INCH-POUND

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MILITARY SPECIFICATION

CLEANER, STEAM, PRESSURE JET, WHEEL-MOUNTED

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

1. SCOPE

1.1 Scope. This specification covers two sizes of electric-motor-driven, wheel-mounted, oil-fired, pressure jet, steam cleaners with a minimum discharge capacity of 100 gallons per hour (gph) or 180 gph.

1.2 Classification. Steam cleaners will be of the following sizes, as specified (see 6.2).

Size	Rated capacity	Rated discharge pressure
1	100 gph	100 psig 1/
2	180 gph	100 psig

1/ Pounds per square inch gauge.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer (Code 156), Naval Construction Battalion Center, Port Hueneme, CA 93043-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4940

SPECIFICATIONS

FEDERAL

P-C-437 - Cleaning Compound, High Pressure (Steam) Cleaner.
WW-C-624 - Coupling Assembly, Hose (Garden, Water, and Water Suction).
ZZ-H-561 - Hose, Rubber, and Hose Assemblies, Rubber, Smooth Bore, Water Suction and Discharge.
ZZ-H-601 - Hose and Hose Assemblies, Rubber (Yarn or Fabric Reinforced) Water Service.

MILITARY

MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-S-12651 - Sprayers, Packaging of.
MIL-C-22542 - Cleaning Compound, High Pressure Cleaner, Liquid.
MIL-H-28596 - Hose and Hose Assembly, Rubber, Steam.

STANDARDS

FEDERAL

FED-STD-H28 - Screw Thread Standards for Federal Services.
FED-STD-595 - Color

(Unless otherwise indicated, copies of the federal and military specifications, and standards are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.1.2 Other Government documents and publications. The following other Government documents, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA 29 CFR 1910.95 - Occupational Noise Level.

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents that are DOD adopted are those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DODISS are the issues of the non-Government documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI B2.4 - Hose Coupling Screw Threads.

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2156 - Smoke Density in Flu Gases from Burning Distillate Fuels, Test for.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
NEMA MG 1 - Standards for Motors and Generators.
NEMA WD 1 - General Purpose Wiring Devices.

(Application for copies should be addressed to the National Electrical Manufacturers Association, 2101 L Street, N.W., Washington, DC 20037.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 - National Electrical Code.

(Application for copies should be addressed to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

SAE J534 - Lubrication Fittings.

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

UNDERWRITERS LABORATORIES INC. (UL)

UL 62 - Flexible Cord and Fixture Wire.
UL 372 - Primary Safety Controls for Gas-and Oil-Fired Appliances.

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

(Non-Government standards and other publications are normally available from the organizations that prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Description. The steam cleaner (referred to hereinafter as cleaner) shall consist of a frame, water, soap, fuel, and electrical systems and all controls, gages, vapor-cleaning gun, and on wheeled-undercarriage.

3.1.1 Standard commercial product. The cleaner shall, as a minimum, be in accordance with the requirements of this specification. Additional or better features which are not specifically prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the cleaner being furnished. A standard commercial product is a product which has been sold or is currently being offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

3.2 First article. When specified (see 6.2), the contractor shall furnish one cleaner for first article inspection and approval.

3.3 Materials. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material, and articles incorporated in the work covered by this specification are to be new and fabricated using materials produced from recovered materials to the maximum extent possible without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. Unless otherwise specified, none of the above shall be interpreted to mean that the use of used or rebuilt products are allowed under this specification.

3.3.1 Dissimilar metals. Contact between dissimilar metals likely to cause deterioration of parts by galvanic corrosion shall be avoided. When such contact cannot be avoided, joints between similar metals shall be protected against galvanic corrosion by plating, coating, insulation, gaskets, or other suitable means. Bolts, nuts, pins, screws, and other fastenings shall be of the same material as the metals joined or shall be cathodic to the metals joined.

3.4 Interchangeability. All units of the same classification furnished with similar options under a specific contract shall be identical to the extent necessary to insure interchangeability of component parts, assemblies, accessories, and spare parts.

3.5 Design. The unit shall be designed to permit easy accessibility for maintenance and service in the field. The design shall be such as to prevent conditions hazardous to personnel or deleterious to equipment. The cleaner shall be designed for a portable cleaning operation, and shall remove dirt, grease, and oil from vehicles, accessories, and ground equipment by means of a cleaning compound.

3.6 Construction. The cleaner shall be complete so that when hooked into electric power and water supply, it can be used for the operations specified herein. The cleaner 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, and operation. Construction of its instruments and gages, as such, shall provide for accuracy of measurement and reading. Working parts, as applicable, shall be protected from dirt, snow, and ice.

