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MILITARY SPECIFICATION

COMPRESSORS, AIR, RECIPROCATING AND ROTARY,

DIESEL ENGINE 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 skid-mounted, and trailer-mounted, diesel-engine-driven reciprocating and rotary air compressors.

1.2 Classification. The air compressors shall be of the following types, classes, and sizes (rated capacity):

Type I - Reciprocating

Type II - Rotary

Class 1 - Skid-mounted

Class 2 - Trailer-mounted, pneumatic-tired

Size - 125 cfm at 100 psig

Size - 250 cfm at 100 psig

Class and size shall be as specified (see 6.2). The type shall be at the option of the contractor.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified (see 6.2), 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: US Army Mobility Equipment Research and Development Command, ATTN: DRDME-DS, Fort Belvoir, VA 22060 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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SPECIFICATIONS

FEDERAL

O-A-548
VV-F-800
WW-C-633

- Anti-Freeze, Ethylene Glycol, Inhibited.
- Fuel Oil, Diesel.
- Couplings, Hose, (Half), Pneumatic, Universal Type.

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MIL-V-173

- Varnish, Moisture-and-Fungus-Resistant (For Treatment of Communications, Electronic, and Associated Equipment).

MIL-P-514

- Plates, Identification, Instruction and Marking, Blank.

MIL-T-704

- Treatment and Painting of Materiel.

MIL-L-2104

- Lubricating Oil, Internal Combustion Engine.

MIL-C-3600

- Compressor, Rotary, Power-Driven; and Compressor, Reciprocating, Power-Driven: Air and Gas (Except Oxygen and Refrigerant), Packaging of.

MIL-G-3859

- Grease Guns, Hand, High Pressure, Lever-Operated; Cartridge and Bulk Loading (14 Ounce and 21 Ounce Capacity).

MIL-G-10924

- Grease, Automotive and Artillery.

MIL-H-17672

- Hydraulic Fluid, Petroleum, Inhibited.

MIL-G-23827

- Grease, Aircraft and Instrument, Gear and Actuator Screw.

MIL-C-45150

- Chassis, Trailer, 2-Wheel Cart Type, 1/4 to 3-1/2 Ton.

MIL-L-46167

- Lubricating Oil, Internal Combustion Engine, Arctic.

MIL-A-52363

- Air Cleaners, Intake: Dry-Type (for Internal-Combustion Engine).

MIL-C-52437

- Chassis Trailer Single and Multi-Axle.

MIL-E-52649

- Engine Cold Starting Aids, Ether Fuel Primers.

STANDARDS

FEDERAL

FED-STD-H28

- Screw Thread Standards.

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MIL-STD-130

- Identification Marking of US Military Property.

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MIL-STD-461	- Electromagnetic Interference Characteristics Requirements for Equipment.
MIL-STD-642	- Identification Marking of Combat and Tactical Transport Vehicles.
MIL-STD-814	- Requirements for Tiedown, Suspension and Extraction Provisions on Military Materiel for Airdrop.
MIL-STD-1400	- Engines, Gasoline or Diesel, Methods of Test.
MIL-STD-1410	- Methods for Selection of Industrial Engines for End Item Application.
MS3 5000	- Battery, Storage, Lead-Acid, Waterproof.
MS35341	- Filter, Fluid, Pressure: Oil, Heavy Duty, By-Pass Type, Senior Size (Non-Base Mounted).
MS35342	- Filter, Fluid, Pressure: Oil, Heavy Duty, By-Pass Type, Senior Size (Base Mounted).
MS35343	- Filter, Fluid, Pressure: Oil, Heavy Duty By-Pass Type, Junior Size.
MS35802	- Filter Elements, Fluid, Pressure-Oil, Full-Flow.
MS35829	- Hinge, Continuous (Piano), .075 Thickness, .187 and .250 Pin Dia.
MS35840	- Cap, Radiator; Pressure, (7 PSI), 2-1/2 Inch, Assembly.
MS35844	- Plug, Machine Thread, Magnetic: Drain.
MS3 9254	- Cartridge, Engine Starting (Engine Cold-Starting Aid).
MS4 9006	- Plug, Pipe, Magnetic-Headless; Aluminum, Iron or Steel.
MS51062	- Cap, Radiator, Pressure (7 PSI), Assembly.
MS51389	- Rain Cap, for Air Cleaner Intake for Industrial Engines.
MS53063	- Indicator, Air Cleaner, Intake Restriction Mechanical Type.
MS75058	- Connector, Receptacle, Electrical-Slave, 2 Contact, 24 Volt, Waterproof.

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

2.1.2 Other Government documents, drawings, and publications. The following other Government documents form a part of this specification to the extent specified herein.

DRAWINGS

MARINE CORPS

5060	- Sling, Multiple Leg, Assembly, 5-Ton.
5103	- Standard Wiring Systems for Diesel Powered Industrial Equipment.
5104	- Standard Instrument Panel.

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2.1.3 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.

2.2 Other publications. The following documents 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, Unfired Pressure Vessels.
Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.
Performance Test Code - Displacement Compressors, Vacuum Pumps and Blowers, PTC9.

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

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1, Structural Welding Code.

(Application for copies should be addressed to the American Welding Society, Inc., 2501 North West Seventh Street, Miami, FL 33125.)

ENVIRONMENTAL PROTECTION AGENCY

Title 40, CFR, Part 204, Subpart B - Noise Emission Standards for Construction Equipment.

(Application for copies should be addressed to the Public Affairs Office, Environmental Protection Agency, Rockville, MD 20852.)

SOCIETY OF AUTOMATIVE ENGINEERS (SAE)

SAE Handbook

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15086.)

3. REQUIREMENTS

3.1 Description. The air compressor shall consist of a diesel engine, a compressing unit, safety equipment, a housing, a receiver, cooling and regulating systems and related piping, gages, instruments and controls, assembled on either a single unified steel sub-base skid frame or a trailer.

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3.2 Drawings. The drawings forming a part of this specification are end product drawings. No deviation from the prescribed dimensions or tolerances is permissible without prior approval of the contracting officer. Where tolerances could cumulatively result in incorrect fits, the contractor shall provide tolerances within those prescribed on the drawings to insure correct fit, assembly and operation of the compressor. Any data (e.g., shop drawings, layouts, flow sheets, processing procedures, etc.) prepared by the contractor or obtained from a vendor to support fabrication and manufacture of the production item shall be made available, upon request, for inspection by the contracting officer or his designated representative.

3.3 First article (preproduction model). The contractor shall furnish one or more compressors as specified (see 6.2), for examination and testing within the time frame specified (see 6.2), to prove prior to starting production that his production methods 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 will conduct any or all of the preproduction examination and tests, as specified (see 6.2).

3.4 Material. Material shall be as specified herein and, when applicable, as shown on the applicable drawings. Materials not specified shall be selected by the contractor and shall be subject to all provisions of this specification (see 6.11).

3.4.1 Corrosion-resisting treatment. Unless otherwise specified herein, corrosion-resisting treatment shall consist of galvanizing or electrodepositing of cadmium, chromium, copper, or nickel.

3.4.2 Dissimilar metals. Nonpermissible galvanic couples (dissimilar metals) as defined in MIL-T-704 shall be insulated from each other by a coat of chromate primer, zinc-chromate tape, electrical tape, or other equally effective means.

3.5 Environmental requirements.

- (a) Temperature. The air compressor shall start and operate as specified herein at any temperature ranging from minus 25° F to plus 120° F.
- (b) Precipitation. The compressor shall operate as specified herein in rain falling at a rate of 3 inches per hour.

3.6 Safety. Compressor components that are subject to high temperatures, or are energized electrically, shall be shielded to avoid hazards to operating or maintenance personnel. All moving parts shall be guarded when such parts are exposed to contact by personnel or otherwise create a hazard. Fuel tanks shall be located in a manner which will not allow spills or overflows to run onto engine, exhaust, or electrical equipment. Sharp edges, projecting points and excessive length of fastening devices shall be avoided.

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3.6.1 Safety devices. Safety devices shall be provided to:

- (1) Shut down engine when the coolant temperatures reaches 220° F.
- (2) Shut down engine when the engine oil pressure drops below 15 pounds per square inch (psi).
- (3) Shut down the engine when the engine speed exceeds the engine manufacturer's recommended maximum speed.
- (4) Prevent the engine from starting when the air receiver pressure is 10 psi or greater on rotary-vane type compressors.

If the safety devices are not of the automatic reset type, a reset button shall be mounted on the instrument panel and shall be clearly marked as to its function.

