

INCH-POUND

MIL-PRF-53047B

8 September 1998

SUPERSEDING

MIL-W-53047A(ME)

30 June 1992

PERFORMANCE SPECIFICATION

WATER CHILLER, SMALL, MOBILE, DIESEL FUEL POWERED

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

1. SCOPE

1.1 Scope. This specification covers a small, mobile, diesel fuel powered water chiller and accessories.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications, standards and handbooks 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).

SPECIFICATIONS

FEDERAL

A-A-52557 – Fuel Oil, Diesel; For Posts, Camps and Stations

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-D/210, Warren, MI 48397-5000 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 4130

Distribution Statement A. Approved for public release; distribution is unlimited.

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DEPARTMENT OF DEFENSE

- MIL-PRF-53109 – Can, Fuel, Military: Plastic, 5-Gallon Capacity
- MIL-PRF-62122 – Cable Assembly, Intervehicle Power: Plug, Receptacle, and Adapter

STANDARDS

FEDERAL

- FED-STD-595 – Colors used in Government Procurement

DEPARTMENT OF DEFENSE

- MIL-STD-209 – Slings and Tiedown Provisions for Lifting And Tying Down Military Equipment

HANDBOOKS

DEPARTMENT OF DEFENSE

- MIL-HDBK-759 – Human Engineering Design Guidelines

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins, Philadelphia, PA 19111-5094.)

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

Code of Federal Regulations (CFR)

2.3 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 which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the document cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)

- ANSI Z 535.2 – Environmental and Facility Safety Signs

(Applications for copies should be addressed to the American National Standard Institute, 11 W. 42nd Street, New York, NY 10036.)

AMERICAN PUBLIC HEALTH ASSOCIATION (APHA)

- Standard Method for Examination of Water and Wastewater
- Part 207 – Odor

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Part 211B – Taste

(Application for copies should be addressed to the American Public Health Association, Inc., 1015 18th Street, Washington, DC 20036.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1655 – Standard Specification for Aviation Turbine Fuels

ASTM F 1122 – Standard Specification for Quick Disconnect Couplings

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 – National Electric Code

(Application for copies should be addressed to the National Fire Protection Association, One Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.)

NATIONAL SANITATION FOUNDATION (NSF)

Standard 14 – Official Plastics Listing.

Standard 51 – Plastic Materials and Components Used in Food Industry

(Application for copies should be addressed to the National Sanitation Foundation, 3475 Plymouth Rd., P.O. Box 1468, Ann Arbor, MI 48106.)

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

3. REQUIREMENTS

3.1 Description. The small mobile water chiller, hereinafter referred to as “water chiller,” shall be a diesel fuel powered pump and refrigeration system for cooling potable water in a field location. The water chiller shall be provided with everything necessary to pump water from an external potable water source, cool it, and dispense chilled potable water or recirculate it to the source. The water chiller unit shall be enclosed, skid mounted for ground emplacement, and provided with a mounting cradle for use on selected water trailers (see 3.6.3). In addition, each unit shall be provided with the interface items identified in table 1 (see 3.3.8).

TABLE I. Interface Items

Materiel	Reqt para	Qty Reqd
Nozzle	3.3.8.1	1
Strainer	3.3.8.2	1
Hose Assembly	3.3.8.3	5
Coupling Assembly	3.3.8.4	4
Adapter, 2-inch	3.3.8.5	2
Adapter, 1 1/2-inch	3.3.8.6	2
Adapter, tank return	3.3.8.7	1

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Adapter, tank feed	3.3.8.8	1
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3.2 First Article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.3 Physical characteristics.

3.3.1 Water chiller unit. The water chiller shall be comprised of a cooling unit, a pump, and diesel fueled power source. The unit shall have an enclosure to keep out debris and projectiles thrown up from the towing vehicle. The enclosure shall be designed to facilitate access for maintenance and repair, and shall be provided with quick-release fasteners that do not require the use of tools to operate.

3.3.1.2 Dimensions. The water chiller shall conform to the dimensions as shown in figure 1.

3.3.1.3 Weight. The water chiller unit, as assembled for operation, shall not exceed 325 pounds in weight.

3.3.1.4 Structural support. The water chiller unit shall withstand, and the mounting cradle shall have sufficient structural strength to bear the weight of the components, while operating and being transported, as specified herein.

3.3.1.4.1 Auxiliary handling. In addition to provisions for mechanical handling equipment, the unit shall be provided with hardware which would allow manual movement of the unit. This method should sustain the weight of the unit and allow repositioning of the unit by four personnel.

3.3.2 Engine. The engine shall function properly with military lubricants and shall operate on diesel fuel conforming to A-A-52557, and Jet A1 fuel conforming to ASTM D 1655 with static dissipaters, and icing and corrosion inhibitors (JP-8). The engine shall be air cooled, shall recoil and electric start, and shall drive the water pump/cooler at the continuous rated output as specified herein. The drive connection shall be such that the cooler and pump operates at optimum speed when the engine operates at optimum speed.

