

MIL-S-4953C(USAF)
 15 August 1967

 SUPERSEDING
 MIL-S-4953B (ASG)
 7 January 1963

MILITARY SPECIFICATION

SPRAY OUTFIT, CORROSION PREVENTIVE COMPOUND AND ENGINE PREOILER, TRAILER MOUNTED, TYPE MA-2

1. SCOPE

1.1 This specification presents requirements for one type of portable, trailer-mounted, corrosion-preventive compound and engine preoiler spray outfit, designated type MA-2.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on the date of invitation for bids, form a part of the specification to the extent specified herein.

SPECIFICATIONS

Federal

CC-M-636	Motor, Alternating Current (Fractional Horsepower)
TT-E-529	Enamel, Alkyd, Semigloss
PPP-B-636	Boxes, Fiberboard

Military

MIL-P-116	Preservation, Methods Of
MIL-D-1000	Drawings, Engineering And Associated Lists
MIL-E-5272	Environmental Testing, Aeronautical And Associated Equipment, General Specification For
MIL-O-6081	Oil, Lubricating, Jet Engine
MIL-L-6082	Lubricating Oil; Aircraft Reciprocating Engine (Piston)
MIL-C-6529	Corrosion Preventive, Aircraft Engine
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-W-8005	Wheels And Hubs, For Industrial Pneumatic Tires
MIL-M-008090	Mobility, Towed Aerospace Ground Equipment, General Requirements For
MIL-C-8188	Corrosion-Preventive Oil, Gas Turbine Engine, Aircraft Synthetic Base

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MIL-A-8421	Air Transportability Requirements, General Specification For
MIL-S-8512	Support Equipment, Aeronautical, Special, General Specification For The Design Of
MIL-P-8585	Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity
MIL-A-8625	Anodic Coatings, For Aluminum And Aluminum Alloys
MIL-H-8794	Hose, Rubber, Hydraulic, Fuel, And Oil Resistant
MIL-E-11275	Engines, Gasoline, Industrial Type, General Specification For
MIL-P-16298	Electric Machines Having Rotating Parts And Associated Repair Parts: PackagingOf
MIL-C-20696	Cloth, Coated, Nylon, Waterproof
MIL-C-52078	Cap-Plug, Cap, And Plug, Protective, Plastic Dust And Moisture Seal

STANDARDS

Federal

FED-STD-595	Colors
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Military

MIL-STD- 129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking Of US Military Property
MIL-STD-143	Specifications And Standards Order Of Precedence For The Selection Of
MIL-STD-281	Automobiles, Trucks, Truck-Tractors, Trailers And Trailer Dollies; Preservation And Packaging Of
MIL-STD-826	Electromagnetic Interference Test Requirements And Test Methods
MIL-STD-831	Test Reports, Preparation Of
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking, And Waterproofing; With Appropriate Test Methods
MS3 3 586	Metals, Definition Of Dissimilar
MS51336	Lunette-Coupler, Drawbar, Ring

DRAWINGS

Air Force

52K6050	Spray Outfit-Corrosion Preventive Compound and Engine Preoiler, Trailer Mounted, Type MA-2
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Henry Spen & Co., Inc.

600113

Spray Gun Assembly-Corrosion Preventive Compound

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

National Bureau of Standards

Handbook H28

Screw-Thread Standards For Federal Services

(Application for copies should be addressed to the Superintendent of documents, Government Printing Office, Washington 25, D. C.)

National Electrical Manufacturer's Association

Standard MG-1

Standards For Motors And Generators

(Copies of the NEMA standard may be obtained upon application to the National Electrical Manufacturer's Association, Engineering Department, 155 East 44th Street, New York 17, New York.)

National Board of Fire Underwriters'

Pamphlet 70

National Electrical Code (Electric Wiring And Apparatus)

(Copies of the NBFU pamphlet may be obtained upon application to the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Massachusetts.)

3. REQUIREMENTS

3.1 Preproduction. This specification makes provision for preproduction testing (see 4.4) .

3 . 2 Components. The spray outfit shall consist of the following major components:

DESCRIPTION

SEE REQUIREMENT

a. Main storage tank

3.8

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b. Auxiliary tank	3.9
c. Electric heater	3.10
d. Pump(s)	3.11
e. Electric motor	3.12
f. Filter	3.13
g. Power plant	3.14
h. Application equipment	3.15
i. Delivery hoses	3.16
j. Hourmeter	3.17
k. Gages	3.18
1. Safety devices	3.19

3.2.1 Special tools. If special tools are required to perform field maintenance of the spray outfit, such tools shall be provided and located in the compartment specified in 3.6.6.1. Requirements for such tools shall be in accordance with MIL-S-8512.

3.3 General. The requirements specified on Drawing 52K6050 apply as requirements of this specification, with the exceptions and additions specified herein. When the drawing and this specification conflict, this specification shall govern.

3.4 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143, except as specified in 3.4.1 and 3.4.2.

3.4.1 Commercial parts. Commercial parts having suitable properties may be used where, on the date of invitation for bids, there are no suitable standard parts. In any case, commercial utility parts such as screws, bolts, nuts, and cotter pins, having suitable properties may be used provided:

- a. They can be replaced by the standard parts (MS or AN) without alteration.
- b. The corresponding standard part numbers are referenced in the parts list, and, if practical, on the contractor's drawings.

3.4.2 Standard parts. With the exception specified in 3.4.1, MS and AN standard parts shall be used where they suit the purpose. They shall be identified on the drawings by their part numbers.