3.6.1 Safety. All parts which are subject to high operating temperatures, or which are energized electrically, shall be insulated, fully enclosed, or guarded when such parts may come in contact with personnel or otherwise would create hazard. All moving parts hazardous to personnel shall be enclosed or guarded. Exhaust or discharges from the burner shall be directed so that they do not endanger personnel. Nonfunctional sharp edges, projecting points, and excessive length of fastening devices shall be avoided. Protective devices shall not impair the operating functions. Warnings shall be mounted on or near the components containing hidden hazards. Steam cleaner noise levels shall not exceed 85 decibels when measured on the A scale of a standard sound level meter at slow response at a height of 5 feet and no greater than 6 feet away from the cleaner. If the combined noise level during any mode of operation measured at the operators position, no greater than 10 feet from the cleaner, exceeds the value for an 8-hour exposure level as recommended in OSHA 29 CFR 1910.95, a warning sign shall be attached to the cleaner in a location conspicuous from the control panel stating that hearing protection is required when operating the cleaner.

3.6.1.1 Safety devices. Each cleaner shall be furnished but not limited to motor overload protection, a pressure-relief valve, a fuel cutoff, primary safety control, manual valves, low water cutoff, and protection against electric shock. Closing of the vapor gun valve shall shut off the supply of fuel, water discharge, and dispensing of cleaning detergent.

3.7 Enclosure. Cleaner shall be provided with metal enclosure covering the cleaner components, with the exceptions of water inlet connections, discharge outlets, gages, and the electrical outlet. Working parts which shall be accessible through doors, removable panels, or movable covers shall be secured, hinged, or latched. Provisions to be able to padlock the control panel to prevent any un-authorized operation of the cleaner shall be included. The enclosure (s) shall be designed and constructed to resist weather and to prevent water from collecting. All normally operated valves and controls shall be easily accessible.

3.7.1 Stowage. Stowage compartment shall be provided for stowing technical publications, tools, and nozzle tips. The stowage compartment shall be arranged so that stowed items cannot be lost or dislodged during transit.

3.7.2 Racks. Racks shall be attached to the cleaner for stowing the cleaning gun assembly and all hoses when not in use.

3.7.3 Metal thickness. Frame and superstructure shall be fabricated from not less than No. 16 gage sheet metal. A minimum thickness of No. 21 gage sheet steel shall be used for the side paneling.

3.8 Maintainability. All major assemblies shall be accessible for maintenance, repair, and replacement without the removal of assemblies and installed attachments not normally removed. Covers or plates which must be removed for component adjustment, repair, replacement, or maintenance shall be equipped with a quick-disconnect fasteners. Drain outlets shall be located for accessibility. All fasteners shall be of corrosion-resistant material. All screw threads shall be in accordance with FED-STD-H28.

3.9 Mobility. Size 1 cleaners shall have an undercarriage with a minimum of two 8-inch by 2-inch size solid or pneumatic-tired wheels on a common axle, and a supporting leg(s) or wheel(s) on the other end of the unit with manufacturer's standard handle bar(s). Size 2 cleaners shall have an undercarriage on a minimum of four 10-inch by 2.75-inch size solid or pneumatic-tired wheels. The rear two wheels of size 2 unit may be mounted on a common axle. The front two wheels of size 2 unit shall be mounted on a swivel with a tee-shaped towing bar that swings easily when towed by hand.

3.10 Performance.

3.10.1 Cleaner capacity. The cleaner shall be capable of continuous delivery of steam at the rated capacity and pressure (see 1.2), with or without cleaning compound.

3.10.2 Heater efficiency. When operating under continuous load, the vapor generator shall have an overall thermal efficiency of not less than 75 percent and emissions shall not exceed No. 2 on the Bacharach scale (see ASTM D 2156).

3.10.3 Burner generating capacity. The burner shall heat within 5 minutes, cold water (40 degrees Fahrenheit (°F) to 55°F) to within 10°F of the saturation temperature at the rated operating pressure.

3.10.4 Operating pressure, volume, and impact. At constant rated pressure, the cleaner shall deliver the rated capacity and develop the minimum impact forces indicated in figure 1. The rated pressure of the cleaner shall be marked on the unit. The cleaner solution plumbing shall be capable of withstanding a static pressure of two times the maximum working pressure.

3.10.5 Storage and operating temperatures. The cleaner, when drained, shall withstand storage without damage in an environment with a temperature range of -40°F to +125°F, and shall operate effectively in a temperature range of +40°F to +125°F ambient temperature. The cleaner shall operate effectively at altitudes up to 2,000 feet without requiring readjustment and with minor air adjustment up to 6,000 feet.

3.10.6 Water supply. Each cleaner shall be equipped to secure water from any of the following sources:

a. Tap-pressure system operating from 25 pound-force per square inch gauge (psig) to 125 psig.
b. For size 2 only, when specified (see 6.2), the water system shall be provided with valves and hose (see 3.25) to allow pumping water from tank, well, stream, or other source. The pump suction shall be capable of lifting water a minimum of 6 feet during operation at full cleaner capacity.