3.3.2.1 Start system. The engine shall be equipped with both a manual (recoil) and electric start system. The start system/engine shall be under no load condition to facilitate starting. The engine electric start system shall be 24 Volts Direct Current (VDC) and powered by the slave receptacle identified in 3.3.5.2. An engine activation device shall be used and located on the operational control panel (see 3.3.6). The manual (recoil) start system does not have to be located in the operational control panel but must be able to be utilized without moving the chiller or removing its housing.

3.3.2.2 Control systems. The engine shall have a positive means of shut off under any condition. All engine controls shall be operator accessible through any shielding or baffling used. Speed control shall have an idle position and an operational position with positive lock in each position.

3.3.2.3 Exhaust system. The engine exhaust system shall be designed and located so that it does not present a hazard to personnel or impede operations specified herein. The exhaust shall be permitted to extend beyond the overall dimensions of the water chiller unit in operation, but shall be retractable within the envelope, or be readily detachable, for storage and transport.

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3.3.2.4 Fuel tank. The fuel tank shall have the capacity to hold enough fuel to operate the chiller for a minimum of six hours, at continuous rated output, under full load. The fuel tank shall be located in a manner that prevents fuel spillage or overflow from contacting the exhaust or electrical systems or is hazardous in operations specified herein.

3.3.2.4.1 External source. When permissible (see 6.2), the unit may meet the six-hour operation requirement through utilization of an external source of fuel supply. The sub-system provided shall pump and filter fuel from a standard, 5-gallon, military, fuel can, in accordance with MIL-PRF-53109, without interruption in operation of the unit to switch cans. The sub-system shall not require manual priming to start and shall be inherently safeguarded against spillage and dissipation of fumes.

3.3.2.5 Drainage. The drainage systems for engine fluids shall not permit fluid discharge onto components of the water chiller. The engine oil drain shall be readily accessible from the exterior of the unit, and shall be provided with a captivated closure.

3.3.3 Water pump. The water pump shall be a pump which will not affect the potability of the water.

3.3.3.1 Priming. The pump shall be self priming when the engine is operating at idle and at optimum speed. The pump shall operate without fuel at least 30 seconds without compromising operational performance.

3.3.3.2 Operation. The water pump shall have the capability to pump water from a potable water source, run the water through a cooling process, and dispense the water into containers.

3.3.4 Cooling unit. The cooling unit shall be sized to provide the cooling capacity required to meet the performance requirements as specified herein.

3.3.4.1 Refrigeration system. The cooling unit refrigeration system shall be able to be used with potable water without affecting the potability and designed and fabricated in accordance with standard practices and safety considerations. The refrigerant shall be a non-ozone-depleting type (R124a, R134a) operating in a sealed system. The sealed system shall not degrade sufficiently to impair operation of the unit, under any of the storage or operational conditions specified. The system shall be constructed so that leakage from the system shall not be greater than 0.1 ounce per year, except at the shaft seal which shall be permitted a 1.0 ounce per year maximum rate.

3.3.4.2 System indicators. The cooling unit shall have pressure and thermal switches that activate fault indicators to visually indicate system problems. The system shall be equipped to shut down the water chiller when the switch is activated (see 3.7.2). After the problem which caused the shutdown is resolved, the indicators/switches shall be capable of resetting to the condition they were in during system operation.

3.3.5 Electrical system. All electrical system components for the unit shall meet NFPA 70 requirements. Electrical system components shall not be adversely affected by engine heat. All electrical components shall be water resistant and designed or located so that their functioning shall not be impaired by heavy rain, road splash, condensation, or water spray resulting from other internal or external causes. Wires and cables shall be positioned or protected to avoid contact with abrasive surfaces or other damaging contacts.

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3.3.5.1 Batteries. On board batteries shall be maintenance free and shall provide 24 VDC for the electrical system. Batteries shall be securely held in place by removable locking devices, and shall be protected against engine and exhaust heat. Adequate room shall be provided for battery maintenance and testing. The battery space shall be ventilated and treated against acid fumes and spillage. The battery terminals shall be provided with non-conductive guards or covers to prevent accidental shorting.

3.3.5.2 Slave start capability. The water chiller shall have a receptacle installed that will allow starting through the use of a standard NATO STANAG No. 4074 slave connector in accordance with MIL-PRF-62122. The slave receptacle shall be integrated into the engine starting system in a manner that will not interfere with starting procedures.

3.3.6 Operational control panel. A control panel shall be provided containing the following fault indicators: engine, pump, and compressor controls and metering, as required. The control panel components shall be enclosed to protect electrical connections and panel components, but the indicators and controls shall be visible and operable at all times. Electrical connections between the control panel and the electrical system shall be such that enclosure integrity is not compromised.