3.5 Materials.

3.5.1 Protective treatment. When materials are used in the construction of the spray outfit that are subject to deterioration when exposed to climatic and environmental conditions likely to occur during service usage, they shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification. The use of any protective coating that will crack, chip, or scale with age or extremes of climatic and environmental conditions shall be avoided.

3.5.2 Metals. Metals shall be of the corrosion-resistant type or shall be suitably protected to resist corrosion during normal service life.

3.5.3 Dissimilar metals. Wherever possible, contact with aluminum or magnesium alloys shall be avoided. Wherever such contacts are unavoidable, they shall be properly insulated. Dissimilar metals are defined in MS33586.

3.6 Design and construction.

3.6.1 The spray outfit shall be designed to apply a hot corrosion-preventive mixture or hot preoiling fluid under hydraulic pressure to the internal parts of aircraft engines by means of a spray gun or preoiling adapters.

3.6.2 The spray outfit shall be constructed so that no parts will work loose in service. It shall be built to withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, installation, and service.

3.6.3 Any design which renders servicing, adjustment, or replacement unduly difficult or repeatedly necessary under field conditions shall not be acceptable.

3.6.4 All screws, pins, and bolts shall be furnished with standard locking devices. Safety wire, self-locking nuts, cotter pins, and lockwashers will be acceptable.

3.6.5 The spray outfit shall be a rigid, compact, self-contained unit adequately protected from severe stresses or distortions normally encountered in shop, station, base, or field transportation. The spray outfit shall be equipped with four wheels and automotive-type axles. Two springs shall be furnished on each axle to adequately support the fully loaded spray outfit under all conditions specified herein. The wheels with tires and hubs, size 6.00-9, shall conform to MIL-W-8005. The tread width shall be 49 inches. Knuckle-type steering incorporating tie rods and kingpins shall be provided on the trailer to provide a high degree of maneuverability. Adequate means for lubrication shall be provided. The cramping angle shall be not less than 40 degrees. A hinged tow bar, 3 feet in length, shall be provided and fitted with a lunette eye conforming to MS51336. A locking device shall be provided to hold the tow bar in a stowed position.

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3.6.5.1 Mobility. The spray outfit shall be constructed to withstand the stresses imposed when subjected to the requirements for Type II mobility in accordance with MIL-M-008090.

3.6.5.2 Air transportability. The spray outfit shall be designed for air transportability in the assembled condition in accordance with MIL-A-8421 with respect to-acceleration loads, tie downs, floor loading, and ramp clearances.

3.6.6 Accessibility. The spray outfit components shall be fully enclosed in a metal cabinet. All working parts, valves, handles, gages, and electrical outlets and components shall be accessible through convenient doors or movable panels.

3.6.6.1 Storage. The spray outfit shall have compartments for the storage of tools, a spray gun, adapters, fittings, nozzles, and operating manuals. The compartments shall be easily accessible from the outside, and shall be provided with devices arranged so that stored items cannot be dislodged during transit. A waterproofed compartment shall be provided for the operating manuals and shall be at least 3 by 9 by 12 inches.

3.6.7 Instrument and controls. All instruments, controls, and gages on the spray outfit shall correspond in appearance. All instruments, switches, controls, and outlets shall be plainly identified by engraved plates and shall be located on the instrument panel.

3.6.8 Application. The spray outfit shall be designed and constructed to apply a hot, corrosion-preventive mixture to the internal compressor sections of aircraft gas turbine engines. The corrosion preventive mixture shall be one of the following:

a. Type II blend. Corrosion-preventive compound consisting of one part Type I concentrate conforming to MIL-C-6529 and three parts of grade 1100 lubricating oil conforming to MIL-L-6082.

b. Type III blend. Corrosion-preventive compound consisting of one part of Type I concentrate conforming to MIL-C-6529 and three parts of grade 610 lubricating oil conforming to MIL-O-6081.

c. Corrosion-preventive compound conforming to MIL-C-8188.

3.6.8.1 The spray outfit shall be designed and constructed to apply hot preoiling fluids conforming to MIL-L-6082 for reciprocating aircraft engines and MIL-O-6081 or MIL-L-7808 for gas turbine engines.

3.6.8.2 All mechanisms and parts designed and constructed to contain flammable liquids shall be positioned, located, and ventilated to preclude the possibility of fire or other explosion caused by such liquid contacting heated surfaces or electrical apparatus.

3.6.8.3 The main and auxiliary compound storage tanks shall be positioned, located, and baffled to prevent spillage of compound or oil over other parts of the spray outfit.

3.6.9 Cabinet. The cabinet shall be constructed to resist weather and prevent water from collecting within the cabinet. All panels for access to the spray outfit components requiring maintenance or adjustment shall be provided with quick-release type fasteners.

3.6.10 Appearance. The spray outfit shall be assembled to form a neat and compact unit without excessive piping, tubing, or hardware and shall correspond in appearance with Drawing 52K6050. All pipes, tubes, valves, and fittings shall be well supported and shall not extend beyond the outer limits of the unit.

3.7 Performance. The spray outfit shall be capable of delivering to the spray gun nozzle a constant supply of corrosion-prevention compound at 10 gallons per hour (gph) and 150 pounds per square inch (psi) at a temperature of 235° Fahrenheit (F) $\pm 15^\circ\text{F}$. The spray outfit shall be capable of delivering to the spray gun a constant supply of preoiling fluid at a minimum rate of 180 gph and 80 psi at a minimum temperature of 100°F and a maximum temperature of 180°F.