3.6.2 Noise limits. The compressor noise level shall meet the Environmental Protection Agency requirements of Title 40, CFR, Part 204, Subpart B - Noise Emission Standards for Construction Equipment.

3.7 Maintainability. The air compressor shall operate as specified herein without maintenance other than the contractor's recommended normal scheduled maintenance, as established by a schedule submitted by the contractor prior to test. All assemblies, installed attachments, wiring, and tubing shall be accessible for servicing, repair and replacement without the removal of other major assemblies and installed attachments. Covers, safety guards and plates which must be removed for component adjustment, repair, replacement, or maintenance shall be equipped with quick-disconnect fastenings. All maintenance, assembly or disassembly operations shall be accomplished with common tools and special tools furnished with the compressor.

3.7.1 Fasteners. Fastening devices such as screws, bolts, pins, nuts, washers, and similar items shall be of a minimum number of types and sizes. Self-tapping screws shall not be used. Choice of fasteners shall be based on consideration for the intended application, load requirement, and ease of maintenance or replacement. Bolts shall be securely installed with locking devices to prevent loosening. Fastener threads shall conform to FED-STD-H28.

3.8 Engine. The diesel engine shall conform to MIL-STD-1410, class I and shall be capable of operating on diesel fuel conforming to VV-F-800 and lubricating oil conforming to MIL-L-2104 and MIL-L-46167. Only full-flow-type oil filters shall be utilized in the engine lubricating system. The temperature of the oil in the engine oil gallery shall not exceed 230° F when tested as specified herein. When an oil cooler is provided, the temperature of the oil in the engine sump, or entering the cooler, shall not exceed 250° F when tested as specified herein. The temperature of the coolant in the top tank of the radiator shall not exceed 210° F when tested as specified herein. The coolant temperature when operating at an ambient temperature of minus 25° F shall be not less than plus 140° F after a 15 minute warm-up at not more than one-fourth of the maximum continuous load rating. When specified (see 6.2), components and

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accessories shall conform to drawing 5103. An auxiliary priming system conforming to MIL-E-52649, type III and MS39254 shall be furnished. The engine shall be the same engine that has been used in the manufacturer's commercial compressor of the same size and capacity for at least one year (see 6.6).

3.8.1 Power and speed rating. The power and speed rating of the engine shall be such that operation of the compressor under any of the operating conditions specified herein will not require horsepower in excess of the continuous horsepower rating of the engine as previously published by the engine manufacturer, or 85 percent of the engine manufacturer's published maximum horsepower rating, at the applied speed, whichever is less.

3.8.2 Fuel system. A fuel tank of sufficient capacity for not less than 8 hours operation under any conditions specified herein shall be furnished. There shall be no leakage from the tank when it is full, or when operated or transported under all conditions specified herein. Primary and secondary fuel filters shall be furnished and may be of the spin-on type.

3.8.3 Radiator. The radiator shall be a standard commercial type. The front of the radiator shall be provided with a removable steel guard to protect it from damage by underbrush.

3.8.4 Cranking and charging system. Unless otherwise specified herein, a 12- or 24-volt cranking and battery charging system shall be furnished. The cranking motor shall be of the heavy-duty type approved by the engine manufacturer. The battery charging system shall be of the heavy-duty-type DC generator or alternator of not less than 35 ampere capacity. When specified (see 6.2), the cranking system shall be in accordance with drawing 5103. The battery charging system shall be protected against reverse polarity conditions.

3.8.5 Storage batteries and battery box. Storage batteries conforming to MS35000-3 shall be furnished and shall be connected to provide 12 or 24 volts. The batteries supplied shall be of quantity sufficient to start the compressor under all operating conditions specified in 3.5. A weathertight enclosure or enclosures shall be provided for the batteries. The enclosure(s) shall (1) have not less than 30-inches ground clearance (class 2 compressors only), (2) hold the batteries level when the compressor is in its normal operating position, (3) provide gas venting to the outside, at or near the top of the enclosure, (4) provide accessibility for servicing and removal of batteries, and, (5) include drains for water or electrolyte spilled within the enclosure. Drainage shall be to a connector without draining over other parts or components. Clear vision shall be provided for checking of the electrolyte level in each cell of the batteries. The batteries shall be fastened to the enclosure(s) to prevent damage from movement and vibration. The interior of the enclosure(s) shall be treated to minimize deterioration resulting from contact with the battery electrolyte. There shall be not less than a 1-inch clearance between the inside of the enclosure and each side and top of the battery cases. The cover shall overlap the sides and ends of the enclosure(s), and shall be either removable or hinged to permit vertical removal of batteries. A device shall be provided to hold the cover open when hinged. Tension-type latches with strikers shall be furnished to keep the cover closed.

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3.8.6 Emergency starting and charging receptacle. A slave receptacle for the 24-volt system only conforming to MS75058 shall be furnished, having sufficient clearance to insert a mating plug connector conforming to MS75057 with its cable. The receptacle shall be located near the storage batteries.

3.8.7 Battery and receptacle cables. Battery and receptacle cables shall satisfy the SAE J541 starter voltage drop for "Heavy Duty Use" and maximum current requirements. Cable lengths shall be as short as practicable.

3.8.8 Fuels and lubricants. The engine shall be serviced and shall operate with the applicable military fuels, lubricants and antifreeze (see table I).

TABLE I. Military fuels, lubricants and antifreeze for diesel engines.

Product	Specification
Antifreeze, ethylene glycol, inhibited	O-A-548
Fuel oil, diesel	VV-F-800
Lubricating oil, internal-combustion engine, heavy-duty	MIL-L-2104
Lubricating oil, internal-combustion engine, arctic	MIL-L-46167
Grease, automotive and artillery	MIL-G-10924
Hydraulic fluid, petroleum, inhibited	MIL-H-17672
Grease, aircraft and instrument gear and actuator screw	MIL-G-23827

3.9 Air receiver and manifold.

3.9.1 Air receiver. The air receiver shall be of sufficient volume to eliminate pulsations from the discharge line and to provide a non-pulsating source of air pressure to correctly actuate the compressor controls. The receiver shall be provided with a drain valve, a safety relief valve set at 125 psig constructed in accordance with the ASME Boiler and Pressure Vessel Code, and an automatic blowdown valve to fully discharge the receiver whenever the engine stops. Discharging of the receiver from 100 psig to 10 psig shall be accomplished in not more than 1 minute. The receiver shall be constructed in accordance with the ASME Boiler and Pressure Vessel Code. 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 may be accepted as evidence that the receiver conforms to the ASME Rules for Construction of Unfired Pressure Vessels.

3.9.2 Manifold. The air receiver discharge line shall be equipped with an air service manifold having individually controlled service outlets and a moisture drain valve. All 3/4-inch outlets shall be fitted with lever-handle, 1/4-turn plug valves, and couplings conforming to WW-C-633, type II or III.

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Unless otherwise specified (see 6.2), the air service manifolds of each size of compressor shall be fitted as specified in table II. When specified (see 6.2), the air receiver discharge line shall have a check valve between the receiver and the manifold to prevent reverse flow of air from any service outlet to the air receiver. All discharge valves and manifolds shall not extend beyond the sides or back of the housing.

TABLE II. Fittings.

Size	Number of 3/4-inch outlets	Min. number of 1-1/2-inch outlets w/globe valve
125	2	-
250	2	1

3.10 Instruments and controls. The panel instruments and controls shall be vibration dampened and illuminated. Separate instrument control panels shall be adjacent and in line with one another. When specified (see 6.2), the instrument panel shall be in accordance with drawing 5104. A moisture separator shall be provided to automatically dump accumulated moisture from the air supply line for all air-actuated controls and gages upon compressor shutdown.

3.10.1 Engine instrumentation and control systems. The control systems shall be of the engine shutoff type (see 3.6.1). Unless otherwise specified (see 6.2), the following additional engine instruments and controls shall be furnished:

- (a) Gage, fuel pressure.
- (b) Control, starter button.
- (c) Control, throttle and shutoff.
- (d) Starting aid control (cold-start system).
- (e) Gage, engine oil pressure.
- (f) Combination tachometer-hourmeter in accordance with SAE J678d.
- (g) Gage, engine coolant temperature.
- (h) Ammeter, battery charging.
- (i) Gage, fuel quantity.

3.10.2 Compressing unit. The following compressing unit instrumentation shall be furnished:

- (a) Gage, air receiver pressure.
- (b) Gage, lubricating oil pressure (pump pressure lubrication).
- (c) Gage, lubricating oil temperature (type II only).
- (d) Gage, coolant temperature (type I, liquid-cooled only).