3.3.7 Water control panel. An input and output water control panel shall be located adjacent to the operational control panel. The unit shall be provided with an input connection to accept water from the external potable storage facility and two output connections, one to dispense the chilled water, and the other to recirculate it through the external storage facility. The connections for the input and the recirculation output shall be class 1, male coupling halves, 3/4 inch nominal size, conforming to ASTM F 1122. The output connection, at the panel, shall be a class 1, female coupling, 3/4 inch nominal size, conforming to ASTM F 1122. The connections shall be protected against contamination, with captivated closures, when not in use. Interconnecting lines for potable water input from and recirculation to the source, and for dispensing through the nozzle shall be provided by three of the ancillary hose assemblies (see 3.3.8.3).

3.3.8 Interface items. Each water chiller shall be provided with the items listed in these subordinate paragraphs (see figure 2), for interface to fielded systems. All items shall be suitable for use with potable water, and shall be guarded against contamination when not in use.

3.3.8.1 Nozzle. A 1-inch size, dispensing nozzle, matching the performance characteristics specified 3.4.2 and 3.5, shall be provided. The nozzle shall be furnished with a built-in check valve or other device, to minimize spillage on cessation of operation, and shall incorporate a spring loaded packing or other means, to preclude adjustment. The nozzle shall be fitted with a removable spout, provided with a captivated closure. It shall be provided with a class 1, female, 3/4 inch nominal size, cam-locking, quick-disconnect coupling half conforming to ASTM F 1122; with a captivated, class 1, 3/4 inch nominal size, cam-locking plug conforming to ASTM F 1122.

3.3.8.2 Strainer. An in-line sediment strainer assembly shall be provided for use in the water input line. The strainer shall trap water borne particles, down to a size that can be handled by the water chiller to ensure potability. The strainer shall be provided with class 1, female, 3/4 inch nominal size, cam-locking coupling halves conforming to ASTM F 1122, or ASTM F 1122, on both ends, fitted with captivated, class 1, 3/4 inch nominal size, cam-locking plugs conforming to ASTM F 1122.

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3.3.8.3 Hose assembly. Hoseline assemblies of 3/4 inch nominal ID tubing or hose, 149.00 ± 1.00 inches long, shall be provided. Each hoseline shall be a single piece, with a minimum bend radius not greater than 4.00 inches. Each assembly shall be provided with class 1, cam-locking, male coupling halves, 3/4 inch nominal size, conforming to ASTM F 1122 at both ends. The hose assemblies shall have captivated caps conforming to ASTM F 1122 at both ends. The assembly shall be rated for a 150 pounds per square inch (psi) working pressure, and shall conform to the environmental requirements specified herein.

3.3.8.4 Coupling assembly. Quick-disconnect hose couplings, comprised of two assembled coupling halves, shall be provided. The coupling halves shall be class 1, female, 3/4 inch nominal size, cam-locking fittings, conforming to ASTM F 1122 with internal and external pipe threads, respectively.

3.3.8.5 Adapter, 2-inch. Quick-disconnect reducing adapters, comprised of two assembled coupling halves, shall be provided. The coupling halves shall be a class 1, male, 2 inch nominal size, cam-locking fitting, conforming to ASTM F 1122; and a class 1, female, 3/4 inch nominal size, cam-locking fitting, conforming to ASTM F 1122. The fittings shall be assembled with a 2 x 3/4 inch, external pipe thread, reducing bushing.

3.3.8.6 Adapter, 1 1/2-inch. Quick-disconnect reducing adapters, comprised of two assembled coupling halves, shall be provided. The coupling halves shall be class 1, male, 1 1/2 inch nominal size, cam-locking fitting, conforming to ASTM F 1122; and class 1, female, 3/4 inch nominal size, cam-locking fitting conforming to ASTM F 1122. The fittings shall be assembled with a 1 1/2 x 3/4 inch, external pipe thread, reducing bushing.

3.3.8.7 Adapter, tank return. An assembled adapter shall be provided, to afford a quick-disconnect capability at the tank. The adapter shall be comprised of a class 1, female, 3/4 inch nominal size, cam-locking coupling half conforming to ASTM F 1122; a 3/4 x 1/2 inch, internal pipe thread, 90-degree reducing elbow; and a 1/2 x 3/8 inch, external pipe thread, reducing nipple. The coupling half shall be fitted with a captivated, class 1, 3/4 inch nominal size, cam-locking plug conforming to ASTM F 1122.

3.3.8.8 Adapter, tank feed. An adapter shall provide quick-disconnect capability at the tank shall be provided. The adapter shall be comprised of a class 1, female, 3/4 inch nominal size, cam-locking coupling half conforming to ASTM F 1122, on or creating the branch of a tee that is 6.00 inches long on the run. The tee shall have a 1 1/4 inch external pipe thread on one end of the run, and shall be fitted with an $8.00 \pm .12$ inch length of 1.75 inch ID, reinforced hose on the other. The hose shall be provided with suitable clamps for attachment to the tee and to the interfacing unit. The coupling half shall be fitted with a captivated, class 1, 3/4 inch nominal size, cam-locking plug conforming to ASTM F 1122.

3.3.8.9 Storage. Each unit shall have provisions to store and protect ancillary items supplied with the water chiller other than the mounting pads and cradle. The storage units shall be pliable, waterproof bags, in sufficient quantity so that no bag and its contents shall exceed 37 pounds. Hoses, tubing, couplings, fittings, or assemblies for interconnection shall be protected against contamination when not in use.