3.11 Electrical equipment. Electrical components including the motors, starters, relays, switches, and wiring, shall conform to NFPA No. 70 and enclosure in accordance with NEMA ICS 6, type 4. Unless otherwise specified (see 6.2), cleaners shall operate on 115 volt (V), 60 Hertz (Hz), single phase, electric power. The conductors and electrical components shall withstand an electrical potential of no less than 1,000V root mean square (RMS) at 60 Hz to ground without breakdown when tested as specified in 4.4.3.7. All wires, conduit, and electrical components shall withstand the temperatures of normal operation. All wiring and conduits shall be secured to prevent contact with hot components. There shall be no exposed electrical connections.

3.11.1 Electric motors. Electric motors shall conform to NEMA MG 1. Motors shall have sealed windings with class B insulation or better, dripproof construction, and be designed for continuous operation.

3.11.2 Motor switch. A manually operated switch shall be provided and shall be easily accessible from the operators side of the cleaner and guarded against weather.

3.11.3 Power cord. Unless otherwise specified (see 6.2), a 25 feet power cable conforming to UL 62 shall be furnished. Power cable shall be three conductor, type SO or SJO with stranded copper conductors, size 14 American Wire Gauge or larger. The cord shall be provided with a flexible strain relief at the end attached to the cleaner. The plug end of the cord shall be terminated in either a NEMA WD 1, type 5-15P or type 6-15P, as applicable, or UL approved 2-pole, 3-wire grounding type plug with dead-front weatherproof construction.

3.12 Heating coil. The heating coil shall be of the continuous-coil type, welded steel construction, and capable of withstanding a hydrostatic test pressure of not less than 1,000 psig. The heater coil shall be not less than a minimum inside diameter (id) of 1/2 inch. The heating coil shall be designed and arranged to permit deliming and easy removal for repairs

and replacement, and to prevent formation of excessive carbon deposits on any part of the coil. The steam generator shall contain no drums or extended pressure chambers. Suitable shutoff valves shall be provided at the heating coil inlet and outlet for reverse flushing of the heating coil, and means shall be provided to prevent heated water backflow into supply line in case of water supply failure.

3.12.1 Blowdown. Cleaners shall have the capacity of a forward blowdown cycle. The blowdown shall remove scale and deposits from the heating coils and increase the time between descalings by allowing the heat to remain on for a time with no water flowing to the coil. The heat dries and cracks the deposits. A full volume of water is then introduced into the coil flashing to steam which creates sufficient pressure to loosen scale and sludge and flush it out of the coil. Blowdown controls and steam outlets shall be designed and located to preclude operator injury and cleaner damage. Blowdown instructions and safety notes shall be permanently attached to the cleaner, near or at the blowdown controls.

3.13 Valves. Valves and fittings shall permit complete drainage, blowdown, and reverse flushing. The heating coil shall be equipped with accessible connections and fittings to permit the introduction and circulation of a scale-removing solution of muriatic acid containing 2 percent (by weight) of paraformaldehyde inhibitor. An auxiliary pump is not required.

3.14 Pressure gages. Dial-type pressure gages of a 2-inch minimum diameter, reading from zero to 200 psi, shall be provided to the coil inlet and outlet side and also to the outlet side of the fuel pump. The gages shall be dampened against vibration or fluctuation. The gages shall be of such quality as to be durable and dependable in service under continual pulsating pressure conditions. Gages shall be flush-mounted in the control panel.

3.15 Burner. The burner shall be of the pressure-atomizing or air-atomizing type, equipped with automatic electric ignition. The burner shall be capable of burning any fuel in the classification of light diesel fuel, kerosene, or jet fuel (30 to 50 API gravity). A manually operated shut off valve shall be installed in the fuel supply line.

3.15.1 Primary safety control. The oil burner shall be equipped with a primary safety control (flame sensor) that senses the presence or absence of flame, in the event of ignition failure or unintentional flame extinguishment shall cause the burner to shut down. Operation of the burner and the fuel flow shall be terminated and require manual reset for reignition if a flame is not established within 45 seconds, insufficient air is supplied for combustion, or the flame becomes erratic. The flame sensor shall be the heat or flame sensing type, and shall not be aided by reflective devices, and shall not be the spark-sensing type. The primary control shall conform to UL 372.

3.15.2 Burner location. The burner shall be so located that openings where fuel or products of combustion might escape are 34 inches above ground level to minimize the danger of vapor explosion. The burner shall be

installed in a manner to facilitate cleaning and replacement. The burner shall be designed and located to preclude the possibility of condensate dripping on the burner components.

3.15.3 Ignition for burner system. The ignition system shall provide a continuous spark of sufficient intensity and capacity to insure positive ignition of the fuel used during all conditions of operation.

3.16 Fuel limit device. The fuel system shall be equipped with an antidribble device and safety shutoff. When the fuel pressure or flow is insufficient for total atomization, the shutoff device shall completely stop the flow of fuel to the burner.

3.17 Automatic safety control. An automatic safety control shall be provided to shutoff the flow of fuel in the event of water failure during operation, during any period of excessive coil temperature or pressure, or in the event of flame failure.