3.11 Regulation. Unless otherwise specified (see 6.2), regulation of the air compressor shall be accomplished by an adjustable automatic air-operated control for establishing the working modulation range of the compressing unit and engine speed. This device shall be capable of selecting an engine speed and a compressor air-intake valve opening to suit any air demand by the air compressor within the established range of modulation in a smooth stepless manner, without hunting. The regulating system shall unload the compressor when the air

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receiver pressure attains a predetermined maximum pressure and shall load the compressor when the air receiver pressure falls to a predetermined minimum pressure. During unloading periods, the engine speed shall be not less than 700 revolutions per minute (rpm) nor greater than 1100 rpm. A moisture separator shall be provided to automatically dump accumulated moisture from air supply lines for the regulation system upon compressor shutdown.

3.12 Air-induction system.

3.12.1 Air cleaners. Individual air cleaners shall be provided for the engine and compressing unit. The air cleaners shall be of the dry type, conforming to MIL-A-52363, class II or III. Each air cleaner shall be provided with a restriction indicator conforming to MS53063-3 which shall be located either at the air cleaner or at the instrument panel in a position visible to the operator. The air cleaner elements for the engine and compressing unit shall be interchangeable.

3.12.2 Air intakes. The inlet of the engine and compressor air-induction systems shall be fitted with a raincap conforming to MS51389. Each inlet shall be located just outside and above the compressor housing in such a manner as to avoid engine exhaust smoke and heat from being drawn into either intake opening. The piping section of the air-induction systems shall be of corrosion-resistant metal and shall be routed so as not to interfere with the function and maintenance of adjacent components. Piping bends shall have as large a radius as possible. All connections shall be air-tight.

3.13 Housing. Unless otherwise specified (see 6.2), a housing constructed of sheet steel not less than 0.075-inch nominal thickness shall be provided to enclose the engine, compressing unit, and instrument panel(s), except for openings that permit entrance of cooling air for the radiator and compressor oil cooler. The entire top of the housing shall be removable. Each side of the housing shall be provided with hinged two-part panels which shall provide maximum accessibility to the compressor components housed therein. Each panel shall be equipped with hinges conforming to MS35829, with brass pins of 0.25-inch diameter, a means to safely position and hold the panel in a fully open position, and not less than two handles and two latches for each panel for securing the panel when closed. Housing access covers shall be provided for maintenance of components other than those accessible by way of the housing side panels. Covers shall be equipped with quick-disconnect fasteners.

3.14 Type I, reciprocating (compressing unit).

3.14.1 Compressing unit. Unless otherwise specified (see 6.2), the compressing unit shall deliver its rated air capacity in cubic feet of free air per minute (cfm) against an air receiver pressure of not less than 100 pounds per square inch gage (psig) during and at the completion of 500 hours operation. The compressing unit shall operate as specified herein when tilted 15 degrees at any position from the horizontal.

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3.14.2 Lubricating system. The compressing unit lubrication system shall be of the full force-feed or a combination force-feed and splash type, and shall incorporate a positive-displacement oil pump, a pressure regulating valve, and full flow or bypass oil filters (see 3.21.7). Crankcase ventilation, filling, draining, and checking provisions shall be as specified in 3.21.4. Lubricating oil temperature in the crankcase shall be not more than 250° F with the compressor running under any of the operating conditions specified in 3.5.

3.14.3 Lubricating oil. Unless otherwise specified (see 6.2), oil conforming to MIL-L-2104 shall be used as a lubricant for the compressing unit in ambient temperatures greater than minus 10° F and MIL-L-46167 in ambient temperatures less than minus 10° F.

3.14.4 Cooling system. The compressing unit cooling system shall be either the air- or liquid-cooled type, designed so that the air discharge temperature from the air receiver shall be not more than 250° F when the compressor is continuously operating at specified rated capacity under any of the operating conditions specified in 3.5. The liquid cooling system shall be of the pressure type, incorporating a radiator with pressure cap conforming to MS51062 or MS35840, thermostat, fan, and circulating pump. The liquid cooling system shall insure a top tank cooling liquid temperature not greater than 210° F.

3.14.5 Clutch. When a clutch is provided, it shall be of the snap-over-center, manually operated type and shall withstand not less than 130 percent of the maximum torque developed by the engine at governed speed.

3.15 Type II, rotary (compressing unit).

3.15.1 Compressing unit. The compressing unit shall be rotary of the sliding-vane or axial-screw type and, unless otherwise specified (see 6.2), shall deliver its rated air capacity in cubic feet of free air per minute (cfm) against an air receiver pressure of not less than 100 pounds per square inch gage (psig) during and at the completion of 500 hours of operation. The compressing unit shall operate as specified herein when tilted 15 degrees at any position from the horizontal.

3.15.2 Cooling and lubricating system. The compressing unit shall be cooled and lubricated by injecting filtered lubricating oil into the compression chamber. The temperature of the discharge air at the receiver outlet shall be not more than 250° F when the compressor is operating continuously at rated capacity under any of the operating conditions specified in 3.5. The system shall be provided with a thermally actuated bypass valve when equipped with an oil cooler. For sliding-vane compressing units, a means shall be provided to drain the compression chamber of all oil which could cause hydraulic lock and vane failure.

3.15.2.1 Lubricating oil reservoir. Filling, draining, and checking provisions shall be as specified in 3.21.4. When the lubricating oil reservoir is located outside of the air receiver, the reservoir shall be provided with a moisture drain fitted with a globe valve.

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3.15.2.2 Compressor oil. Unless otherwise specified (see 6.2), oil conforming to MIL-H-17672, symbol 2110T-H, shall be used as a lubricant for the compressing unit in ambient temperatures greater than 0° F, except that for metallic vane- or axial-screw type compressors, oil conforming to MIL-L-2104 may be used. Oil conforming to MIL-L-46167 shall be used in ambient temperatures less than 0° F.

3.15.2.3 Oil separator. The compressor shall be equipped with an oil separator. When the separator is located within the air receiver, the outlet for the oil return line to the compressing unit shall be not less than 1-inch above the bottom of the receiver.

3.15.3 Minimum-pressure valve. The air receiver discharge line shall be equipped with a minimum-pressure device to prevent the air receiver pressure from dropping below 40 psig when the compressor is operating.

3.15.4 Coupling. The engine shall be aligned with and directly connected to the compressing unit through a flexible coupling.

3.16 Class 1, skid mounted. The class 1 compressor shall be assembled and mounted on a sub-base skid frame of welded construction. The sub-base skid frame shall incorporate two longitudinal structural-shape skids with renewable strip-plate runners, necessary braces and gussets to prevent frame distortion, and a sheet-metal full bottom enclosure of not less than 16 gage mounted between the frame skids not less than 2-inches above the strip-plate runners. Both ends of the frame shall be provided with pulling attachments. The pulling attachments may also be used for lifting or tiedown purposes when such attachments meet the requirements specified in 3.23 or 3.24.

3.16.1 Mobility. The class 1 compressor shall not be damaged when tested as specified in 4.5.2.14.1.

3.16.2 Wet weight. Maximum wet weights will not exceed those shown in table III.

TABLE III. Maximum wet weight for class 1 compressors.

Size	Pounds
125	4000
250	7000

3.17 Class 2, trailer mounted. Class 2 air compressors shall conform to the dimension and weight requirements and shall be mounted on the trailers specified in table IV. When specified (see 6.2), for compressors using the M-200 trailer only the first article compressor(s) shall be mounted by the contractor; one mounting kit, containing all parts, hardware and instructions necessary for mounting of the compressor by the Government on the applicable trailer so that

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it conforms to the requirements for class 2, 2-wheel mounted compressors, shall be furnished with each production compressor. M-200 trailers conforming to MIL-C-45150, when required, will be furnished by the Government, one for each compressor to be mounted by the contractor (see 6.4).

TABLE IV. Class 2 air compressor maximum weights (wet)
and dimensions, with trailer.

Size (cfm)	Trailer	Weight (lbs)	Dimensions (inches)		
			Length	width	height
125	M-200 (2-wheel)	7410	198	96	90
250	MIL-C-52437, size 11	9650 ^{1/}	244	96	90

^{1/} Weight includes pneumatic tool outfit.

3.17.1 Vehicular electrical system. The air compressor shall be equipped with a waterproof 24-volt vehicular electrical system for service and blackout night travel in military operations. All components and wiring shall be located and guarded so as to provide maximum protection from vibration and damage from road hazards.