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3.4 Performance characteristics.

3.4.1 Unit operation. The water chiller shall operate at an optimum speed for a minimum of six continuous hours without shutdown or operator intervention, and at angles of up to 15 degrees from horizontal in any orientation. After a continuous six-hour, full load, operating period, the water chiller shall restart within 30 minutes and operate as specified.

3.4.2 Water chiller. Within five minutes of start, the water chiller unit shall accept 121 ± 1 °F input water and shall dispense it cooled to 62 ± 8 °F, at a rate of not less than 40 gallons per hour. The unit shall perform the same operation with water at 62 ± 8 °F.

3.4.3 Transportability. The water chiller shall withstand impact forces encountered in commercial and military shipment without damage or permanent deformation. The unit shall be provided with slinging and tiedown provisions in accordance with MIL-STD-209. Provisions shall restrain and/or lift the unit in its operating orientation without damaging the water chiller.

3.4.3.1 Survivability. Mounted onto the host vehicle, the water chiller shall survive transport under all the following conditions:

- a. On improved roads at speeds up to 50 mph
- b. On unimproved roads at speeds up to 20 mph
- c. Cross-country at speeds up to 20 mph.
- d. Belgian Block at speeds up to 20 mph

3.5 Environmental.

3.5.1 Operational temperature. The water chiller unit shall start and operate as specified at any ambient temperature between 70 °F and 120 °F.

3.5.2 Storage. The water chiller shall not be damaged or sustain operational degradation by storage at any ambient temperature between -25 °F and 160 °F. If system drainage is used to meet this requirement drains shall be readily accessible.

3.5.3 Humidity. The water chiller shall not sustain deterioration, corrosion, or other changes that will have a negative impact on the operation or maintenance of the unit, from exposure to humidity from 0 to 100%.

3.5.4 Rain. The water chiller shall not sustain deterioration, corrosion, or other changes that will have a negative impact on the operation or maintenance of the unit, from exposure to free rain fall at four inches per hour or blowing rain falling at one inch per hour.

3.5.5 Sand and dust. The water chiller shall not sustain deterioration, corrosion, or other changes that will have a negative impact on the operation or maintenance of the unit, while in 25 mph blowing dust and sand.

3.5.6 Noise limits. Steady-state noise produced by the chiller shall not exceed 85 decibels on the A scale (dB(A)), for sustained exposure. If remedial procedures for noise suppression have been pursued to the satisfaction of the procuring activity and permission to exceed 85 dB(A) including prorated values specified in Occupational Safety and Health Act regulations (OSHA 2201) is obtained, then hazard sign(s) shall be provided. The sign(s) shall conform to ANSI Z 535.2 and be prominently displayed on the unit, visible from any angle of approach. At a minimum, each sign shall state "HEARING PROTECTION REQUIRED WITHIN (specify)

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FEET FOR PROLONGED EXPOSURE” and shall be legible from the distance indicated on the sign.

3.6 Interface.

3.6.1 Envelope dimensions and interface requirements. Restrictions for controls, connections and interface, and the envelope dimensions for the water chiller shall be as shown in figure 1. No component of the water chiller shall extend beyond the overall envelope defined, except as defined in 3.3.2.3. No controls or connections to which access is required in shall be located on the rear or top of the unit.

3.6.2 Mounting.

3.6.2.1 Water chiller unit. The water chiller unit shall securely interface with a mounting cradle as shown in figure 1. The skid, or other provisions, shall be designed to ensure the correct orientation of the assembled unit.

3.6.2.2 Cradle. When specified (see 6.2), a mounting cradle shall be provided as an ancillary item to the water chiller. The cradle shall be as specified in figure 1. The cradle shall be provided with all the installation hardware and accessories required to attach the water chiller unit, and to mount the cradle.

3.6.3 Trailer interface. Assembled with its mounting cradle, and pads as necessary, the water chiller shall interface with the following equipment:

- a. Trailer, Tank: Potable Water, 400-Gallon, 2-Wheel, M149A2

3.6.3.1 Government-loaned property. When specified (see 6.2), access to the trailer shall be made available to the contractor.

3.7 Sustainment.

3.7.1 Corrosion protection. The water chiller and its accessories shall be inherently corrosion resistant or treated to provide protection against the various forms of corrosion and deterioration to which they are susceptible.

3.7.1.1 Dissimilar metals. Dissimilar metals shall not be used in immediate contact with each other unless protected against galvanic corrosion.

3.7.1.2 Identification of materials and finishes. The manufacturer shall identify the specific material, material finish, or treatment for use with components and sub-components.

3.7.1.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life-cycle costs. Used, rebuilt, or remanufactured components, pieces and parts shall not be incorporated in the unit.

