conjunction with and simultaneously with the endurance test (see 4.6.2.4). The air-discharge temperature shall be determined when the compressor is operating at minimum capacity at maximum discharge pressure. Any one of the following conditions shall constitute failure of this test:

a. Discharge air pressure less than 175 psig.
b. Discharge air temperature in excess of ambient plus 100° F.
c. Free-air capacity less than that specified in table II.

4.6.2.3.1 Power consumption. Test unit at rated speed and while delivering its rated capacity for power consumption, using a calibrated motor or dynamometer. Horsepower in excess of the continuous horsepower rating of the motor shall constitute failure of this test.

4.6.2.4 Endurance. Operate the compressor for not less than 500 hours continually in periods of not less than 4 hours of running time. Oil changes and other preventive maintenance shall be performed during downtime. There shall be no replacement of parts. Adjustments provided by integral devices and repairs which require 1 man-hour or less may be made. The 500 hours of operation

shall be accomplished at rated capacity and pressure. Record appropriate remarks, including a record of all stops and adjustments. Record the following data at least once during each 24 hour period. Readings shall be taken only after at least 1 hour of continuous operation:

a. Air temperature, ambient.
b. Air temperature at receiver discharge.
c. Air receiver pressure.
d. Barometric pressure.
e. Air temperature at compressor intake.
f. Air temperature upstream of nozzle.
g. Air pressure at compressor intake.
h. Nozzle throat diameter.
i. Nozzle coefficient of discharge.
j. Differential pressure across the nozzle.
k. Compressor unit speed (rpm).
l. Compressor capacity (cfm) computed.

Completion of less than 500 hours of operation at rated capacity and pressure, discharge air temperature in excess of ambient plus 100° F, requirement for replacement of parts, requirement for repairs requiring more than 1 man-hour to complete, or necessity for adjustment not provided for by integral devices shall constitute failure of this test. Computed CFM capacity less than specified shall constitute failure of this test (see 3.15.1 and 3.16.1).

4.6.2.5 High temperature. Unless otherwise specified, subject the compressor to an ambient temperature of 120° F plus or minus 5° F until all components have stabilized at this temperature in the test chamber. Then start and operate the compressor at rated capacity and pressure for not less than 4 hours while maintaining 120° F plus or minus 5° F ambient temperature. The operating time for this test may be counted toward the accomplishment of the endurance test. Record the data as specified in 4.6.2.4 at 30-minute intervals. Failure to start and operate at rated capacity, pressure and speed, discharge air temperature in excess of ambient plus 100° F or requirement for replacement of parts shall constitute failure of this test.

4.6.2.6 Low temperature. Unless otherwise specified, subject the compressor to an ambient temperature of minus 25° F plus or minus 5° F until all components have stablized at this temperature in the test chamber. Then start and operate the compressor at rated capacity, pressure and speed for not less than 4 hours while maintaining minus 25° F plus or minus 5° F ambient temperature. The operating time for this test may be counted toward the accomplishment of the endurance test. Record the data as specified in 4.6.2.4 at 30-minute intervals. Failure to start and operate at rated capacity, pressure and speed, or requirement for replacement of parts shall constitute failure of this test.

4.6.2.7 Cycling. Start the compressor and allow the receiver pressure to build up until the pressure-regulation control operates. Then reduce the receiver pressure until the pressure-regulation control activates to increase the pressure. Vary the pressure as above until a total of 20 high-pressure actuations and 20 low-pressure actuations have been reached. Inability of the

pressure-regulation control to control the pressure as specified shall constitute failure of this test.

4.6.2.8 Pressure regulation. When an adjustable pressure-regulating valve of the pressure-relief type actuated by receiver pressure is used at the beginning and after completion of the endurance test, start the compressor and allow the receiver pressure to build up to determine pressure required to discharge full capacity through the pressure-regulating valve. Then reduce the receiver pressure to determine the pressure at which the pressure-regulating valve reseats. Inability to meet the requirements specified in 3.20.4 shall constitute failure of this test.