3.18 Combustion chamber. The combustion chamber shall automatically be purged for 15 seconds before each start. The combustion chamber shall be protected against flame impingement.

3.19 Fuel tank design. The fuel tank shall be fabricated from no less than 18 gauge sheet metal. The tank shall be sealed to prevent possible seepage, splashing, or leakage of other liquids that might contaminate the fuel in the tank. The fuel tank shall have a sufficient capacity for a minimum of 4 hours operation.

3.19.1 Fuel tank accessories. The fuel tank shall be provided with a filling inlet suitably capped and vented. The filler-neck shall be so designed as to preclude any spillage from running into machine components. A strainer shall be in the filler-neck. The tank shall be provided with a drain valve or plug. The fuel line shall have a suitable strainer located between the fuel tank and fuel pump and shall be equipped with a shutoff valve between tank and strainer.

3.19.2 Fuel tank location. The fuel tank shall be so located as to prevent spilled fuel from dripping on the motor, transformer, electric wiring, or to other components of the cleaner.

3.20 Fuel pump. The fuel pump shall have a maximum capacity of 4 gph at 130 psig, be packless, and have an adjustable bypass to the fuel tank when a gear driven pump is used. Diaphragm pump application shall not require an adjustable bypass.

3.21 Water pump. The pump shall be a positive displacement type capable of handling either water or cleaning solution at a constant rate of delivery.

3.21.1 Pump construction. The pump shall be of inherently sealed construction to insure constant maximum capacity under continuous operation. The pump shall have all intake and discharge valve parts, such as disks,

balls, seats, and springs made of Monel or of stainless steel. The intake and discharge valve parts shall be of such a design that they can be readily replaced. The pump material shall be resistant to the cleaning acid solution and cleaning compound.

3.21.2 Shock-absorbing device. Units provided with a reciprocating or impulse type pump shall be equipped with a shock-absorbing device.

3.22 Cleaning solution systems. The cleaning solution system shall be designed to handle liquid or powder cleaning compound as specified (see 6.2). Liquid compound shall conform to MIL-C-22542 while powder compound shall conform to P-C-437. The cleaning solution shall be introduced at the pump suction or at the coil outlet, manually adjustable from zero to 10 percent by volume. The metering valve shall be located at the control panel and shall indicate the ratio in 0.5 percent increments and numbered at one percent intervals.

3.22.1 Liquid cleaning compound. When designed for liquid cleaning compound, the cleaner shall be provided with a rack to secure a 5-gallon liquid solution container or a solution tank as specified (see 6.2). When a solution tank is required, the tank shall be fabricated from stainless steel plate or high density polyethylene. The tank shall have a capacity of no less than 5-gallons, properly vented and provided with means to determine the liquid level inside the tank. The tank shall be in accordance with the manufacturers standard practice, and shall be installed where the spilled cleaning compound will not drip or splash onto the burner or any electrical components.

3.22.2 Powder cleaning compound. When designed for powder cleaning compound, the same tank as in 3.22.1 shall be furnished, except that an agitator conforming to manufacturers design to keep the powder and water in solution shall be included.

3.22.3 Measuring container. When specified (see 6.2), a measuring container with a capacity for not less than 60 ounces (oz) of cleaning compound shall be provided for each cleaner. The container shall be marked in increments of 10 oz to facilitate the addition of 10 oz of compound for every gallon of water in the solution tank. Means shall be provided to secure the measuring container by the clamps, hangers, or other devices in a location adjacent to the solution tank. The device for holding the container shall permit removal of the container without the use of tools. The capacity and markings of the measuring container shall be based on a cleaning compound weight of 60 pounds per cubic foot.

3.23 Drainage. Means shall be provided for completely draining the solution tank. The drain connection shall include such piping and fittings as are required to provide ready accessibility for manual control of the discharge flow. The drain outlet shall be so located that the solution will not drain onto other components or structural members of the cleaner. The drain connection and any associated piping and fittings shall have a nominal pipe size of not less than 1/2 inch.

3.24 Delivery equipment. A vapor-cleaning gun 4-1/2 feet long, having a nozzle and self-closing valve, shall be furnished. Each gun assembly shall include an insulated swivel handle and insulated or air-cooled grips. No less than three nozzles shall be provided. The vapor nozzles shall include one round nozzle with a hardened tip, one 2-inch flat nozzle, and one 4-inch flat nozzle.

3.24.1 Delivery hoses. A set of delivery hoses shall be provided for each steam cleaner. The set shall consist of one 50-foot and one 25-foot long hose complete with all necessary couplings to connect both lengths of hose together and to make connections to the cleaner and the cleaner gun. The delivery hoses shall meet the construction and test requirements of MIL-H-28596 except that the male pipe-threaded hose nipples shall be held in place with bolting clamps and the size shall be 1/2-inch id.