3.7.1.4 Conduit materials. Materials in contact with potable water shall conform to the Code of Federal Regulations (CFR), 21, Part 177. All plastic materials that contact potable water shall be tested or listed as being acceptable for contact with drinking water by the National Sanitation Foundation under standards 14 and 51. When tested, in accordance with American Public Health Association (APHA) standard method for the examination of water and waste water, part 211B,

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potable water shall not impart taste to a level higher than Flavor Threshold No. 4. When tested to APHA, part 207, the water shall not impart odor to a level higher than Threshold Odor No. 3.

3.7.1.5 Design, material, and manufacturing processes. Unless otherwise specified, the design, materials, and manufacturing process selection is the prerogative of the contractor as long as all articles submitted to the government fully meet the operating, interface, ownship and support, and operating environment requirements specified.

3.7.2 Protective devices.

3.7.2.1 Low oil pressure. The system shall be provided with means to shut down the engine when the oil pressure falls below the minimum operating pressure, as specified by the engine manufacturer.

3.7.2.2 High water temperature. The system shall be provided with means to shut down the engine when the temperature of incoming potable water reaches 140 ± 5 °F.

3.7.2.3 Low water temperature. The system shall be provided with means to shut down the engine when the temperature of incoming potable water reaches 58 ± 3 °F.

3.7.2.4 Safety. All rotating or reciprocating parts shall be guarded against hazard to personnel. All parts that are subject to high operational temperatures shall be guarded against hazard to personnel. All electrical terminals shall be completely enclosed or insulated to prevent inadvertent contact by personnel or equipment that may cause arcing. The engine exhaust system shall be designed, located, and installed to minimize fire hazards in the event of fuel spillage during refueling. The exhaust system shall incorporate a spark arresting muffler, if applicable, to the type of engine used. The refrigeration system shall be protected against over-pressure.

3.7.3 Reliability. The chiller shall be inherently reliable.

3.7.3.1 Maintenance ratio. The water chiller shall have a maintenance ratio not greater than 0.08. Maintenance ratio is the total active maintenance man-hours required (scheduled and unscheduled) in comparison to the total operating hours. Work-hours for repair of replaced components scheduled before, during, and after operation checks are excluded.

3.7.4 Cleaning, treatment, and painting. Unless otherwise specified (see 6.2), all surfaces, painted internally and externally shall be cleaned, treated, and painted according to the manufacturer's standard commercial practice. MIL-C-46168 shall be used as a guide for coating. The color of the exterior shall be Tan 686. Color no. 33446 of FED-STD-595 shall be used as a guide.

3.8 Marking.

3.8.1 Identification marking. Identification marking shall be permanent, legible, and shall include, as a minimum, the manufacturer's identification code and part number, and the unit's weight and date of manufacture.

3.8.2 Operating instructions. Instructions deemed essential for safe and efficient operation of the water chiller shall be furnished on a plate attached to the unit. The instructions shall be clear, concise and placed adjacent to the unit operating controls. Piping and wiring diagrams, and any other data necessary for the maintenance or preservation, for storage or transport, of the unit shall

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also be provided. The instructions shall be on a durable material capable of surviving all operating and storage conditions applicable to the water chiller.

3.8.3 Labeling. All connections, controls, and displays shall be labeled. Guidance is provided by MIL-HDBK-759.

4. VERIFICATION

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. First article inspection shall be performed on one complete unit (see 6.3) when a first article is required. This inspection shall include the examination of 4.4 and the tests of 4.5.

4.3 Conformance inspection. Inspection of production units shall include the examinations of 4.4 and the tests specified in 4.5.11.

4.4 Examination. Each unit shall be physically examined for compliance with requirements specified in 3.3 to 3.8.3. This element of inspection shall encompass all examinations of performance, safety, human engineering, and dimensional requirements. Non-compliance with any specified requirement, or the presence of one or more defects lessening required efficiency shall constitute cause for rejection. Each unit shall be examined for the defects specified table II.

TABLE II. Inspection requirements.

Item	Reqt para	Defect	Examination
101	3.3.1	Physical characteristics not as specified.	Visual/Doc.
102	3.3.1.2	Dimensions not as specified.	Visual/SIE
103	3.3.1.3	Weight not as specified.	Visual/SIE
104	3.3.1.4	Structural support not as specified.	Visual/SIE
105	3.3.2	Engine not as specified.	Visual/Doc.
106	3.3.3	Water pump not as specified.	Visual/Doc.
107	3.3.4	Water cooler not as specified.	Visual/Doc.
108	3.3.5	Electrical system not as specified.	Visual/Doc.
109	3.3.5.1	Batteries not as specified.	Visual/Doc.
110	3.3.5.2	Slave start connector not as specified.	Visual/SIE
111	3.3.6	Operational control panel not as specified.	Visual
112	3.3.7	Input/output water control panel not as specified.	Visual/SIE
113	3.3.8	Ancillary items not as specified.	Visual/Doc.
114	3.3.8.9	Storage provisions not as specified.	Visual
115	3.6	Interface requirements not as specified.	Visual/Doc.
116	3.7.1	Materials not as specified.	Doc.