4.6.2.9 Class 3.

4.6.2.9.1 Casters. Push and pull the compressor horizontally in all directions, turn the compressor 360 degrees, and tilt the compressor 15 degrees from the horizontal in all directions. Overturning or any condition that interferes with the maneuverability of the compressor or physical damage to the compressor shall constitute failure of this test.

4.6.2.10 Tilted operation. Tilt the compressor 15 degrees from the horizontal about the longitudinal axis and operate in this position for 30 minutes. This test shall be performed in each of the four directions (compressor tilted with respect to longitudinal and transverse axes). Allow the compressor to stand for 4 hours in the tilted position most likely to adversely affect the lubrication then start and operate the compressor for 30 minutes in that position. Any malfunction due to tilted operation such as lack of lubrication, rough or erratic operation, or permanent deformation of any part or component shall constitute failure of this test.

4.6.2.11 Class 4.

4.6.2.11.1 Lifting attachment. Lift class 4, size 15-cfm compressor in its normal travel position using only the permanently affixed lifting attachments. Determine the force and angle of application for each attachment and the clearance between each sling and the compressor. Then anchor the compressor and subject each attachment to a load equal to 2-1/2 times the load determined above and applied at the angle determined above. Apply each load for not less than 90 seconds. Weld failure or permanent deformation of the lifting attachments or structural members shall constutute failure of this test.

4.6.2.12 Capacity. Test each compressor for capacity in accordance with 4.6.2.3 except that each compressor shall be tested as a unit driven by its electric motor. Prior to testing, run-in each compressor as prescribed by the contractor. Occurrence of one or more of the following conditions shall constitute failure of this test:

a. Discharge air pressure less than 200 psig.
b. Discharge air temperature in excess of ambient temperature plus 100° F.
c. Free-air capacity less than that specified in table I.

4.7 Inspection comparison. The Government may select compressors at any time during the contract production period and subject these compressors to the examination specified in 4.6.1 and the tests specified to determine conformance to the requirements of this specification. The inspection will be performed by the Government, at a site selected by the Government, on units selected at random from those which have been accepted by the Government and will not include the previously inspected first article compressors. In addition to any test specified as part of the inspection comparison, the Government reserves the right to conduct any and all other tests contained in this specification as part of the inspection comparison, and failure of such additional tests shall have the same effect as failure of those tests specified as inspection comparison.

4.7.1 Inspection failure. Failure of an inspection comparison compressor to meet any requirement specified herein during and as a result of the examination and tests specified in 4.7 shall be cause for rejection of the inspection comparison compressor(s) and shall be cause for refusal by the Government to continue acceptance of production compressors until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiencies. Correction of such deficiencies shall be accomplished by the contractor at no cost to the Government on compressors previously accepted and produced under the contract. Any deficiencies found as a result of the inspection comparison will be considered prima facie evidence that all compressors accepted prior to the completion of inspection comparison are similarly deficient unless evidence to the contrary is furnished by the contractor and such evidence is acceptable to the contracting officer.

4.8 Inspection of packaging. The preservation, packing, and marking shall be examined and tested to determine compliance with the quality assurance provisions of MIL-C-3600.

5. PACKAGING

5.1 Preservation, packing, and marking. The air compressors, accessories, repair parts, tools, and publications shall be preserved, packed, and marked in accordance with MIL-C-3600. The level of preservation and the level of packing shall be level A, B or commercial as specified (see 6.2).

6. NOTES

6.1 Intended use. The compressors are intended for use as a source of compressed air in the normal operations conducted at filling stations and vehicle maintenance shops.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.
b. Type, class, and size required (see 1.2).
c. Time frame required for submission of first article model and number of compressors to be furnished (see 3.2).

d. When the Government will conduct any or all of the first article examination and tests. When the Government will conduct some but not all of the first article examination and tests, the contracting officer should specify which examination and tests will be conducted by the Government and which examination and tests shall be conducted by the contractor (see 3.2).
e. Length of airhose to be furnished if other than as specified (see 3.8).
f. Color required (see 3.14).
g. Capacity of air-receiver tank if other than as specified (see 3.17.1).
h. Air-receiver tank fittings required if other than as specified (see 3.17.1).
i. Style of motor if other than that specified in 3.20.1.
j. Power supply on which electric motors will operate (see 3.20.1). (Dual-voltage motors may be furnished but only one of the voltages shall be specified for the motor on the compressor).
k. Degree of preservation and packing required (see 5.1).