3.7.1 Heating time. The corrosion-preventive compound shall be heated in a 12 gallon auxiliary tank to 235°F -115°F with electric heaters in not more than 30 minutes from an ambient temperature of 30°F. The mixture shall not be scorched and shall not exceed 250°F. The preoiling fluid shall be heated in the 12 gallon auxiliary tank to 170°F $\pm 10^\circ\text{F}$ with electric heaters in not more than 30 minutes from an ambient temperature of 30°F. The fluid temperature shall not exceed 180°F.

3.7.2 Pressure. The heated compound or oil shall be continuously pumped through a replaceable filter through one hose to the spray gun or adapters and returned to the preservative auxiliary tank through another hose. The compound shall be pumped at 150 psi. The preoiling fluid shall be pumped at 80 psi maximum. The pressure throughout the system shall not exceed 200 psi.

3.7.3 Heating capacity. The spray outfit shall be capable of heating 12 gallons of preservative compound or preoiling fluid per hour at a continuous flow rate. A total draw-off of 9 gallons of fluid shall be provided.

3.7.4 Temperatures. The spray outfit shall be capable of withstanding exposure to, but not operation in, temperatures ranging from -65° to +160°F.

3.7.5 Altitude. The spray outfit shall be capable of operating at altitudes up to 6,000 feet and at ambient temperatures ranging from 30° to 90°F.

3.7.6 Tilted position. The spray outfit shall be capable of operating in tilted position at angles up to 15 percent or 8 1/2 degrees from the horizontal.

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3.8 Main storage tank. The spray outfit shall be equipped with a main storage tank of 24 gallons capacity. The tank shall be constructed of sheet metal having a minimum thickness of Number 11 (0.1196 inch) manufacturer's gage and shall be hot dip galvanized after fabrication. A filler neck and cap shall be provided on the tank. The main storage tank shall supply the compound to the 12 gallon auxiliary tank by gravity. An air vent shall be provided in the tank to permit air and vapors to escape. The air vent shall be designed to preclude the entry of foreign particles in the tank. The tank shall be valved for drainage. A liquid level indicator shall be provided to accurately determine the quantity of oil in the main tank at all times.

3.9 Auxiliary tank. The auxiliary tank shall have a minimum capacity of 12 gallons. The tank shall be of all welded construction having a minimum thickness of Number 11 (0.1196 inch) manufacturer's gage and shall be designed to withstand twice the hydrostatic pressure of the compound. The tank shall be insulated so that the heat loss will be minimum. An air vent shall be provided in the auxiliary tank to vent into the space above the compound in the main storage tank for cleaning purposes. The tank shall be hot-dip galvanized after fabrication. Ports shall be provided in the tank for cleaning purposes. The tank shall be provided with the discharge line above the electric heaters.

3.9.1 The tank shall have provisions for immersion or cartridge-type electric heaters. The tank shall be piped and valved to permit the recirculation of the compound or oil through the hoses and return to the tank. The tank shall be provided with fittings and valves for attaching the delivery hoses. The tank shall be designed so that the electric heaters are covered with compound or oil under all operating conditions. The tank shall be provided with a valve to permit the entire tank to be drained.

3.10 Electric heater. An immersion or cartridge-type heater shall be provided in the auxiliary tank for heating the corrosion-preventive compound or the preoiling fluid. The heater shall be of sufficient wattage to heat the corrosion-preventive mixture from 30° to 235°F ±15°F or preoiling fluid from 30° to 170°F ±10°F in 30 minutes without burning or carbonizing the compound or oil. The heater shall be suitably located in the auxiliary tank to give an equal distribution of heat to the compound or oil and prevent scorching.

3.10.1 The heater shall operate on a 220 volt (V) 60 cycle, single phase power source. It shall be wired for operation from an outside power source or from the alternator on the unit. The heater shall not require more than 5,000 watts maximum.

3.10.2 The heater shall be placed in the auxiliary tank in a manner to permit ease of removal for repair or inspection.

3.11 Pump(s). The pump(s) shall be of the positive-displacement rotary-gear type. The pump(s) shall have a capacity for delivering preoiling fluid of not less than 180 gph at 80 psi and corrosion-preventive compound at 10 gph at 150 psi. If two pumps are provided, they shall be equipped with the necessary switches and instructions and diagrams to show their correct operation.

3.12 Electric motor. The pump shall be driven by an electric motor conforming to CC-M-636. The motor shall be an explosion-proof, capacitor start, induction run motor and shall be designed to operate on 220V, 60-cycle, single-phase alternating current. The motor shall be protected for continuous-duty service. The motor shall be suitable for operation in a minimum ambient temperature of 122°F with a temperature rise not to exceed the safe operating temperature limits of the insulating material used as specified in Standard MG-1. The motor shall be of sufficient horsepower to drive the pump to obtain the volume and pressures specified herein as recommended by the motor manufacturer.

3.13 Filter. A filter shall be provided in the system capable of collecting impurities that may clog the pump or spray gun nozzle. The filter shall be provided with a 40 micron element. The filter shall be located in the spray outfit for ease of removal and replacement of the filter element.

3.14 Power plant. The alternator shall be driven by an air-cooled gasoline engine conforming to MIL-E-11275.

3.14.1 Power. The normal rated power of the engine shall drive the engine cooling fan, pump, alternator, controls, and all other engine accessories. The engine shall be of sufficient horsepower to meet all requirements specified herein, as recommended by the engine manufacturer for continuous-duty operation.