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117	3.7.4	Cleaning, treatment, and painting not as specified.	Visual/Doc.
118	3.8.1	Identification markings not as specified.	Visual
119	3.8.2	Operating instructions not as specified.	Visual
120	3.8.3	Labeling not as specified.	Visual

Doc = Documentation, SIE = Standard Inspection Equipment.

4.5 Tests. Unless otherwise specified herein, tests shall be conducted on the water chiller as assembled and prepared for operation. All water used in testing shall be potable to preclude decontamination at test conclusion. No braces, sealing materials, tiedown devices, or other items that are not inherently a part of the operating water chiller shall be employed. Each water chiller shall be subjected to the tests in table III in the sequence listed.

TABLE III. Test schedule.

Item	Test Sequence	Test Para	Requirement Para
101	Protection & safety devices	4.5.1	3.7.2
102	Performance	4.5.2	3.3.2, 3.4.1 & 3.4.2
103	Water pump test	4.5.2	3.3.3
104	Water cooler tests	4.5.2	3.3.4
105	High temperature operation	4.5.2	3.5.1
106	Storage withstanding	4.5.3	3.5.2
107	Humidity	4.5.4	3.5.3
108	Rain	4.5.5	3.5.4
109	Sand and dust	4.5.6	3.5.5
110	Noise limits	4.5.7	3.5.6
111	Reliability test	4.5.8	3.7.3
112	Maintainability test	4.5.9	3.7.3
113	Transportability	4.5.10	3.4.3

4.5.1 Protective devices test.

4.5.1.1 Switch test. Thermal or pressure switches shall be manufacturer certified to percent accuracy, or shall be tested prior to use. If tested, the medium used shall be that for which the switch is designed. No fewer than three separate tests will be run on each switch. Failure to operate within rated capacity shall constitute failure of this test.

4.5.1.2 Fault indicators and engine shut off device. The fully assembled water chiller unit shall be non-operational for the test. Switches shall be disconnected one at a time for circuit testing. After switch disconnection an appropriate voltage shall be applied to the leads normally connected to the switch. The fault indicator and engine shut off device shall be observed for reaction and evaluated. At the conclusion of two tests of each circuit a multi-circuit test shall be conducted. Two circuits shall be disconnected and activation voltage applied to each at precisely the same

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time. On conclusion of the multi-circuit function test another individual circuit function test shall be conducted. Failure to detect a fault in any circuit or to actuate the pertinent protection device shall constitute failure of this test.

4.5.1.3 Safety. As part of the functional test all aspects of operation shall be evaluated for safety of personnel and equipment. All observed unsafe conditions that result from design, assembly, or operation in accordance with operating instructions shall be noted. Failure to comply with the requirements specified in 3.7.2 shall constitute failure of this test.

4.5.2 Operational tests. The high temperature operation, capacity, fuel consumption, and pressure tests shall be performed concurrently with the water chiller in a controlled temperature environment. The unit shall be placed in an environmental chamber and a tank filled with potable water shall be connected to the inlet of the water chiller. Pressure gauges shall be connected to compressor service ports. The fuel tank shall be filled with a measured amount of fuel. The water and the chamber shall be heated to 121 ± 1 °F, with the test unit components exposed for a minimum period of four hours. The water and chamber temperature shall be monitored continuously during the exposure period and throughout testing. At the conclusion of the exposure period, all temperature and compressor pressure readings shall be observed. The unit shall be started using an electric starting motor. Five minutes after compressor start, a water sample shall be drawn and captured from the dispensing port, for a minimum period of 3 minutes. The stream and captured water temperatures shall be taken, and the chilled water production capacity shall be determined based on the capture sample weight. This sampling shall be repeated, at 5 minute intervals, two more times. Unless continuously determined, the compressor pressure readings shall be taken every 15 minutes of the first two hours of the test. If pressures are stabilized, the readings shall be at 30 minute intervals thereafter. If not stable, the 15 minute reading schedule shall be continued to test completion. After the three initial samplings, the production capacity and water temperature test shall be repeated every 30 minutes until test completion, with samples drawn alternately from the dispensing and recirculation ports. At the conclusion of the six hour run, the unit shall be shutdown for a period of 30 minutes. Fuel level shall be measured and the fuel consumption calculated. If there is insufficient fuel remaining to complete the additional testing, a measured quantity of fuel shall be added. After the 30 minute shut down the water chiller shall be started and operated for one hour, with the ambient temperatures at 70 ± 2 °F and the water temperatures at 75 ± 2 °F. The 30 minute shutdown and one hour operation shall be repeated four more times, operating the unit at a 15 degree angle from horizontal in each of its cardinal orientations. The unit shall then be shutdown for 30 minutes, and manually restarted using the recoil starter. One or more of the following shall constitute failure of the operational tests:

- a. Inability of the unit to start (electric or recoil) or operate on restart. (see 3.3.2.1)
- b. Fuel consumption greater than the manufacturer's stated value. (see 3.3.2.4)
- c. Inability of the unit to operate for a continuous six-hour period, shutdown for 30 minutes, restart, and operate as specified. (see 3.4.1)
- d. Inability of the unit to chill water to 62 ± 8 °F, from 120 °F, at a rate of 40 gph. (see 3.4.2)
- e. Inability of the unit to chill water to 70 ± 1 °F, from 75 °F, at a rate of 40 gph. (see 3.4.2)