3.17.2 Size 125 trailer mounting. The compressor shall be attached to the Government-furnished trailer with bolts and locknuts at not less than three trailer crossmembers. The weight at the trailer lunette eye shall be not less than 500 pounds and not greater than 800 pounds with the compressor level and not supported by the landing gear.

3.17.2.1 Size 250-trailer mounting. Unless otherwise specified (see 6.2), the class 2, size 250-cfm compressor shall be equipped with toolboxes and special airdrop suspension provisions.

3.17.2.1.1 Toolboxes. The toolboxes shall be capable of containing one pneumatic tool outfit. One pneumatic tool and compressor outfit (FSN 3820-950-8584) will be loaned to the contractor by the Government for equipment layout and tool compartment size determination (see 6.5). One or more toolboxes shall be mounted on each side of the compressor and one box on the rear center or trailing end of the compressor. Toolboxes shall be bolted to and supported by structural steel members welded to or cantilevered from the steel subbase frame, but not the trailer upon which the frame rests. The toolboxes shall be fabricated of sheet steel of not less than 0.125-inch nominal thickness. Covers for all toolboxes shall be at the same height, shall be fabricated of raised, medium pattern, safety-plate steel, and shall have rolled edges that make the boxes raintight when closed. Each toolbox and cover shall be provided with a steel hinge conforming to MS35829, having a 0.25-inch diameter brass pin, not less than two hook-type clamps, a rigid U-type handle, a hasp accommodating a padlock shackle of 3/8-inch diameter, and devices to hold the covers in the fully opened position, all welded or through-bolted in such a manner that they

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will not constitute an obstruction to closing or projecting hazard to operating personnel. The toolboxes shall provide compartments, drawers or tiedowns for securing all components of the tools outfit. Fuel- and oil-resistant elastomer sheet material shall be permanently affixed to the bottom of the toolboxes to prevent contact of the tools with the metal surface. Tiedowns shall be designed to prevent movement of tools in excess of 1/2-inch in any direction. A portion of the toolbox may be utilized to accommodate the compressor engine-starting batteries when it meets the requirements of 3.8.5. The conduit and receptacles for the lighting system may also be housed in the toolbox. These accessories shall be separated from the tool compartments by steel partitions of welded construction and all compartments shall be provided with drain holes in the bottom corners. An instruction plate(s) (see 3.28) depicting the arrangement of and identifying each tool shall be permanently affixed to the underside of the toolbox cover(s). A continuous wrap-around bumper of 3-inch 6-pound-per-foot steel channel shall be welded or bolted along the exterior lower portion of the rearmost-side and rear-center toolboxes from fender-well to fender-well.

3.17.2.1.2 Airdrop suspension provisions. Four integral-item suspension provisions conforming to MIL-STD-814 shall be provided. Suspension provisions may be used as lifting attachments when such provisions meet the requirements specified in 3.23.

3.17.3 Chock blocks. Two chock blocks having dimensions as shown on figure 1 and constructed of aluminium, magnesium, or semirigid elastomer shall be furnished. Each chock block shall weigh not more than 11.5 pounds and shall be equipped with a handle or line to allow it to be carried in one hand. Cradles, brackets or storage boxes shall be mounted on the trailer to securely hold the chock blocks when not in use.

3.17.4 Storage provisions. Unless otherwise specified (see 6.2), the compressor shall be provided with storage space for the detachable intervehicular air hose lines, electrical harness, and any maintenance tools and manuals furnished with compressor. In addition to the storage space, two dummy couplings for the air hose lines and a spring clip for the electrical harness shall be mounted on the compressor. The dummy couplings and clip shall prevent dragging of the air and electrical lines on the ground when one end of each line is connected to its service connection and the other end is connected to a dummy coupling or spring clip, as applicable.

3.18 Mobility. The compressor shall be towable over paved highways at an average speed of 20 miles per hour (mph), over graded gravel roads at an average speed of 10 mph, and over rough cross-country terrain at an average speed of 8 mph without bottoming, weaving or sidesway, and without evidence of malfunction, permanent deformation or damage. Each compressor shall be provided with an instruction plate with a caution notice stating that the maximum towing speed is 25 mph (see 3.28). The compressor shall negotiate side slopes up to 8 degrees and approach, negotiate and depart from a ramp having a slope of 20 degrees. Compressor components that could be damaged by water immersion shall either be waterproof or located a minimum of 30 inches above ground level to allow fording in water to that depth.

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3.19 Hose reels. Unless otherwise specified (see 6.2), the sizes 125-cfm and 250-cfm compressors shall be equipped with revolving hose reels, each capable of handling not less than one 50-foot length of air hose, 3/4-inch nominal size. When specified (see 6.2), each hose reel shall be capable of handling not less than three 50-foot lengths of air hose 3/4-inch ID with couplings. One hose reel shall be provided for the size 125-cfm compressor and two hose reels shall be provided for the size 250-cfm compressor. The air hose shall be attached to the reel by a coupling conforming to WW-C-633, type II or III. The couplings shall be located so that when the hose is spooled onto the reel no sharp bends will occur in the hose. Each reel shall be provided with a takeoff-shutoff valve. Reels shall be located so as to be accessible to a man standing on the ground yet high enough to be protected from underbrush. A 3/4-inch-size spud or dummy coupling conforming to WW-C-633 shall be attached to a fixed pipe nipple for securing the free end of the hose when not in use. Each reel shall be equipped with a device to prevent reel rotation when not operational.

3.20 Electromagnetic interference. The electromagnetic interference emission characteristics of the compressor shall conform to MIL-STD-461, class IIIC.

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

3.21.1 Lubricants. The compressor shall operate as specified herein when lubricated with military lubricants (see table I).

3.21.2 Lubricating fittings. Lubricating fittings shall conform to SAE J534. Fittings shall be located in a protected position and shall be accessible to a grease gun conforming to MIL-G-3859 with flexible extension. 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.

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

3.21.4 Filling, draining and checking provisions. Enclosures such as gearcases that contain a reservoir of lubricants for the lubrication of parts enclosed shall be equipped with dipsticks, check plugs not less than 1/2-inch pipe size, or gages to determine the level of the lubricant. Each enclosure shall be equipped for filling the enclosure with a lubricant and for draining. The drain outlet shall be fitted with a magnetic drain plug, size conforming to MS35844 or MS49006. The drain outlet shall be located so that removal of the plug 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. Intergral tubes or troughs may be used to convey the lubricant from the drain outlet to a container.

3.21.5 Grease lubrication. All grease lubrication, including lubrication of sealed bearings, shall be with grease as follows:

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- (a) MIL-G-23827 - For instruments, all sealed bearings, and other bearings where operating temperatures do not exceed 250° F.
- (b) MIL-G-10924 - For bearings where operating temperatures do not exceed 175° F.

The compressor shall be assembled, run-in (broken-in), tested and delivered with these greases. The bearings shall be cleaned before lubrication, because military greases are not always compatible with other greases. A tag shall be attached in a conspicuous place to indicate which military grease has been used.

3.21.6 Oil lubrication. 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. A tag shall be attached in a conspicuous place to indicate the temperature range and grade of lubricant used.

3.21.7 Oil filters. Filters of either the bypass or full-flow type shall be provided on the engine and compressing unit and shall be interchangeable. Unless otherwise specified (see 6.2), bypass filter elements shall conform to MS35341, MS35342 or MS35343, and full-flow filter elements shall conform to MS35802.

3.22 Fungus and moisture resistance. The electrical circuitry, including all components and connections except as specified below, shall be protected from the effects of fungus growth and moisture by an overall treatment with varnish conforming to MIL-V-173, with 1 percent copper 8-quinolinolate (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.

3.23 Lifting attachments. Permanently affixed attachments that enable the compressor to be lifted in its normal travel position shall be provided. Each attachment shall withstand, without damage to any part of the compressor, 2-1/2-times the resulting vertical force imposed when the compressor is suspended by the lifting attachments for a period of 90 seconds. Attachments for multiple slings shall be located so that: (a) slings will converge at not more than 19 feet above the lowest extremity of the compressor, and (b) not less than 1-inch clearance will be maintained between the slings and the compressor. Use of spreader bars is permitted. The inside diameter of the attachment eye shall be not less than 3 inches. Lifting attachments may also be

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used as tiedown attachments when such attachments meet the requirements specified in 3.24. When specified (see 6.2), the attachments shall be located so that the compressor is lifted in its normal operating position when using a sling in accordance with drawing 5060.