3.14.2 Fuel tank. The fuel tank shall be incorporated as a part of the engine assembly and shall have a capacity sufficient to provide fuel for 4 hours minimum operation at rated load. The fuel tank and supporting frame shall be sufficiently rigid to insure freedom from vibration and assure that the tank will not be damaged during normal handling or use. A filler opening of 2 inches minimum diameter shall be provided. The opening shall be located in an accessible location on the outside of the cabinet. The cap shall be painted red. The filler opening shall be stenciled denoting the type of fuel to be used.

3.14.2.1 Fuel pump. If a fuel pump is used, it shall have sufficient capacity to supply the engine at its maximum rated load when lifting the fuel against a suction head of 4 feet.

3.14.3 Governor. The governor shall be capable of adjustment so that rated speed shall be maintained at normal rated load.

3.14.3.1 Variation in speed from no load to rated load and from rated load to no load shall not exceed ± 10 percent of rated speed, except that during instantaneous load changes, the momentary speed variations shall not exceed ± 10 percent of rated speed with the load variation not exceeding 75 percent of rated load.

3.14.3.2 Tachometer. An integral tachometer-hourmeter shall be provided on the engine instrument panel. The hourmeter shall record engine operating time only.

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3.14.4 An electrical starting system, manual starting system, and a battery charging system with relays shall be provided. The electrical system shall be 24V. A commercial battery shall be provided. Fuses or circuit breakers shall be provided as required to protect the electrical system.

3.14.5 Electrical equipment.

3.14.5.1 Alternator. An alternator shall be provided to supply power to the heater, safety controls, motor, and accessories. The alternator shall be rated at 6 kilowatt (kw), 7.5 kilovolt amperes (kva), 220V, 60 cycle, single phase alternating current (AC). The 220V supply shall be center tapped to provide 110V across each winding conductor. The center tap shall be grounded to the frame of the spray outfit.

3.14.5.2 The alternator shall conform to Standard MG-1. The temperature rise of the alternator and wiring shall not exceed the safe limits for the class of insulation used and as recommended by the alternator manufacturer. The output voltage and frequency of the alternator shall be within ± 3 percent of the rated value at rated speed when the load is varied from minimum load to 125 percent full load.

3.14.5.3 Panels.

3.14.5.3.1 Control panel. All instruments, gages, and controls shall be mounted on a control panel and shall consist of at least a voltmeter, ammeter, exciter-field rheostat, voltage-regulator rheostat, voltage-regulator switch and two 110V receptacles.

3.14.5.3.2 Switch panel. The switch panel shall incorporate an electric source selector level, heater switch, pump switch, panel light, and a compound-temperature gage.

3.14.5.3.3 The panel wiring and wiring arrangement shall be in accordance with Pamphlet 70. Care shall be exercised in wiring the control panel and making connections to the accessories.

3.14.5.4 Attachment cable. A three conductor Number 8 gage or larger, type SO heavy-duty attachment cable complete with a standard three wire twist lock plug shall be provided. The cable shall not be less than 35 feet long. The ground conductor shall be grounded to the spray outfit.

3.14.5.5 Valves. An electrical solenoid valve which will close by depression of a trigger shall be provided in the return line to permit pressure to build up at the gun. With the solenoid valve closed, a relief valve on the gun shall permit compound to spray from the gun nozzle. The relief valve shall be set to open at 150 psi. A safety valve shall be provided in the system to limit the pressure to 200 psi in the event of a clogged nozzle or kinked lines.

3.14.5.6 Electric timer. A hermetically sealed electric timer shall be provided in the electrical system between the trigger switch on the gun and the solenoid valve in the system. The timer shall close the solenoid valve when the trigger is depressed and cause the compound to spray from the nozzle. The timer shall be set to operate at 2 second intervals between spray injections. The timer shall be capable of being regulated to permit predetermined quantities of 50 cubic centimeters (cc) to a pint of compound to be sprayed. The timer shall be set to spray 50 ± 2 cc of corrosion-preventive mixture by one depression of the trigger. A switch shall be provided to bypass the timer during preoiling operations so the solenoid valve will remain closed as long as the trigger switch is depressed.

3.14.5.7 All electrical equipment, apparatus, and wiring used in operation from the local power source shall be explosion-proof. The explosion-proofing shall be suitable for use in class I, division II, group D atmospheres as specified in Pamphlet 70.

3.15 Application equipment.

3.15.1 Corrosion preventive compound. The gun and nozzle for spraying the compound shall be in accordance with Henry Spen & Co Drawing 600113, Revision C, with the following exceptions:

a. The handle shall be of a thermosetting plastic material which is resistant to damage by impact, oil and heat.

b. The cable conforming to Henry Spen & Co Drawing 100489 may be any suitable two-conductor cable with an oil-resistant cover and of suitable length to be taped or clamped to the delivery hoses.

c. The handle shall incorporate a moveable trigger which actuates a single-pole, single throw (normally open) switch. The trigger shall be positioned for operation by the operator's index finger.

d. The switch shall be installed inside of the handle and connected to the pin connector at the butt of the handle by installing the leads inside of the handle.