4.5.2.1 Refrigerant system leakage. Charge the refrigerant system to recommended working pressure with dry nitrogen containing an appropriate refrigerant gas leak detector. Calibrate a leak detector to the type and mixture of gas used and set to indicate a leakage rate of 1.0 ounce

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per year. Test leakage at the compressor shaft seal. Reset the detector to a rate of 0.1 ounces per year and test the entire system for leakage. Leakage greater than 1.0 ounce per year at the shaft seal or greater than 0.1 ounces per year for the rest of the system, or deformation or malfunction of any component shall constitute failure of this test.

4.5.3 Storage withstanding. For the purposes of these tests, damage is defined as, but not limited to, rupture of tubing; damage to control components, binding of engine, pump, or other mechanical parts, deterioration or permanent setting of gaskets or packing, damage to insulation, breakdown of adhesives; or loss of refrigerant as applicable.

4.5.3.1 High temperature. The water chiller shall be operated for a period of not less than one hour, monitoring its performance. It shall then be subjected to an ambient temperature of 155 to 160 °F for a period of four hours, then allowed to stabilize in an ambient temperature of 88 °F for a period of not less than one hour but not greater than three. Examine the water chiller for deterioration, corrosion, or other damage, then operate it for a period of not less than one hour. Inability of the water chiller to start and operate, any significant deviation from pre-exposure operation, or any deterioration, corrosion or other damage shall constitute failure of this test.

4.5.3.2 Low temperature. The water chiller shall be tested as above (see 4.5.3.1) except that it shall be subjected to an ambient temperature of -30 °F to -25 °F for the four hour exposure.

4.5.4 Humidity. The water chiller shall be subjected to a humidity test as defined in table IV. The water chiller shall be subjected to two cycles of the test; the second to occur within six hours of the first. The water chiller shall not be operated during the test, but shall be operated before and after. Failure of the unit to operate as prescribed herein shall constitute failure of this test.

TABLE IV. Humidity test requirement (24 hour)

Time	Temperature °F	Relative humidity %	Time	Temperature °F	Relative humidity %
6 hours	88	88	4 hours	105	59
1 hour	90	85	1 hour	102	65
1 hour	93	80	1 hour	99	69
1 hour	96	76	1 hour	97	73
1 hour	98	73	1 hour	94	79
1 hour	100	69	1 hour	91	85
1 hour	102	65	1 hour	90	85
1 hour	104	62	1 hour	89	85

4.5.5 Rain. The water chiller shall be subjected to simulated rainfall, produced by means of water spray and measured by an accurate and dependable gauge. Nozzles shall emit droplets having a diameter of not less than 1.5 millimeters. The water supply temperature shall be between 50 and 70 °F. After exposure to each of the subordinate tests, the water chiller shall be operated for 15 minutes. Failure of the unit to start and operate as prescribed herein, after exposure, shall constitute failure of the test.

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4.5.5.1 Free rain. With the water chiller non-operational, subject each of the four sides and the top of the water chiller to a simulated rainfall of not less than four inches per hour, on each side and top for not less than 30 minutes each, for a total nominal test duration of 150 minutes. Direction of rainfall against each of the four sides and the top shall be varied throughout the test, from vertical to 30 degrees from vertical. Failure of the unit to start and operate as prescribed herein, after exposure, shall constitute failure of the test.

4.5.5.2 Blowing rain. With the water chiller operating, subject each of the four sides to a simulated rainfall of not less than one inch per hour, combined with a horizontal wind of 40 ± 5 mph for a period of not less than one hour for each side. Total nominal test duration shall be four hours. Sustainment of damage or failure of the unit to operate as prescribed herein, throughout the test, shall constitute failure of this test.

4.5.6 Sand and dust. The water chiller shall be tested to verify its withstanding the effects of sand and dust. For the dust test, red china clay or silica flour shall be used. The following size distribution for either shall be followed:

Red china clay or silica flour composition –

- 100 % shall pass through a 100 mesh screen
- $98 \pm 2\%$ shall pass through a 140 mesh screen
- $90 \pm 2\%$ shall pass through a 200 mesh screen
- $75 \pm 2\%$ shall pass through a 325 mesh screen

Sand used for testing shall be Silica sand of at least 95% SiO_2 by weight, and shall be composed as follows:

Sand composition –

- $1 \pm 0.5\%$ shall be retained by a 20 mesh screen
- $1.7 \pm 0.5\%$ shall be retained by a 30 mesh screen
- $14.8 \pm 0.5\%$ shall be retained by 40 mesh screen
- $37.0 \pm 1\%$ shall be retained by a 50 mesh screen
- $28.6 \pm 1\%$ shall be retained by a 70 mesh screen
- $12.7 \pm 1\%$ shall be retained by a 100 mesh screen
- $5.2 \pm 1\%$ shall pass a 100 mesh screen

The dust concentration for the blowing dust test shall be maintained at $0.3 \pm 0.2 \text{ g/ft}^3$, with air velocity at 25 mph, and the unit shall be exposed for six hours. At the end of the exposure the water chiller shall be inspected for damage, started, and operated for 30 minutes. Cleaning or replacement of filters is permissible prior to operation. Failure of the unit to start and operate as specified herein or high operating temperatures shall constitute failure of this test.