3.24 Tiedown attachments. Permanently affixed attachments that permit fastening the compressor to the floor or deck of a transportation medium shall be provided. Each attachment shall withstand, without damage to the compressor, its proportion of the following static loads for not less than 3.0 seconds and not more than 6.0 seconds: 4-G forward, 4-G rearward, 2-1/4-G vertical, and 1-1/2-G sideward, where G equals cargo weight of the compressor. Attachments shall be rounded and beveled to prevent cutting of the tiedown material. Tiedown attachments may also be used as lifting attachments when such attachments meet the requirements specified in 3.23.

3.25 Transportability by rail. The compressor shall withstand the stresses encountered in rail shipment without damage or deformation to any part of the compressor.

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

3.27 Shipping data plate. A shipping data plate conforming to MIL-P-514, type III, composition C, of type I, grade A, class 1 material shall be provided. The plate shall also show the silhouette of the compressor in transport position, indicating the center of gravity and the location and capacity of the lifting and tiedown attachments. Each plate shall be attached by screws, bolts or rivets in a conspicuous protected location.

3.28 Instruction plates. Each compressor shall be equipped with instruction plates, including diagrams, 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. Each plate shall be attached by screws, bolts or rivets in a conspicuous protected location.

3.29 Treatment and painting. The portions of the compressor normally painted shall be cleaned, treated and painted in accordance with MIL-T-704, type A, color as specified (see 6.2).

3.30 Stenciling. Registration numbers shall be marked on the compressor in accordance with MIL-STD-642 (see 6.7). The correct tire pressure shall be marked on the side, above each tire "TP--", in lettering of a color and style in accordance with MIL-STD-642.

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3.31 Workmanship.

3.31.1 Casting and forgings. All parts, components and assemblies of the compressor which include castings and forgings shall be clean of harmful extraneous material such as sand, dirt, pits, sprues, scale, and flux. Rework shall be limited to procedures which do not reduce strength or affect function.

3.31.2 Metal fabrication. Metal used in fabrication shall be free from kinks and sharp bends. The straightening of material shall be done by methods that will not cause injury to the material. Corners shall be square and true. Flame-cutting, using tips suitable for the thickness of the steel, may be employed instead of shearing and sawing. All bends shall be made with controlled means to insure uniformity of size and shape. Precaution shall be taken to avoid overheating. Heated steel shall be allowed to cool slowly. External surfaces shall be free of burrs, sharp edges and corners, except when sharp edges or corners are required or where they are not detrimental to safety.

3.31.3 Welding. The surfaces of parts to be welded shall be free from rust, scale, paint, grease, mill scale that can be removed by chipping and wire brushing, 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. Parent materials, weld filler metals, and fabrication techniques shall be as required to enable the compressor to conform to the examination and test requirements specified in Section 4. Parts to be jointed by fillet welds shall be brought into as close contact as possible and in no event shall be separated by more than 3/16-inch, unless appropriate bridging techniques are used. Unless otherwise specified (see 6.2), the welding process used in fabrication of the compressor shall be at the option of the contractor.

3.31.4 Welders. Before assigning any welder to manual welding work covered by this specification, the contractor shall provide the contracting officer with certification that the welder has passed qualification tests as prescribed by either of the following listed codes for the type of welding operations to be performed and that such qualification is effective as defined by the particular code:

AWS D1.1, Structural Welding Code, Section 5, Qualification.
ASME Boiler and Pressure Vessel Code, Section IX, Welding
Qualifications.

Contractors who make only horizontal welds need not qualify welders for "all position welding". Subject to approval by the Government, contractor's standard welder qualification may be substituted in lieu of the above codes provided that the contractor's procedure is equivalent to the above codes. The contractor shall be responsible for determining that automatic welder equipment operators are capable of producing quality welds in accordance with AWS or ASME codes.

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3.31.5 Bolted connections. Boltholes shall be accurately formed and shall have the burrs removed. Washers or lockwashers shall be provided where necessary. Matching thread areas securing bolts conforming to SAE J429 or capscrews shall be of sufficient strength to withstand the tensile strength of the bolt. All fasteners shall be correctly torqued and shall have full thread engagement.

3.31.6 Riveted connections. Rivets shall fill the hole 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.

3.31.7 Machine work. Tolerances and gages for metal fits shall conform to the limits specified herein, and on applicable drawings, and to the standards of the industry.

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 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. Inspections shall be classified as follows:

- (a) Preproduction inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).
- (c) Comparison test (see 4.6).
- (d) Inspection of packaging (see 4.7).

4.3 Preproduction inspection.

4.3.1 Examination. Prior to testing, the preproduction compressor(s) shall be examined for defects marked "X" in column 1 of table V. Presence of one or more defects shall be cause for rejection of the preproduction compressor(s).

4.3.2 Tests. The preproduction compressor(s) shall be subjected to the tests marked "X" in column 1 of table VI. Failure of any test shall be cause for rejection of the preproduction compressor(s). A preproduction test log, similar in format to figure 2, shall be kept, recording all appropriate test data. A copy of the test log shall be included in the test report.

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4.4 Quality conformance inspection.

4.4.1 Examination. Each compressor shall be examined for the defects marked "X" in column 2 of table V. Presence of one or more defects shall be cause for rejection.

4.4.2 Tests. Each compressor shall be subjected to the tests marked "X" in column 2 of table VI. Failure of any test shall be cause for rejection.

4.5 Inspection procedure.

4.5.1 Examination. Examination shall be in accordance with table V.

TABLE V. Examination schedule.

Prepro- duction	Indivi- dual	Defects	Requirement Paragraph
1	2	3	4
X	-	101. Weight or dimensions not as specified.	3.16.2, 3.17, 3.17.2
X	-	102. Material not as specified.	3.4
X	-	103. Corrosion-resisting treatment not as specified.	3.4.1
X	-	104. Presence of nonpermissible galvanic couples.	3.4.2
X	X	105. Safety provisions or equipment missing or not as specified.	3.6, 3.6.1, 3.6.2
X	-	106. Maintainability provisions not as specified.	3.7
X	-	107. Fasteners not as specified.	3.7.1
X	-	108. Engine, components or accessories not as specified.	3.8
X	-	109. Fuel tank construction not as specified.	3.8.2
X	-	110. Radiator not as specified.	3.8.3
X	-	111. Cranking system not as specified.	3.8.4
X	X	112. Batteries missing or not as specified.	3.8.5

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TABLE V. Examination schedule (cont'd)

Prepro- duction	Indivi- dual	Defects	Requirement Paragraph
1	2	3	4
X	-	113. Battery box not as specified.	3.8.5
X	-	114. Starting and charging receptacle not as specified.	3.8.6
X	-	115. Cables not as specified.	3.8.7
X	-	116. Engine fuels and lubricants not as specified.	3.8.8
X	X	117. Air receiver not as specified.	3.9.1
X	-	118. Air service manifold not as specified.	3.9.2
X	-	119. Instruments and controls not as specified.	3.10, 3.10.1, 3.10.2
X	-	120. Air line moisture separator(s) missing or not as specified.	3.10, 3.11
X	-	121. Air cleaners not as specified.	3.12.1
X	-	122. Air intakes not as specified.	3.12.2
X	-	123. Housing not as specified.	3.13
X	-	124. Compressing unit not as specified.	3.14.1 or 3.15.1, as appli- cable.
X	-	125. Compressing unit lubrication system not as specified.	3.14.2 and 3.14.3 or 3.15.2 thru 3.15.2.3, as appli- cable.
X	-	126. Cooling system not as specified (type I).	3.14.4
X	-	127. Clutch not as specified (type I).	3.14.5
X	-	128. Coupling not as specified. (type II).	3.15.4
X	-	129. Skid mounting not as specified (class 1).	3.16
-	X	130. Mounting kit missing or inadequate (class 2, 2-wheel for Government mounting).	3.17
X	-	131. Electrical system inoperative or not as specified (class 2).	3.17.1

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TABLE V. Examination schedule (cont'd)

Prepro- duction	Indivi- dual	Defects	Requirement Paragraph
1	2	3	4
X	-	132. Trailer mounting not as specified (class 2).	3.17.2
X	-	133. Fording provisions not as specified (class 2).	3.18
X	-	134. Toolboxes not as specified (class 2, 2-wheel).	3.17.2.1.1
X	-	135. Chock blocks not as specified (class 2)	3.17.3
X	-	136. Hose reels not as specified (sizes 125 cfm and 250 cfm).	3.19
X	-	137. Lubrication provisions not as specified.	3.21 thru 3.21.7
X	-	138. Fungus and moisture resistance not as specified.	3.22
X	-	139. Lifting and tiedown attachments not as specified.	3.23, 3.24
X	X	140. Identification marking not as specified.	3.26
X	X	141. Shipping data plate not as specified.	3.27
X	X	142. Instruction plates not as specified.	3.28
X	-	143. Treatment and painting not as specified.	3.29
X	-	144. Stenciling not as specified.	3.30
X	-	145. Workmanship not as specified.	3.31 thru 3.31.7

4.5.2 Tests.

4.5.2.1 Test conditions. Prior to test, the compressor shall be serviced with military fuels, oils and greases. Oils shall be those designated for use in the ambient temperature at the place of test. 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. Unless otherwise specified herein, tests shall be conducted without shelter or protection and at ambient temperature of test site with all compressor components and accessories installed and functioning normally. Specified capacity measurements shall be made at a receiver pressure of 100 psig, in accordance with ASME Performance Test Code PTC 9, utilizing a flow-nozzle differential pressure meter.