3.15.2 Preoiling fittings. The necessary fittings for applying the preoiling fluid shall be provided. The fittings shall be adaptable to fit on the end of a 6 foot length of hose which shall be fastened to the spray gun in lieu of the corrosion-preventive compound nozzle. The following fittings shall be provided :

a. 1 inch - 18 National Special (NS) threaded by 2 inches long

b. 3/4 inch - 14 National Taper Pipe (NPT) by 2 inches long

c. 1/4 inch - 18 NPT by 2 inches long

d. 1/8 inch - 27 NPT by 2 inches long

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3.15.2.1 Threads shall conform to Handbook H28. The relief valve on the spray gun shall be adjustable to obtain the specified preoiling delivery pressures.

3.16 Delivery hoses. Two hoses, in accordance with MIL-H-8794, shall be provided for circulating and spraying the corrosion compound. The hoses shall be 3/8 inch inside diameter and 35 feet in length. The fittings shall be as specified on Drawing 52K6050.

3.16.1 Hose and cable reel. A reel shall be provided with swivel fittings and an electrical take off to accommodate the two 35 foot hoses and one 35 foot cable specified in 3.14.5.4. The reel shall be equipped with a travel lock and shall operate manually to wind and unwind.

3.17 Hourmeter. The spray outfit shall be provided with an elapsed time indicator suitably adapted to 110V, 60 cycle AC. The hourmeter shall be of the counter type mounted on the spray outfit and displaying operating hours in 1 hour increments. The hourmeter shall record pump operating time.

3.18 Gages. The spray outfit shall be equipped with the necessary pressure relief valves, line-pressure gages, temperature gages, shut-off valves on the outlet and return lines, and drain valves required for safe and satisfactory operation of the unit. The pumping system shall be provided with inlet and outlet pressure gages. All gages shall have a range of 200 percent of the normal designed operating pressure. Unless otherwise prohibitive due to function or operation, the gages shall be located on the instrument panel.

3.19 Safety devices. The spray outfit shall be provided with all safety devices common to equipment of this type, including safety pressure relief valves, throttle valves, thermostats, blow off drain valves, and electrical overload protective devices. The pressure valves shall be piped for return of the compound into the storage tanks.

3.20 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The drawing number requirements of MIL-D-10 00 shall govern changes in manufacturer's part number.

3.21 Electromagnetic. The spray outfit shall be shielded against electromagnetic interference in such a manner that the interference will not exceed the limits specified in series 1001, MIL-STD-826 for class of equipment T (Electrical Tools and Similar Equipment). Test methods in the 5000 series and 6000 series are not applicable.

3.22 Noise level. The noise level of the spray outfit shall not exceed the limits specified herein for various frequency bands when measured approximately 5 feet above ground level at a distance of not more than fifteen feet from the unit at 90 degree intervals around the unit and also at the operator's panel and under all operating conditions. Maximum allowable noise level limits shall be:

<u>Frequency band</u> (cycles per second)		<u>Noise level limit</u> (db. Above 0.0002 dynes/cc ²)
20 to	75	108
75 to	150	98
150 to	300	90
300 to	600	83
600 to	1,200	78
1,200 to	2,400	75
2,400 to	4,800	72
4,800 to	10,000	71

3.23 Dimensions. The overall dimensions of the spray outfit shall not exceed:

- a. Height - 35 inches
- b. Length - 80 inches
- c. Width - 60 inches

3.24 Pipe threads. Pipe threads shall be in accordance with Handbook H28.

3.25 Finish. The exterior and interior surfaces not subject to high temperatures shall be finished with two coats or more of yellow enamel conforming to TT-E-529, color Number 13538 of FED-STD-595.

3.25.1 Exterior or exposed surfaces. All exposed parts, including iron and steel screws, nuts, bolts, washers, and lockwashers, shall be suitably protected against corrosion by permanent and impermeable finishes. For large bolts and nuts, painting shall be sufficient. The outside of all castings shall be smooth.

3.25.2 Interior (inclosed) surfaces. All interior surfaces shall be protected with a corrosion resistant coating.

3.25.2.1 All steel sheets shall have protective surface treatments and corrosion resistant finishes.

3.25.2.2 No magnesium alloys shall be employed.

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3.25.2.3 Aluminum-alloy surfaces not subjected to excessive heat shall be anodized in accordance with MIL-A-8625. Exterior aluminum alloy sheets within the cabinet shall be primed in accordance with MIL-P-8585 and given two or more coats of enamel conforming to TT-E-529, color Number 13538 of FED-STD-595.

3.25.2.4 Piping and fittings. All piping and fittings shall be of corrosion-resistant material or the exterior surfaces treated to resist corrosion.

3.26 Instruction panel. The spray outfit shall have an operating instruction panel impervious to oil and grease or weather, mounted on the inside of the spray outfit, and shall include the following information:

a. Operating and maintenance instructions, including detailed instructions for obtaining the proper percentage of corrosion compound.

b. Detail instructions for delivering the preoiling fluid.

c. Instructions for setting the timer.

d. Instructions for locking out the timer and delivering any amount of preoiling fluid.

e. An electrical diagram.

f. A lubrication diagram.

g. Procedures in the event of operating failure.

h. Identify pressure regulating valve and reference relationship to spray gun relief valve.

3.26.1 All controls shall be permanently and legibly marked as to identity and functions.

3.27 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.28 Workmanship.

3.28.1 General. The spray outfit, including all parts and accessories shall be constructed and finished in a thoroughly workmanlike manner. Particular attention shall be given to neatness and thoroughness of soldering, wiring, marking of parts and assemblies, welding and brazing, painting, riveting, machine screw assemblies, and freedom of parts from burrs and sharp edges.