3.24.2 Bypass or relief valve. A pressure bypass or relief valve shall have relieving capacity to keep the operating pressure of a cleaner not more than 10 percent greater than the rated pressure.

3.24.3 Water supply hose. The water supply hose shall conform to grade 1 of ZZ-H-601, 3/4-inch id size, having an oil and grease resistant outer cover. The hose shall be 3/4-inch nominal diameter by 50 feet in length and shall be provided with male and female couplings conforming to ANSI B2.4.

3.25 Suction hose. When specified (see 6.2), 25 feet of suction hose having an id of not less than 1 inch shall be provided with each size 2 cleaner (see 3.10.6). The hose shall conform to grade A, style A, class 1 of ZZ-H-561, and shall be provided with all necessary couplings conforming to WW-C-624. A foot check valve and strainer shall be provided.

3.26 Dimensions and weight. The dimensions and weight of the cleaner shall not exceed the following:

Height .....60 inches.
Width .....60 inches.
Length .....72 inches.
Total weight of each unit, including
accessories: 1,700 pounds (lb)

3.27 Lubrication. Unless otherwise specified (see 6.2), means for lubrication shall be in accordance with the manufacturer's standard practice. The lubricating points shall be easily visible and accessible. Hydraulic lubrication fittings shall be in accordance with SAE J534. Where use of high-pressure lubricating equipment, 1,000 pound-force per square inch (psi) or higher, will damage grease seals or other parts, a suitable warning shall be affixed to the equipment in a conspicuous location. The unit shall be lubricated prior to delivery with type of lubricant specified in the operator's manual and grade of lubricant recommended for ambient temperature at the delivery point. The unit shall be conspicuously tagged to identify the lubricants and their temperature range.

3.28 Cleaning, treatment, and painting. Surfaces normally painted in good commercial practice shall be cleaned, treated, and painted as specified herein. The color of the finish coat conforming to FED-STD-595 shall be as specified (see 6.2). Surfaces to be painted shall be cleaned and dried to insure that they are free from contaminants such as soil, grease, welding slag and spatter, loose mill scale, water, dirt, corrosion product, or any other contaminating substances. As soon as practicable after cleaning, and before any corrosion product or other contamination can result, the surfaces shall be prepared or treated to insure the adhesion of the coating system. The painting shall consist of at least one coat of primer and one finish coat. The primer shall be applied to a clean, dry surface as soon as practicable after cleaning and treating. Painting shall be with manufacturer's current materials according to manufacturer's current processes and the total dry film thickness shall be not less than 2.5 mils over the entire surface. The paint shall be free from runs, sags, orange peel, or other defects.

3.29 Identification plate. An identification plate will be furnished by the contracting officer or by the contractor as specified (see 6.2) for each cleaner. The contractor shall stamp all necessary data in the blank spaces of the plate provided for that purpose, and securely affix a plate to each cleaner in a conspicuous place with nonferrous screws, rivets, or bolts not less than 1/8-inch in diameter. The applicable nomenclature contained in the contract item description shall be placed in the top blank.

3.30 Instruction plates. The cleaner shall be equipped with instruction plates suitably located, describing any special or important procedures to be followed in operating and servicing the equipment. Plates shall be of a material which will last and remain legible for the life of the equipment, and shall be securely affixed thereto with nonferrous screws, rivets, or bolts of not less than 1/8-inch in diameter. In addition, the cleaner shall have the following instructions:

a. "Use a liquid cleaning compound conforming to MIL-C-22542" or "use a pre-mixed concentration of 10 ounces of cleaning compound conforming to P-C-437 per gallon of water", as applicable to the unit. The instruction shall be marked in a conspicuous location on the exterior of the cleaner.
b. "Use light diesel oil, kerosene, or jet fuel (JP-5) conforming to MIL-T-5624." The instructions, to be in 1/2-inch lettering, shall be permanently and legibly marked on a noncorrosive plate to be attached adjacent to the fuel filler cap, and shall be marked on the outside front of the cleaner.

3.31 Maintenance tools. When specified (see 6.2), maintenance tools shall be furnished.

3.32 Workmanship. The quality of workmanship shall be such as to produce cleaners that are in accordance with the requirements of this specification and that are so constructed as to insure the proper functioning of all parts of the unit.

3.32.1 Steel fabrication. The steel used in fabrication shall be free from kinks, sharp bends, and other conditions which would be deleterious to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by the design. Manufacturing processes shall be done neatly and accurately. All bends shall be made by controlled means to insure uniformity of size and shape.

3.32.2 Bolted connections. Boltholes shall be accurately punched or drilled and shall have the burrs removed. Washers or lockwashers shall be provided in accordance with good commercial practice, and all bolts, nuts, and screws shall be tight.