6.3 First article inspection. When a first article inspection is required, the items should be a preproduction model. The first article should consist of one or more units. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, tests and approval of the first article test results and disposition of the document's first article.

6.3.1 First article. Any changes or deviations of production compressors from the approved first article model during production will be subject to the approval of the contracting officer. Approval of the first article model will not relieve the contractor of his obligation to furnish compressors conforming to this specification. The contractor should provide a written report to the contracting officer covering all deficiencies, malfunctions, and test failures. This report shall be presented within 48 hours from the time of failure and should describe components and parts affected, both directly and indirectly; corrective action taken or to be taken by the contractor, and the contractor's proposed method of proving the adequacy of the corrective action.

6.4 Lubricants. Selection of lubricants, fluids, and greases shall be in accordance with section 5 of MIL-STD-838. Unless otherwise authorized by the US Army Belvoir Research and Development Center, lubricants, fluids and greases for ground equipment systems shall be restricted to those listed under chapter 2 of MIL-HDBK-113.

6.5 Free air. Free air is defined as air at atmospheric conditions surrounding the compressor, at the point where the compressor is installed, but not in the immediate vicinity where it may be affected by the heat of the compressor.

6.6 Information figures. Figure 1 shows a caster-mounted compressor, which has been found acceptable; however, the figure is included for illustration only and is not intended to preclude the furnishing of other designs which conform to this specification.

6.7 Data requirements. The contracting officer should include requirements for such data as technical publications, instructional materials, illustrated parts lists, and contractor's maintenance and operation manual to be furnished with each compressor.

6.8 Provisioning. The contracting officer should include provisioning requirements for repair parts and maintenance tools as necessary (including any special tools), and instructions on shipment of compressors. A suggested paragraph is as follows:

> "Shipment of compressors shall include repair parts, maintenance tools, operational instructions, and accessories, unless exceptions are provided elsewhere in the contract."

6.9 Recycled material. It is encouraged that recycled material be used when practical as long as it meets the requirements of the specification (see 3.3).