4.5.2.2 Test schedule. Tests shall be in accordance with table VI. It is not required that tests be performed in the order listed, except that the engine performance, compressing unit power consumption, and relief valve tests shall precede all other tests, and the compressor performance test shall be the last test performed.

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TABLE VI. Test schedule.

Prepro- duction	Indivi- dual	Test	Test paragraph	Requirement paragraph
1	2	3	4	5
X	X	Test conditions.	4.5.2.1	3.7
X	-	Engine performance.	4.5.2.3	3.8.1
X	-	Compressing unit power consumption.	4.5.2.4	3.8.1, 3.14.1, 3.15.1
X	-	Relief valve.	4.5.2.5	3.9.1
X	-	Tilted position.	4.5.2.6	3.14.1, 3.15.1
			4.5.2.6.1	
			4.5.2.6.2	
X	-	Endurance and cycling.	4.5.2.7 thru 4.5.2.7.4	3.8.2, 3.9.1, 3.11, 3.14.1, 3.15.1, 3.15.3
X	-	High temperature.	4.5.2.8 thru 4.5.2.8.3	3.5, 3.8
X	-	Low temperature.	4.5.2.9, 4.5.2.9.1, 4.5.2.9.2	3.5, 3.8
X	-	Precipitation.	4.5.2.10, 4.5.2.10.1, 4.5.2.10.2	3.5
X	-	Lifting and tiedown attachments.	4.5.2.11	3.23, 3.24
X	-	Rail impact.	4.5.2.12	3.25
X	-	Electromagnetic interference.	4.5.2.13	3.20
X	-	Mobility.	4.5.2.14	
		Mobility class I	4.5.2.14.1	3.16.1
		Mobility class II	4.5.2.14.2 thru 4.5.2.14.2.2	3.18
X	-	Control systems.	4.5.2.17	3.6.1, 3.10.1
X	-	Airdrop suspension provisions (class 2, size 250 cfm).	4.5.2.15	3.17.2.1.2
X	-	Noise.	4.5.2.16	3.6.2
X	X	Compressor performance	4.5.2.18	3.14.1, 3.15.1

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4.5.2.3 Engine tests. Prior to installation of the engines in the compressor and examination and test of the preproduction model, the engine shall be tested in accordance with Test Method Series 2000, MIL-STD-1400, except Test Method 2400 shall not apply. Nonconformance to 3.8 and 3.8.1 shall constitute failure of this test. Upon successful completion of this test and prior to installation of the engine in the preproduction model, the fuel system and governor shall be sealed by a Government representative at the settings established by this test. Seals shall also be installed to prevent separation of the oil pan and the cylinder head or valve covers from the cylinder block. Any changes made to these settings or removal or alteration of the seals or adjustments by other than a Government representative, or without his expressed consent, will invalidate all tests previously performed.

4.5.2.3.1 Production engine tests. Each engine shall be tested in accordance with MIL-STD-1400, Test Method Series 4000, except that the engine manufacturer's standard production tests may be substituted provided they equal or exceed Test Method Series 4000.

4.5.2.4 Compressing unit power consumption. The compressing unit shall be driven by a dynamometer, and the brake horsepower (bhp) and speed required to produce rated capacity shall be determined. Continuous bph in excess of that established by the engine performance test shall constitute failure of this test.

4.5.2.5 Relief valve. Slowly increase pressure on the relief valve by overriding the compressor pressure regulating system or by connecting the relief valve to a separate pressure source. Failure of the relief valve to unseat at a pressure of 125 psig, plus or minus 10 psig, shall constitute failure of this test.

4.5.2.6 Tilted position.

4.5.2.6.1 Test procedure. Operate the compressor in four tilted positions, each of which shall be 15 degrees from the horizontal plane about the compressor transverse and longitudinal axes. The test shall be conducted operating the compressor for 1 hour at rated capacity in each of the four positions, in a sequence whereby the compressor is operated first in the position least likely to adversely affect the lubrication or fuel system and lastly in the position most likely to adversely affect these systems. The fuel tank shall be full at the start of each position run. Upon completing the last position run, stop the engine and allow the compressor to stand in this tilted position for 4 hours, then operate the compressor for 30 minutes at rated capacity. Capacity measurement shall be made at least once during each of the five phases of the test.

4.5.2.6.2 Failure criteria. Inability of the compressor to produce rated capacity, evidence of compressor air or fluid leaks, or any malfunction shall constitute failure of this test.

4.5.2.7 Endurance and cycling. Subject the compressor to 500 hours of operation, entailing 375 hours of endurance and 125 hours of cyclic operation, as follows.

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4.5.2.7.1 Endurance phase. The compressor shall be operated continually (see 6.8.1), at rated capacity. Test data shall be recorded every 4 hours, plus or minus 0.5 hour, and a capacity computation shall be made every fifth set of data readings. A graph shall be prepared plotting capacity and corresponding air receiver discharge temperature for each capacity computation made. The following shall also be checked at least once during the endurance phase, as applicable:

- (a) Fuel tank capacity for conformance with 3.8.2.
- (b) Blowdown valve for conformance with 3.9.1.
- (c) Minimum-pressure valve for conformance with 3.15.3.

4.5.2.7.2 Cycling phase. The compressor shall be cycled automatically to operate the compressor through a complete loading-unloading cycle every 5 minutes. Unloading shall be for not more than 1 minute duration, and engine idle speed shall be as specified in 3.11. At the end of the cycling test phase, remove the compressor from cycling operation and operate the compressor at rated capacity for 1 hour. After 1-hour operation, make a capacity computation.

4.5.2.7.3 Test data. The following data shall be recorded during endurance and cycling tests:

- (a) Air temperature, ambient.
- (b) Air temperature at compressor intake ($^{\circ}$ F).
- (c) Air temperature at receiver discharge ($^{\circ}$ F).
- (d) Air pressure at compressor intake (psia).
- (e) Air receiver pressure (psig).
- (f) Barometric pressure (inches mercury).
- (g) Compressor speed (rpm).
- (h) Compressor capacity (cfm), computed.
- (i) Nozzle coefficient.
- (j) Pressure drop across nozzle.
- (k) Down-time data:
 - (1) Start-time.
 - (2) Stop-time.
 - (3) Down-time, hours and minutes.
 - (4) Total accumulated operating hours.
 - (5) Reason for each stop, such as:
 - a. Normal services typical of replenishing fuel, add or change lubricants, add radiator coolant, clean or change filters, etc.
 - b. Adjustment (character).
 - c. Malfunction (nature and cause).
 - d. Part replacement, such as fan belt.
 - (6) Quantities of compressor lubricants used (qt.), add or change.

4.5.2.7.4 Failure criteria. Any one or more of the following shall constitute failure of this test:

- (a) Inability of the compressor to produce rated capacity.
- (b) Inability to meet the performance requirements specified in 3.14.1 or 3.15.1.

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- (c) Fuel tank capacity not as specified in 3.8.2.
- (d) Damage to or malfunction of the compressor.
- (e) Engine idle speed not as specified during unloading.
- (f) Blowdown valve not as specified in 3.9.1.
- (g) Minimum-pressure valve not as specified in 3.15.3 (type II only).

4.5.2.8 High temperature.

4.5.2.8.1 Test procedure. Subject the compressor to an ambient temperature of 120° F, plus or minus 5° F, until the engine coolant liquid, the fuel tank liquid, and the engine and compressing unit lubricating oil temperature are stabilized. Start the compressor and operate at rated capacity for not less than 7 hours while maintaining 120° F, plus or minus 5° F, ambient temperature. No adjusting or replacing of the engine or compressor components shall be permitted after the first hour of operation.