3.32.3 Riveted connections. Rivet holes shall be accurately punched or drilled and shall have the burrs removed. Rivets shall be driven with pressure tools and shall completely fill the holes. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

3.32.4 Welding. Welding procedures shall be in accordance with a nationally recognized welding code. The surface of parts to be welded shall be free from rust, scale, paint, grease, or other foreign matter. Welds shall be of sufficient size and shape to develop the full strength of the parts connected by the welds. Welds shall transmit stress without permanent deformation or failure when the parts connected by the weld are subjected to proof and service loadings.

3.32.5 Brazing and soldering. Brazing and soldering shall be in accordance with the manufacturer's standard practice. Resin-base fluxes shall be used in all soldering operations.

3.32.6 Castings. All castings shall be sound and free from patching, misplaced coring, warping, or any other defect which reduces the castings ability to perform its intended function.

3.32.7 Forgings. Forgings shall be free from scale, enclosures, cold shuts, mismatching, and other defects that may affect the structural strength of the forgings. Repair processes, such as welding, peening, plugging, or filling with cold solder or metallic paste, shall not be attempted without authorization of the contracting officer.

3.32.8 Machine work. Tolerances for contact and bearing surfaces shall conform to standards prevailing among manufacturers normally producing steam cleaners.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements specified herein and in applicable referenced documents.

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

a. First article inspection (see 4.2.1).
b. Quality conformance inspection (see 4.2.2).

4.2.1 First article inspection. The first article inspection shall be performed on one cleaner when a first article is required (see 3.2 and 6.2). This inspection shall include the examination of 4.3, the tests of 4.4, and, when specified, the preproduction pack inspection of 4.6. The first article may be either a first production item or a standard production item from the supplier's current inventory provided the item meets the requirements of the specification and is representative of the design, construction, and manufacturing technique applicable to the remaining items to be furnished under the contract.

4.2.2 Quality conformance inspection. The quality conformance inspection shall include the examination of 4.3, the tests of 4.4.3, and the packaging inspection of 4.6.

4.3 Examination. Each steam cleaner shall be examined for compliance with the requirements specified in section 3 of this specification. Any redesign or modification of the contractor's standard product to comply with specified requirements, or any necessary redesign or modification following failure to meet specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examinations and dimensional measurements. Noncompliance with any specified requirements or presence of one or more defects preventing or lessening maximum efficiency shall constitute cause for rejection.

4.4 Tests.

4.4.1 Test conditions. The cleaner shall be tested and inspected under the following conditions:

4.4.1.1 Apparatus. Apparatus used in conjunction with testing specified herein shall be of the laboratory precision type and shall be calibrated at proper intervals to assure laboratory accuracy.

4.4.1.2 Fuel consumption. Fuel consumption measurement shall be made by the quantitative method, whereby the quantity consumed for a selected elapsed time shall be measured. The time selected shall be such that each reading will cover an elapsed time of at least 5 minutes. All expressions of quantities shall be recorded on a weight basis, and shall be measured by a direct weight-reading device such as a scale or precision meter calibrated to read in pounds and ounces, and shall be plotted on performance curves covering the entire operational range of the cleaner. Performance graphs shall include fuel consumption and thermal efficiency versus water flow rates.

4.4.1.3 Liquid flow rates. Liquid flow rates shall be determined by weighing the liquid flowing over a period of not less than 1 minute, or by measuring the time required to empty a container of known volume. Flow-meter readings may be used.

4.4.1.4 Temperature. Temperatures shall be measured by means of appropriately located thermocouples or thermometers. Temperatures shall be expressed in degrees Fahrenheit.

4.4.1.5 Pressure. The gages shall have a dial diameter of not less than 4 inches.

4.4.2 Preparation for test. The cleaner shall be prepared for test by servicing with the fuels and lubricants specified by the manufacturer.

4.4.2.1 Running-in. The nature and extent of running-in shall be as specified by the manufacturer.

4.4.2.2 Discharge pressures. Discharge pressures specified herein shall be those measured at the discharge side of the heating coil.

4.4.2.3 Servicing cleaner. The cleaner shall be serviced prior to any testing, in accordance with the instructions of the manufacturer.

4.4.2.4 Cleaning compound. Cleaning compound conforming to P-C-437 or MIL-C-22542 shall be used in any and all tests specified herein.

4.4.2.5 Water supply. Ample water supply shall be connected to the water supply inlet on the cleaner unit.

4.4.2.6 Checking controls. All valves, the pump, and controls shall be checked to assure proper operation of the cleaner.

4.4.2.7 Data readings. During the testing specified herein, at least the following data shall be recorded at intervals not more than 30 minutes apart; items k thru o may be read before and after the scheduled maintenance (blowdown and descaling).

a. Date.
b. Time.
c. Ambient temperature.
d. Liquid flow rate (water or solution) in gallons per hour.
e. Liquid temperature (water or solution) at outlet from heater.
f. Liquid temperature (water or solution) entering nozzle.
g. Liquid temperature (feedwater to cleaner) entering unit.
h. Water pressure at coil inlet.
i. Water pressure at coil outlet.
j. Pressure drop through coil.
k. Heater fuel consumption in pounds per hour or gallons per hour.
l. Heater output in British Thermal Units per hour (Btu/hr).
m. Heater thermal efficiency.
n. API gravity of the fuel used.
o. Btu/pound of fuel.