3.28.2 Dimensions. Dimensions and tolerances not specified, shall be as close as is consistent with best shop practices. When dimensions and tolerances may affect the interchangeability, operation, or performance of the spray outfit, they shall be held or limited accordingly.

3.28.3 Screw assemblies. Assembly screws and bolts shall be tightened to the specified torque values for these assemblies.

3.28.4 Riveting. Riveting operations shall be carefully performed to insure that the rivets are tight and satisfactorily headed.

3.28.5 Welding. Where welding, brazing, or soldering is used in the fabrication of the spray outfit, the process used shall be in accordance with the highest commercial standards. No welding shall be resorted to as a repair measure, except that small blowholes in castings may be filled when not in critical areas provided that the procuring activity is fully informed of all pertinent details and approves the repair procedure prior to its accomplishment.

3.28.6 Cleaning. The spray outfit shall be thoroughly cleaned of loose spattered, or excess solder, metal chips, and other foreign material after final assembly. Burrs and sharp edges, as well as resin flash that may crumble, shall be removed.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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.

4.2 Classification of tests. The inspection and testing of the spray outfits shall be classified as follows:

- a. Preproduction tests.
- b. Acceptance tests.

4.3 Test conditions.

4.3.1 Apparatus. All instruments and apparatus used in determining the test results specified herein shall be of laboratory precision type and shall be in current calibration.

4.3.2.1 Liquid flow rates. Liquid flow rates shall be determined by weighing the efflux or by measuring a known volume over a time interval of not less than five minutes. Flowmeters shall not be used unless specifically approved by the procuring activity.

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4.3.2.2 Temperature. Temperature shall be measured by means of properly located thermocouples, thermistors or liquid-in-glass thermometers. Sensors, connectors, and lead wire shall be properly arranged, insulated and compensated to minimize error. Measurements shall be accurate to within $\pm 5^{\circ}\text{F}$. Readings shall be reported in degrees Fahrenheit.

4.3.2.3 Pressure. Insofar as is practicable, pressures and pressure differentials shall be measured by liquid manometers. Pressures exceeding the range of liquid manometers shall be measured with properly calibrated Bourdon tube type gages. Gages shall be of laboratory type having a dial diameter not less than four inches.

4.3.3 Preparation for test. Prior to testing, the spray outfit shall be prepared for testing by assembling, adjusting and servicing with the fuels and lubricants as specified in the operating and maintenance instruction manual.

4.3.4 Preliminary run-in. The nature and extent of run-in shall be as specified by the manufacturer.

4.3.5 Discharge pressure. The discharge pressure shall be the static pressure measured at the spray gun nozzle or at the discharge side of the 6 foot flexible hose used for preoiling.

4.3.6 Power. The engine driven alternator shall be used for all tests unless an outside 220V power supply is specified.

4.3.7 Fluid. Unless preoiling fluids are specified, corrosion preventive mixtures consisting of each of the mixtures specified in 3.6.8 shall be used in all tests. The preoiling fluids shall be as specified in 3.6.8.1.

4.3.8 Inspection, servicing and adjustment. Inspections, servicing and adjustments shall be performed only as specified in the operation and maintenance instruction manual unless such instructions are contrary to the requirements specified herein.

4.3.8.1 Planned stops may be made at each 25 hour interval during the endurance test for inspection, servicing and adjustments. The lapsed time shall be recorded on the adjustments. Any major adjustment shall be cause for rejection, correction and retest.

4.3.9 Data. Data sheets shall include all recorded data as specified herein. All data recorded in accordance with 4.4 shall be included in the test report in accordance with MIL-STD-831.

4.3.9.1 Readings. During the tests specified herein, at least the following data shall be recorded at intervals not greater than 30 minutes for performance demonstrations and other short duration tests and at intervals not greater than 2 hours during the endurance test specified in 4.6.8.

- a. Date
- b. Time
- c. Ambient temperature (dry bulb and wet bulb)
- d. Atmospheric pressure
- e. Liquid flow rate (pounds per minute and gallons per hour)
- f. Static pressure at the nozzle
- g. Cabinet temperature
- h. Engine revolutions per minute and total hours operated
- i. Pump pressure
- j. Temperature of mixture at the nozzle
- k. Alternator output voltage and frequency
- l. Amperage readings (Alternator output and pump motor)

4.3.9.2 Notes. Notes shall be included to indicate adjustments, servicing, leaks, vibrations, operation of unit and auxiliary equipment and any other irregularities and corrective measures taken.

4.4 Preproduction tests.

4.4.1 Preproduction test report. After the preproduction tests are completed, a preproduction test report shall be prepared in accordance with MIL-STD-831.

4.4.2 Preproduction test samples. When required by the procuring activity the contractor shall submit the two samples subjected to preproduction testing to the procuring activity which will use them for the following:

- a. An inspection of the mechanical construction of the spray outfit.
- b. To perform any tests included in the specification after reviewing the contractor's test report.

4.4.3 Tests. Preproduction tests shall consist of all tests specified in 4.6.

4.4.3.1 Part failures. If during the preproduction testing of the spray outfit, a part fails, that part will be replaced with a redesigned part or one of a different material, unless the procuring activity authorizes the installation of a new part of the original design and material for one which failed due to faulty material or workmanship. The preproduction testing will be considered completed only when every major part in the unit has passed all tests. At the discretion of the procuring activity, redesigning and retesting may be required of any part or component which

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fails or indicates weakness after completing its preproduction test, but which is retained in the unit to complete testing of the parts.