4.5.2.8.2 Test data. Record the following data at 30-minute intervals during the last 7 hours of test:

- (a) Engine coolant liquid temperature (top tank).
- (b) Engine lubricating oil temperature (gallery).
- (c) Compressor air discharge temperature (measured at the compressor receiver discharge).
- (d) Compressor air receiver pressure.
- (e) Compressor discharge capacity.
- (f) Compressing unit lubricating oil temperature (type I only).
- (g) Compressing unit coolant liquid temperature (type I, liquid cooled only).
- (h) Ambient temperature.

4.5.2.8.3 Failure criteria. Any one or more of the following shall constitute failure of this test.

- (a) Engine coolant liquid temperature higher than 210° F.
- (b) Engine lubricating oil temperature higher than 250° F.
- (c) Compressor air discharge temperature higher than 250° F.
- (d) Compressor air receiver pressure less than 100 psi.
- (e) Compressor discharge capacity less than that specified.
- (f) Compressing unit lubricating oil temperature higher than 250° F (type I only).
- (g) Compressing unit coolant liquid temperature higher than 210° F (type I, liquid cooled only).

4.5.2.9 Low temperature.

4.5.2.9.1 Test procedure. Subject the compressor to a temperature no greater than minus 25° F for a period of not less than 12 hours. At the end of the 12 hour period, start the compressor three times with all recorded temperatures stabilized at minus 25° F, plus or minus 5° F, and allow it to run until a receiver pressure of 100 psig has been reached. After the third start, operate

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the compressor through 5-minute loading-unloading cycles as specified in 4.5.2.7.2 until all recorded temperatures have stabilized from cycle to cycle. Throughout the test, the ambient temperature shall be maintained at minus 25° F, plus or minus 5° F. Test data recorded shall be that specified in 4.5.2.8.2 at intervals as required.

4.5.2.9.2 Failure criteria. Any one or more of the following shall constitute failure of this test:

- (a) Inability of the engine to start three times.
- (b) Incorrect operation or inaccessibility of instruments or controls.

4.5.2.10 Precipitation.

4.5.2.10.1 Test procedure. The compressor shall be exposed to simulated rain, falling toward the compressor at an angle of approximately 45 degrees from the horizontal at a rate of not less than 3-inches per hour. Simulated rain shall be uniformly distributed over the left side, front, right side, rear, and top of the compressor. The apparatus for producing the spray shall emit water in the form of droplets rather than a fine mist. The spray shall continue while the compressor is operated as follows:

- (a) Engine off - 5 minutes.
- (b) Start engine within 2 minutes (without removing internal moisture).
- (c) Operate compressor under load - 1 hour.

4.5.2.10.2 Failure criteria. Evidence of any of the following shall constitute failure of this test:

- (a) Inability to start within 2 minutes.
- (b) Water in the air intake filters providing a restriction in excess of 25 inches of water (manometer reading).
- (c) Faulty operation of any electrical switch or gage.
- (d) Leakage of water into internal components such as (but not limited to) the compressing unit, engine crankcase, and fuel tank.

4.5.2.11 Lifting and tiedown attachments. Determine the load and direction of application for each lifting attachment. Apply 2-1/2 times the determined load to each lifting attachment in the direction of application for a period of not less than 90 seconds. Apply the static loads as specified in 3.24 to the tiedown attachments for a period of not less than 3.0 seconds and not more than 6.0 seconds. Failure or permanent deformation of any attachment or structural member shall constitute failure of this test. This test is not required for lifting or tiedown attachments which are part of Government-furnished trailers or trucks.

4.5.2.12 Rail impact. The rail impact test shall be performed prior to completion of the last 250 hours of endurance testing. The end item, in its normal shipping configuration, shall be adequately blocked and secured to the

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floor of the test rail car using the tie down attachments. Blocking shall be used to prevent any longitudinal, vertical or lateral movement. Loading and tie down shall be in accordance with applicable practices of the Association of American Railroads. The test car shall be impacted into two to five buffer cars. The buffer cars shall be located on a level section of track with the air and handbrakes set and the draft gear extended. The total weight of the buffer cars shall be 250,000 pounds minimum. All cars shall be equipped with standard draft gear and conventional under frame. One impact shall take place at 8 miles per hour (mph) in one direction and one impact at 8 mph in the opposite direction. The velocities given are minimum values and should not be exceeded by more than is necessary to insure that these values are met. The speed just prior to impact shall be measured by electronic or electrical means, or both, having an accuracy of plus or minus 5 percent. The front of the compressor shall face in the direction of the empty cars. Repeat the procedure with the rear of the compressor in the direction of the empty cars. Evidence of damage or permanent deformation to the compressor or any component or part shall constitute failure of this test.

4.5.2.13 Electromagnetic interference. The compressor shall be subjected to the tests specified in MIL-STD-461 for class IIIC equipment. The tester shall furnish the contracting officer with the test report for evaluation within the time frame specified (see 6.2). Disapproval of the report shall constitute failure of this test.

4.5.2.14 Mobility. Perform the following applicable mobility test(s).

4.5.2.14.1 Mobility, class 1. Pull (skid) the compressor over level dry ground at speeds up to 5 mph in a series of five "S" curves for a linear distance of 300 feet. Evidence of snubbing, deformation or structural failure of the compressor shall constitute failure of this test.

4.5.2.14.2 Mobility, class 2, two-wheel mounted.

4.5.2.14.2.1 Travel test. Tow the compressor over a smooth hard-surface highway at speeds up to 55 mph, averaging not less than 45 mph, for a total distance of not less than 10 miles. Tow the compressor over rough cross-country terrain (see 6.8.5), at speeds up to 20 mph, averaging not less than 15 mph, for a total distance of not less than 25 miles. During the test, all tools shall be in place in the toolboxes. After completion of the test, conduct the performance test as specified in 4.5.2.18. Evidence of bottoming, weaving or sidesway, inability of the trailer to follow the towing vehicle, interference between the trailer and towing vehicle, any other hazardous towing characteristic, malfunction, permanent deformation, or damage to the compressor, tools or components, or failure of the performance test shall constitute failure of this test.

4.5.2.14.2.2 Slope test. Tow the compressor on a side slope of 20 percent. Repeat the procedure with the compressor traveling in the opposite direction. A physical test or design layout shall be made to determine the ability of the equipment to move up and down a ramp of 30 percent slope. The bottom and top of

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the ramp shall end in horizontal landings forming sharply defined 30 degree angles with the ramp. Inability of the compressor to negotiate the slopes as specified or contact of any compressor component (except tires) with the ramp shall constitute failure of this test.

4.5.2.15 Airdrop suspension provisions (class 2, size 250 cfm). Apply the limit load as specified in MIL-STD-814 to each of the suspension provisions in the direction most likely to be encountered during an airdrop. When airdrop suspension provisions are used as lifting attachments, this test may be used in lieu of the upward static load required by the lifting and tiedown attachments test. Permanent deformation or damage to any one or more of the airdrop suspension provisions shall constitute failure of this test.

4.5.2.16 Sound level measurement.

4.5.2.16.1 Representative duty position. Measure the sound level at every 45 degrees, plus or minus 5 degrees, of azimuth 65 inches, plus or minus 1 inch, above the ground level at 7 meters radius from the geometric center of the equipment. The compressor shall be operated at rated capacity, the escaping air shall be piped away and the test surface shall be paved. Nonconformance to 3.6.2 shall constitute failure of this test.

4.5.2.17 Control systems. Each of the control systems shall be actuated by making the necessary temporary alterations to compressor operation wherever such alterations will not result in a risk of damage to the compressor. Where a damage risk is present, this test may be conducted with the control system completely or partially removed from the compressor by subjecting the system sensor to other sources of temperature or pressure. Operation of any one or more control systems not in accordance with 3.6.1 or 3.10.1 shall constitute failure of this test.

4.5.2.18 Compressor performance. Each compressor shall be run for 8 hours; the first 7 hours shall be run-in period, and the capacity shall be determined during the final hour of this test. Inability of the compressor to produce the rated capacity or malfunction of the compressor shall constitute failure of this test.

4.6 Comparison test. The Government may select compressors at any time during the contract production period and subject these compressors to the examination and tests specified in 4.4 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 compressors selected at random from those which have been accepted by the Government and will not include the previously inspected preproduction model. 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 comparisons, and failure of such additional tests shall have the same effect as failure of those tests specified as inspection comparison.