Notes shall be entered in the logs regarding adjustments, servicing, vibrations, and any other irregularities and corrective measures taken during the test run.

4.4.2.8 Inspection, servicing, and adjustments. Planned stops shall be made at 8-hour intervals during the endurance test for inspections, servicing, and adjustments. Records shall be kept of any adjustments of a minor nature. Major adjustments shall be cause for rejection.

4.4.2.9 Test time. Intervals of endurance test time of less than 1 hour, terminated by a parts failure, shall not be credited in 1/2-hour intervals, except where shorter periods are a test requirement.

4.4.3 Performance tests. The cleaner shall be subjected to the following tests:

4.4.3.1 Vapor spray test. The cleaner shall be operated for 4 hours as a vapor cleaner, and shall deliver the minimum rated capacity at the rated pressure (see 3.10.4).

4.4.3.2 Operating pressure test. The cleaner shall be operated at the specified rates and with feedwater supplied within the normal temperature range of +40°F to +55°F to determine compliance with respect to:

a. Thermal efficiency (see 3.10.2).
b. Pressure regulation (see 3.10.4).

4.4.3.3 Impact performance test. The cleaner shall be checked for impact performance to determine compliance with 3.10.4. A 25-foot hose shall be used and the following method shall be applied: Impact (delivery force) values shall be derived by directing the vapor nozzle from a fixed position and distance as shown in figure 1, at a round target with 2-square-inches of surface (1.6-inch id). The target device shall register the impact force on a scale or gage without undue mechanical or actuating losses. The force, in lb, registered on the 2 square inch target shall be multiplied by 0.50 to determine the impact pressure in psi.

4.4.3.4 Safety controls test. Safety controls shall be tested to detemine adequacy for protection of personnel operating the cleaner. The following tests shall be conducted:

4.4.3.4.1 Excess pressure test. While using the 50-foot hose, stop the solution at the gun. The safety control shall cut off the fuel supply to the burner before 150 psig pressure is generated; hose connections shall not leak.

4.4.3.4.2 Water shortage or failure test. With the cleaner in full operation, restrict the water supply; the temperature control shall cut off the fuel to the burner when the temperature reaches 340°F but not to exceed 375°F.

4.4.3.5 Mobility test. The completely assembled cleaner with accessories shall be tested in accordance with 3.9.

4.4.3.6 Static pressure test. Subject the pressure system of each assembled cleaner to a hydrostatic test of not less than two times the maximum working pressure (see 3.10.4). Subject the burner coil to a hydrostatic test of not less than 1,000 psi. The pressure system and the burner coil shall show no evidence of leakage, damage or deformation.

4.4.3.7 Dielectric strength test. The cleaner primary circuits shall be subjected to 1,000V RMS at 60 Hz, between mutually insulated circuits, and between insulated circuits and ground. Voltage shall be applied at the rate of approximately 500V per second until the specified voltage is reached. Voltage shall be maintained at 1,000V for a period of 1 minute to verify compliance with the requirement in 3.11.

4.5 Endurance test. Unless otherwise specified (see 6.2), the first article shall be subjected to a 250-hour endurance run. The cleaner shall be operated with cleaning compound and run at the rated discharge pressure. The maximum efficiency loss shall not exceed 2 percent. The total 250 hours shall be accumulated in 8-hour runs in accordance with the manufacturer's operating procedures.

4.6 Packaging inspection. The inspection of the preservation, packing, and marking shall be in accordance with the requirements of section 4 of MIL-S-12651. The inspection shall consist of the quality conformance inspection; and, when specified (see 6.2), a preproduction pack shall be furnished for examination and test within the time frame required.

5. PACKAGING

5.1 Preservation, packing, and marking. The preservation, packing, and marking shall be in accordance with the requirements of MIL-S-12651 with the level of preservation and the level of packing as specified (see 6.2).

6. NOTES

(This section contains information of a general, or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The cleaner covered by this specification is intended for the washing and cleaning of vehicles and miscellaneous ground equipment by the application of steam, pressure, and cleaning compound solution.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b Size required (see 1.2).
c. Issues of DODISS cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
d. When a first article is required for inspection and approval (see 3.2).
e. When a complete water system for size 2 cleaner should be furnished as specified (see 3.10.6).
f. When electrical power is other than as specified (see 3.11).
g. When cleaning solution system should be designed for liquid or for powder cleaning compound (see 3.22).
h. When cleaner should be provided with rack or solution tank (see 3.22.1).
i. When measuring container should be furnished as specified (see 3.22.3).
j. When suction hose is required (see 3.25).
k. When lubrication is other than as specified (see 3.27).
l. Color of finish coat as specified (see 3.28).
m. When identification plate is to be furnished by the contracting officer or by the contractor (see 3.29).
n. When maintenance tools are required (see 3.31).
o. When endurance test is required (see 4.5).
p. When a preproduction pack inspection is required and time frame required for submission (see 4.2.1 and 4.6).
q. Level of preservation and level of packing required (see 5.1).