Custodians:
Army - ME
Navy - YD

Review activity:
DLA-CS

User activity:
Navy - MC

Preparing activity:
Army - ME

Project 4310-0168

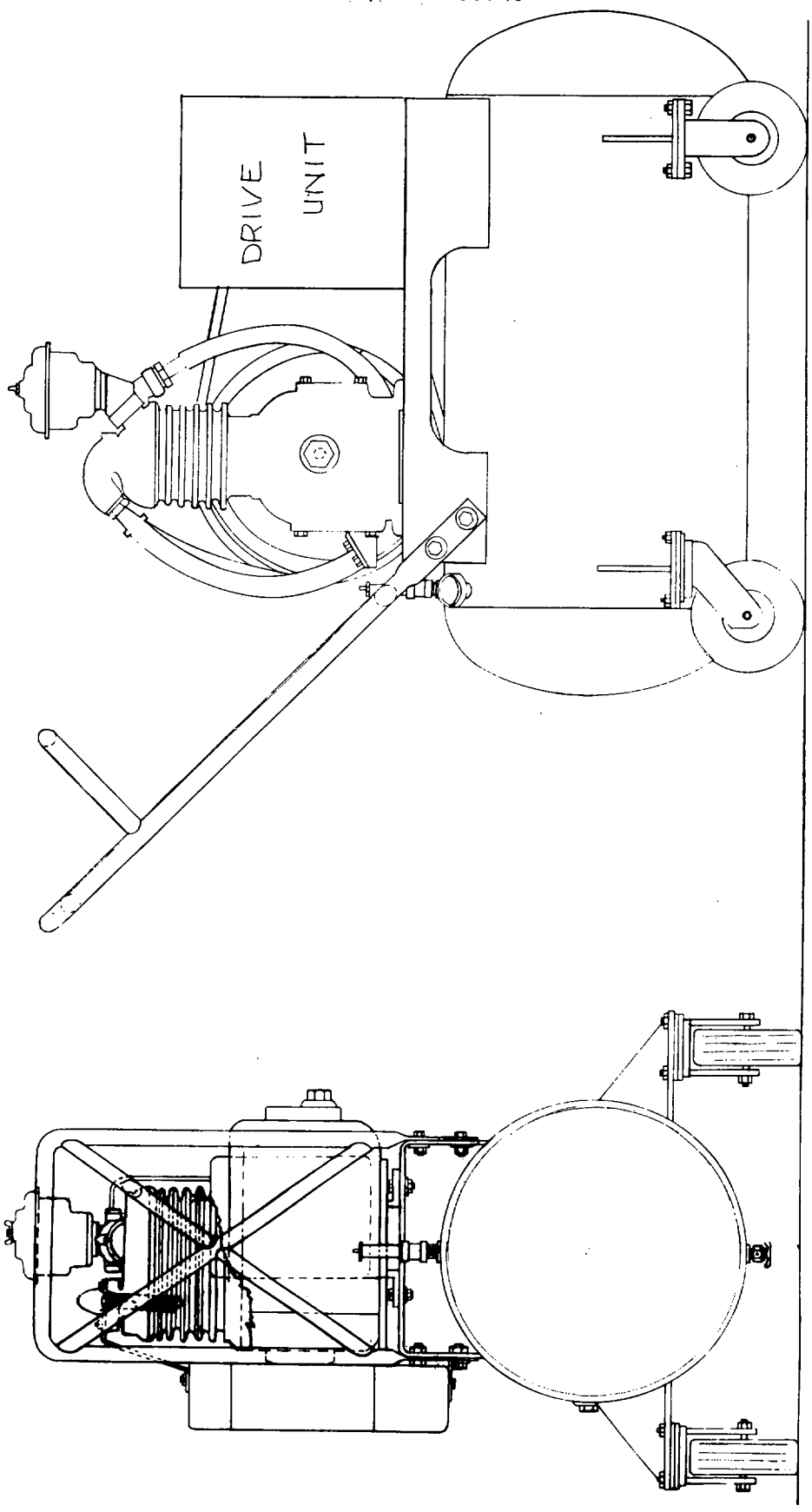

FIGURE 1. Compressor, air, caster mounted (general configuration). X-3726

DATA SHEET
MFG NAME_____ P/N_____ Record Time & Amount of 1. Engine Oil Added 2. Compressor Oil Added Sheet__of__

Test Title:_____ Run No._____ Date_____

	Item	SYM	UNITS	Readings 1	2	3	4	5	6	7	8	9	10	...	...		
1.	Time Start, Readings, Stop	R_t	HRS. MIN.	(IF STOP IS UNSCHEDULED GIVE REASON FOR STOP AND DOWN TIME)													
2.	Temp. (Ambient) Dry Bulb	T_a	°F														
3.	Temp. (Wet Bulb)	Twb	°F														
4.	Pressure (Ambient)	P_b	In. Hg														
5.	Temp., Compressor Lubricant	T_L	°F														
6.	Temp., Receiver Discharge	T_r	°F														
7.	Pressure, Rec.	T_r	PSIG														
8.	Pressure, Compressor Intake	P_a	PSIA														
9.	Temp., Compressor Intake	T_1	°F														
10.	Temp., Upstream of Nozzle	T_2	°F														
11.	Pres. Differential Across Nozzle	ΔP	$In.H_2O$														
12.	Comp. Speed	N	RPM														

FIGURE 2. Preproduction test log.

X-1904 A