4.4.4 Electrical certification. The contractor shall submit proof that the electrical equipment specified in 3.14.5 which will be supplied under this specification conforms to the requirements of Pamphlet 70. The label or listing of the Underwriters' Laboratories, Inc. will be accepted as evidence of conforming to the requirements.

4.4.4.1 In lieu of the label or listing, the contractor may submit independent proof satisfactory to the procuring activity that the electrical equipment conforms to the requirements of Pamphlet 70. Compliance with these requirements does not absolve the contractor from complete compliance with the other requirements of this specification.

4.5 Acceptance tests. Acceptance tests shall consist of the following:

- a. Individual tests
- b. Sampling plan and tests

4.5.1 Individual tests. Each spray outfit shall be subjected to the following tests as described under 4.6.

- a. Examination of product
- b. Dielectric strength
- c. General operation

4.5.2 Sampling plan. One spray outfit shall be selected at random from each lot of fifty or fraction thereof on the order and subjected to tests in 4.6.4.1 through 4.6.4.4.

4.5.2.1 Lot. A lot shall consist of spray outfits manufactured under essentially the same conditions and submitted for inspection at substantially the same time.

4.5.2.2 Rejection and retest. When one or more spray outfits from a lot fail to meet the specification, acceptance of all spray outfits in the lot shall be withheld until the extent and cause of failure are determined. After corrections have been made, all required tests shall be repeated.

4.5.2.3 Individual tests may continue. For production reasons, individual tests may be continued pending the investigation of a sampling test failure. Final acceptance of the entire lot or lots produced later shall not be made until it is determined that all items meet all the requirements of the specification.

4.5.3 Defects in spray outfits already accepted. The investigation of a test failure could indicate that defects may exist in spray outfits already accepted. If so, the contractor shall fully advise the procuring activity of all defects likely to be found and methods of correcting them.

4.6 Test methods.

4.6.1 Examination of product. The spray outfit shall be inspected to determine compliance with the requirements specified herein with respect to materials, workmanship, dimensions, and marking.

4.6.2 Dielectric strength. The motor alternator and the electrical system shall be subjected to a dielectric strength test at a potential of 1,450 volts for one minute. Any current leak shall be cause for rejection.

4.6.3 General operation. The spray outfit shall be checked during operation for general performance of safety features. All valves, pump, heating system, and other controls shall be checked to assure proper operation of the spray outfit. This checking shall be performed during the test specified in 4.6.4.1 and 4.6.4.3.

4.6.4 Performance demonstration. The following tests shall be conducted in the order given.

4.6.4.1 The spray outfit shall be operated for 30 minutes pumping the preoiling fluid at a rate of 180 gph at a pressure of 80 psi heated to a maximum temperature of $100^{\circ}\text{F} \pm 10^{\circ}\text{F}$ with the electric heaters. After this test, the unit shall be filled with the preservative compound and the compound heated from 30°F to $235^{\circ}\text{F} \pm 15^{\circ}\text{F}$ in 30 minutes or less. The preservative compound shall then be pumped for 30 minutes at a rate of 10 gph at a pressure of 150 psi. The timer or spray gun shall not be used in this test.

4.6.4.2 The spray outfit shall be operated for 30 minutes delivering the heated corrosion-preventive compound through the spray nozzle at a rate of 1 pint per minute at 150 psi. The timer shall not be used in this test.

4.6.4.3 The spray outfit shall be operated at 150 psi delivering the heated corrosion-preventive compound through the nozzle with the timer on the gun in operation. The trigger shall be depressed 30 times. The quantity of compound delivered at each depression of the trigger at the spray gun shall be 50 ± 2 cc. The quantity delivered shall be the average of six measurements taken during the test.

4.6.4.4 The spray outfit shall be operated at 150 psi delivering the heated corrosion-preventive compound through the nozzle with the timer on the gun set for delivery of 1 pint at each depression. This operation shall be repeated 30 times. The quantity delivered shall be the average of six measurements taken during this operation.

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4.6.4.5 The spray outfit shall be operated at 150 psi delivering the heated corrosion compound through the nozzle with the timer set for 1/2 pint delivery at each depression. An outside power source of 220V shall be used. The trigger shall be depressed and recycled 30 times. The quantity delivered shall be the average of six measurements taken during this operation.

4.6.4.6 Mobility tests. The spray outfit shall be subjected to the tests specified in MIL-M-008090 for type II mobility.

4.6.4.7 Electromagnetic interference. The spray outfit shall be tested as a complete unit in accordance with MIL-STD-826. Test methods shall be as described in method 1001 for class Gi equipment. Test methods in the 5000 series and 6000 series are not applicable.

4.6.4.8 Operation in tilted position. The spray outfit shall be tilted in four different positions at an angle of 15 percent or 8 1/2 degrees from the horizontal plane. Using preoiling fluid, the spray outfit shall be operated, for 15 minutes, as specified in 4.6.4.1 in the four positions. The unit shall be permitted to stand for 4 hours in the tilted position most conducive to fuel leakage. Using preoiling fluid, the unit shall then be started and operated, for a period of 15 minutes, as specified in 4.6.4.1. Observation shall be made to determine that complete lubrication is maintained during all phases of the tilted operation and the heaters are completely covered with compound.

4.6.4.9 Noise level. The noise level of the spray outfit shall be measured at a number of points on a circle around the spray outfit not more than 15 feet from the unit in a horizontal plane, and also at the operator's control panel. Measurements shall be taken out-of-doors in a plane 5 feet above the ground. A type 759A General Radio Company sound level meter, or equal, shall be used to test for noise level. The noise level of the spray outfit shall not exceed the limits specified in 3.22 under any operating condition.