6.3 First article. When a first article inspection is required, the item will be tested and should be a first production item or it may be a standard production item from the contractor's current inventory as specified in 4.2.1. The first article should consist of one cleaner. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, test, and approval of the first article.

6.4 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements should be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DOD FAR Supplement, Part 27, Sub-Part 27.475-1 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data should be delivered by the contractor in accordance with the contract or purchase order requirements.

6.5 Subject term (key word) listing.

Electric
High Pressure
Liquid compound
Oil-fired
Portable
Powder compound
Pressure
Washer

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness
of the changes.

Custodians:
Army - AL
Navy - YD
Air Force - 99

Review Activities:
DLA - CS
Navy - AS
Air Force - 82

User Activity:
Navy - MC

Preparing activity:
Navy - YD

(Project 4940-0570)

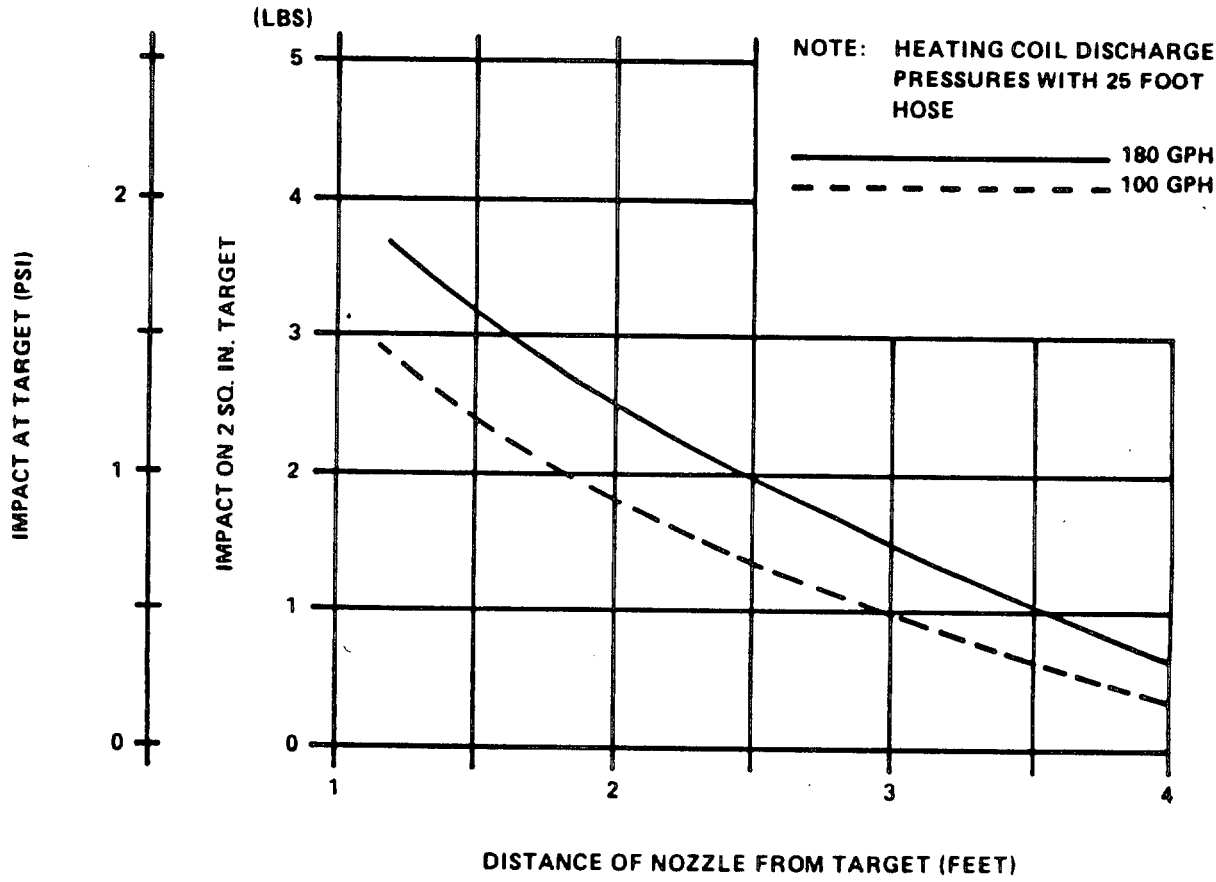

FIGURE 1. Nozzle impact forces.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-C-22894F	CLEANER, STEAM, PRESSURE JET, WHEEL-MOUNTED

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE.

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document*(s)* or to amend contractual requirements.

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Port Hueneme, CA 93043-5000

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