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4.6.1 Inspection failure. Failure of a comparison test to meet any requirement specified herein during and as a result of the examination and tests specified in 4.6 shall be cause for rejection of the inspection comparison compressor 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.

4.7 Inspection of packaging. The preservation, packing, and marking shall be examined and tested as specified in MIL-C-3600. Unless otherwise specified (see 6.2), a preproduction pack shall be furnished within the time frame required.

5. PACKAGING

5.1 Preservation, packing, and marking. Each complete compressor with components, repair parts, tools, and technical publications, when applicable, shall be preserved, packed, and marked in accordance with MIL-C-3600. Preservation shall be level A, B or Commercial, and packing shall be level A, B or Commercial as specified (see 6.2). When level A or B packing is specified, the skid-mounted compressors shall be prepared as specified for boxed compressors and the trailer-mounted compressors shall be prepared as specified for trailer-mounted compressors.

6. NOTES

6.1 Intended use. The compressors are intended for use as portable sources of compressed air.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Class and size required (see 1.2). The type is at the option of the contractor.
- (c) Time frame required for submission of preproduction model and number of preproduction compressors required (see 3.3).
- (d) When the Government will conduct any or all of the preproduction model examination and tests. When the Government will conduct some but not all of the preproduction 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 3.3).
- (e) When the components and accessories as specified on drawing 5103 are required (see 3.8).

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- (f) When a cranking system as specified on drawing 5103 is required (see 3.8.4).
- (g) When service outlets as specified in table II are not required (see 3.9.2).
- (h) When a crank case check valve is required (see 3.9.2).
- (i) When an instrument panel as specified on drawing 5104 is required (see 3.10).
- (j) When additional instruments are not required (see 3.10.1).
- (k) When regulation of the compressor other than as specified is required (see 3.11).
- (l) When a housing other than as specified is required (see 3.13).
- (m) When a compressing unit other than as specified is required (see 3.14.1 or 3.15.1).
- (n) When lubricating oils other than as specified may be used (see 3.14.3 or 3.15.2.2).
- (o) When mounting kits shall be furnished for Government mounting of compressors on trailers in lieu of mounting by the contractor (see 3.17).
- (p) When toolboxes are not required for mounting on class 2, size 250-cfm compressor (see 3.17.2.1).
- (q) When aerial delivery requirements do not apply for the class 2, size 250-cfm compressor (see 3.17.2.1.2).
- (r) When storage provisions are not required (see 3.17.4).
- (s) When hose reels are not required for sizes 125-cfm and 250-cfm compressors (see 3.19).
- (t) When hose reels capable of handling not less than three 50-foot lengths of 3/4-inch air hose with couplings are required for sizes 125-cfm and 250-cfm compressors (see 3.19).
- (u) When bypass filters other than as specified are required (see 3.21.7).
- (v) When a sling in accordance with drawing 5060 is required (see 3.23).
- (w) Color required (see 3.29).
- (x) When the welding process will not be at the option of the contractor (see 3.31.3).
- (y) Time frame required for submission of the electromagnetic interference test report (see 4.5.2.13).
- (z) Time frame required for submission of preproduction pack (see 4.7).
- (aa) Degree of preservation and degree of packing required (see 5.1).

6.3 Preproduction model. Any changes or deviations of production compressors from the approved preproduction model during production will be subject to the approval of the contracting officer. Approval of the preproduction model will not relieve the contractor of his obligation to furnish compressors conforming to this specification.

6.4 Government-furnished property. The contracting officer should arrange to furnish the property specified in 3.17 when required.

6.5 Government-loaned property. The contracting officer should arrange for the loan of property specified in 3.17.2.1.1, when required.

6.6 Engine. The contracting officer should obtain from all bidders a copy of their commercial literature indicating engine models used in similar compressor application (see 3.8).

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6.7 Registration numbers. When the compressors are not to be mounted on Government-furnished trailers, the contracting officer should furnish a list of registration numbers to be applied to the compressors (see 3.30).

6.8 Definitions. The following definitions shall apply throughout this specification.

6.8.1 Continually. Operation in increments of not less than 4 hours, except for interruptions required for normal servicing of the compressor. Downtime shall not be considered as operation time.

6.8.2 Failure. A failure is defined as any malfunction which a qualified operator or mechanic cannot remedy within 30 minutes (excluding waiting time) by using controls or any tools or parts which are furnished with the compressor or issued to a direct-support maintenance unit, and which causes or may cause:

- (a) Failure to commence operation, cessation of operation, or inability of the compressor to produce rated capacity.
- (b) Serious damage to the compressor by continued operation.
- (c) Serious personnel safety hazards.

6.8.3 Rough cross-country terrain. A very rough wavy hard surface, usually a "Belgian-block" or "chatter" test course.

6.9 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.

6.10 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."

6.11 Recycled material. It is encouraged that recycled material be used when practical as long as it meets the requirements of the specification (see 3.4).

Custodians:

Army - ME

Navy - YD

Preparing activity:

Army - ME

Project 4310-0157

Review activity:

Navy - MC

User activity:

Army - CE

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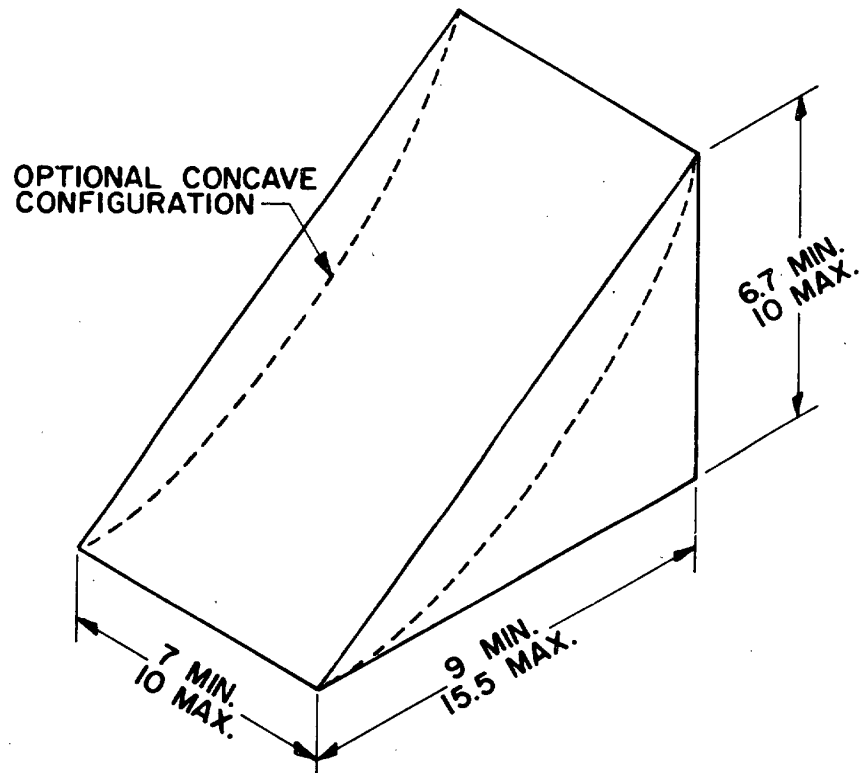


FIGURE 1. CHOCK BLOCK ASSEMBLY

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DATA SHEET		MFG NAME _____ P/N _____		Record Time & Amount of _____		1. Engine Oil Added _____ Sheet ____ of ____		2. Compressor Oil Added _____							
Test Title: _____		Run No. _____		Date _____											
Item		Sym	Units	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)	T _{wb}	°F												
4.	Pressure (Ambient)	P _b	In.Hg												
5.	Temp., Engine Coolant	T _{el}	°F												
6.	Temp., Engine Lubricant	T _{el}	°F												
7.	Temp., Compressor Lubricant	T _L	°F												
8.	Temp., Receiver Discharge	T _r	°F												
9.	Pressure, Rec.	T _r	PSIG												
10.	Pressure, Compressor Intake	P _a	PSIA												
11.	Temp., Compressor Intake	T ₁	°F												
12.	Temp, Upstream of Nozzle	T ₂	°F												
13.	Pres. Differential Across Nozzle	ΔP	In.H ₂ O												
14.	Comp. Speed	N	RPM												

FIGURE 2. Preproduction test log.

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MIL-C-555J Compressors, Air, Reciprocating and Rotary, Diesel Engine Driven

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