4.6.5 Transportability. The spray outfit shall be subjected to landing and acceleration loads in accordance with the requirements of MIL-A-8421.

4.6.6 Serviceability. The serviceability of the complete assembly shall be evaluated from the standpoint of ease of operation, servicing, and maintenance. Particular attention shall be directed toward maintenance with a minimum number of common tools, servicings, and provisions made to exclude dirt, snow, and ice from the cabinet, tanks, and working parts.

4.6.7 Environmental. The environmental and endurance tests may be conducted on separate units so that the time required for testing will be held to a minimum and that the endurance test may be conducted on units not requiring a complete disassembly for cleaning prior to conducting the endurance tests.

4.6.7.1 High temperature exposure. The spray outfit shall be placed in a test chamber and exposed to high temperature test Procedure II of MIL-E-5272. Upon completion of the exposure period, the spray outfit shall be removed from the test chamber and examined. There shall be no evidence of softening of thermoplastic materials or other damage.

The spray outfit shall be subjected and satisfactorily complete the tests specified in 4.6.4.1 while still at the high temperature.

4.6.7.2 Low temperature exposure. The spray outfit shall be placed in a test chamber and exposed to an ambient temperature of $-65^{\circ} \pm 2^{\circ}\text{F}$ for a period of 48 hours. Upon completion of the exposure period, the spray outfit shall be removed from the test chamber. After warming up to a temperature of $30^{\circ} \pm 2^{\circ}\text{F}$, the spray outfit shall satisfactorily complete the tests specified in 4.6.4.1.

4.6.7.3 Altitude. The spray outfit shall be placed in a test chamber or under conditions equivalent to 6,000 feet altitude and an ambient temperature between 30° and 90°F . The spray outfit shall be subjected to the tests specified in 4.6.4.1.

4.6.8 Endurance. The endurance test shall be conducted on the complete spray outfit. The endurance test shall consist of 300 hours operation in an ambient temperature of 30° to 90°F . The preoiling fluid shall be recycled in the system for this test. The pumping rate shall be 180 gph at a pressure of 80 psi with the oil heated to a temperature of 180°F maximum. Inspections, servicing and adjustments may be made in accordance with 4.3.8.1.

4.6.9 Performance check. Immediately following the test specified in 4.6.8 and without intervening reconditioning, the spray outfit shall be subjected to the tests specified in 4.6.4.1. The change in performance shall not exceed 2 percent above or below the specified requirements.

4.7 Inspection of the preservation, packaging, packing and marking for shipment and storage. Sample items or packs and the inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of Section 5, or the documents specified therein.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C as specified (see 6.2).

5.1.1 Level A. The trailer chassis and engine shall be preserved and packaged in accordance with MIL-STD-281.

5.1.1.1 Electrical equipment. All electrical equipment, apparatus, and wiring, used to operate the power source of the spray outfit, shall be preserved and packaged in accordance with MIL-P-16298.

5.1.1.2 Delivery hoses. Openings of the delivery hoses shall be sealed with plastic plugs conforming to MIL-C-52078. The hoses shall be coiled to a safe diameter and tied. Coiled hoses shall be placed in the storage cabinet in a manner to prevent abrasion.

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5.1.1.3 Spray gun. The spray gun shall be preserved with type P-10 preservative in accordance with MIL-P-116, Method I. The preserved spray gun shall be packaged in a fiberboard box conforming to PPP-B-636, grade V3C. Closure shall be in accordance with the appendix of PPP-B-636. The packaged spray gun shall be placed in the storage cabinet.

5.1.1.4 Internal surfaces. All internal surfaces of the main and auxiliary tanks, pumps, valves, and lines, subject to corrosion, shall be preserved by flushing with type P-10 preservative in accordance with MIL-P-116.

5.1.1.5 Physical protection. All items secured within the storage compartment of the cabinet housing shall be cushioned in accordance with MIL-STD-1186.

5.1.1.6 Shrouding. Each cabinet inclosure of the spray outfit shall be covered with a shroud conforming to MIL-C-20696, type II, class 2. The shroud shall be provided with adequate tie down facilities.

5.1.2 Level C. The spray outfits shall be preserved and packaged in accordance with the manufacturer's commercial practice.

5.2 Packing. Packing shall be level A, B or C as specified (see 6.2).

5.2.1 Level A, B or C. Each spray outfit preserved and packaged as specified in 5.1.1 or 5.1.2 shall be shipped mobile (uncrated).

5.3 Marking. In addition to any special marking required in the contract or order, the spray outfits shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The type MA-2 spray outfit is intended for use in conjunction with the storing and preoiling of reciprocating and gas turbine aircraft engines. The spray outfit is intended for use in the application of a predetermined amount of hot corrosion-preventive compound to the internal parts of aircraft engines and for preoiling aircraft engines prior to initial run-in.

6.2 Ordering data. Procurement documents should specify:

- a. Title, number, and date of this specification.
- b. Level of packaging and packing required (see Section 5) .
- c. Where the preproduction test samples should be sent, the activity responsible for testing and necessary instruction concerning the submittal of test reports (see 4.4.1 and 4.4.2).
- d. Any drawings, instructions, spare parts or other items that should accompany the test samples.

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6.3 Identification of changes. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodian:
Air Force - 82

Preparing Activity:
Air Force - 82

Review Activity:
Air Force - 82

Project Number 4940-F002