The sand concentration for the blowing sand test shall be maintained at 0.005 g/ft^3 . The air velocity shall be 25 mph and the water chiller shall be exposed for a total of 360 minutes, at 90 minute per side. At the end of the exposure the water chiller shall be inspected for damage, started, and operated for a period of 30 minutes. Cleaning or replacement of filters is permissible prior to operation, and minor abrasion of the finish will not be considered damage. Failure of the

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unit to start and operate as specified herein or high operating temperatures shall constitute failure of this test.

4.5.7 Noise level test. With the unit operating at full load, the noise levels shall be measured at the operator's position, 18.00 inches from the control panel, and at a minimum of 12 equal arcs, within a radius of 18.00 inches from the periphery of the unit. Three sets of noise level readings shall be taken at each location and an average computed, and weighted on a dB(A) scale. Failure of the unit to operate within the 85 dB(A) threshold without appropriate marking shall constitute failure of this test.

4.5.8 Reliability. The water chiller shall be operated, cooling water for an aggregate of 100 hours. The test cycles shall be longer than 3 hours but not longer than 6 hours. The water chiller unit shall be shut down for a maximum of 30 minutes between test cycles. Occurrence of any unscheduled maintenance action during the 100 hours or the inability of the unit to function as described in section 3 of this specification shall constitute failure of this test.

4.5.9 Maintainability. The maintainability test shall be conducted concurrently with the reliability test. Data collected during maintenance activities shall be used to determine compliance with maintainability requirements as specified herein. Nonconformance to the maintenance ratio as specified in 3.7.3.1 shall constitute failure of this test.

4.5.10 Transportability. Slings and tiedown provisions shall be tested in accordance with MIL-STD-209. Failure to lift or restrain the unit in its operating orientation or withstand the stresses, in the amount and direction of the pull specified for the type of unit, shall constitute cause for rejection. Weld failure, breaking, cracking, permanent deformation, or loosening of the provisions, or their connecting structural components shall also constitute failure of this test.

4.5.10.1 Survivability. The water chiller shall undergo four cycles of the transportation tests defined in table V. The unit shall be in operating condition, with all fluids at operating levels, mounted onto its cradle. The testing on different surfaces need not be contiguous but each test shall be uninterrupted. A visual inspection shall be conducted after every cycle, to determine whether testing should continue.

TABLE V. Transportation survivability tests

Surface	Speed (max)	Distance (mim)
Improved (paved) roads	50 mph	100 miles
Unimproved (unpaved) roads	20 mph	100 miles
Cross-country	20 mph	50 miles
Belgian Block	20 mph	6 miles

At the end of testing the unit shall be operated for not less than on half hour. Failure of the unit to meet the performance requirements of 3.4.1 and 3.4.2 or any detrimental loosening, permanent deformation, or damage to any component of the water chiller or any of its ancillary items, shall constitute failure of this test.

4.5.11 Conformance testing. Each production unit shall be started and operated a minimum of fifteen minutes. Failure of the unit to start within five minutes, or to operate continuously for

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fifteen minutes without operator intervention, or the inability to draw or dispense water through each of the ports shall constitute failure of this test.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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 water chiller covered by this specification is intended to cool potable water from storage and transport tanks and dispensing it into containers or recirculating the water back to the source. The item is military-unique since its operational and storage requirements are unmatched by any commercial counterpart. The units must be capable of any combination of use and storage without adverse effect on immediate employment; dispensing and recirculation of chilled water to the source; must operate in environmental extremes of 70 °F to 120 °F, at any relative humidity; and be capable of throughput exceeding requirements in commercial applications.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and, date of this specification
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2 and 2.3)
- c. When a first article is required, time frame for submission, and the number of units required (see 3.2)
- d. When an external fuel supply is permissible (see 3.3.2.4.1)
- e. When a mounting cradle and hardware is required (see 3.6.2.2)
- f. How access to a trailer will be made available to the contractor (see 3.6.3.1)
- g. When treatment and painting will not be the manufacturer's standard, if a color change is required, if camouflage patterns are required or special markings are required (see 3.7.4)
- h. Packaging requirements (see 5.1).

6.3 First article. When a first article inspection is required, the sample shall be a first article production unit. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, approval of the first article test results, and disposition of the first article unit.

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

6.5 Government-loaned property. The contracting officer should arrange for access to the property specified in 3.6.3 when applicable (see 6.2). The property will not be transferred to the contractor and may be supplanted or supplemented with the documentation of MIL-PRF-45316.

6.6 Subject term (key word) listing.

Cooling

Potable water

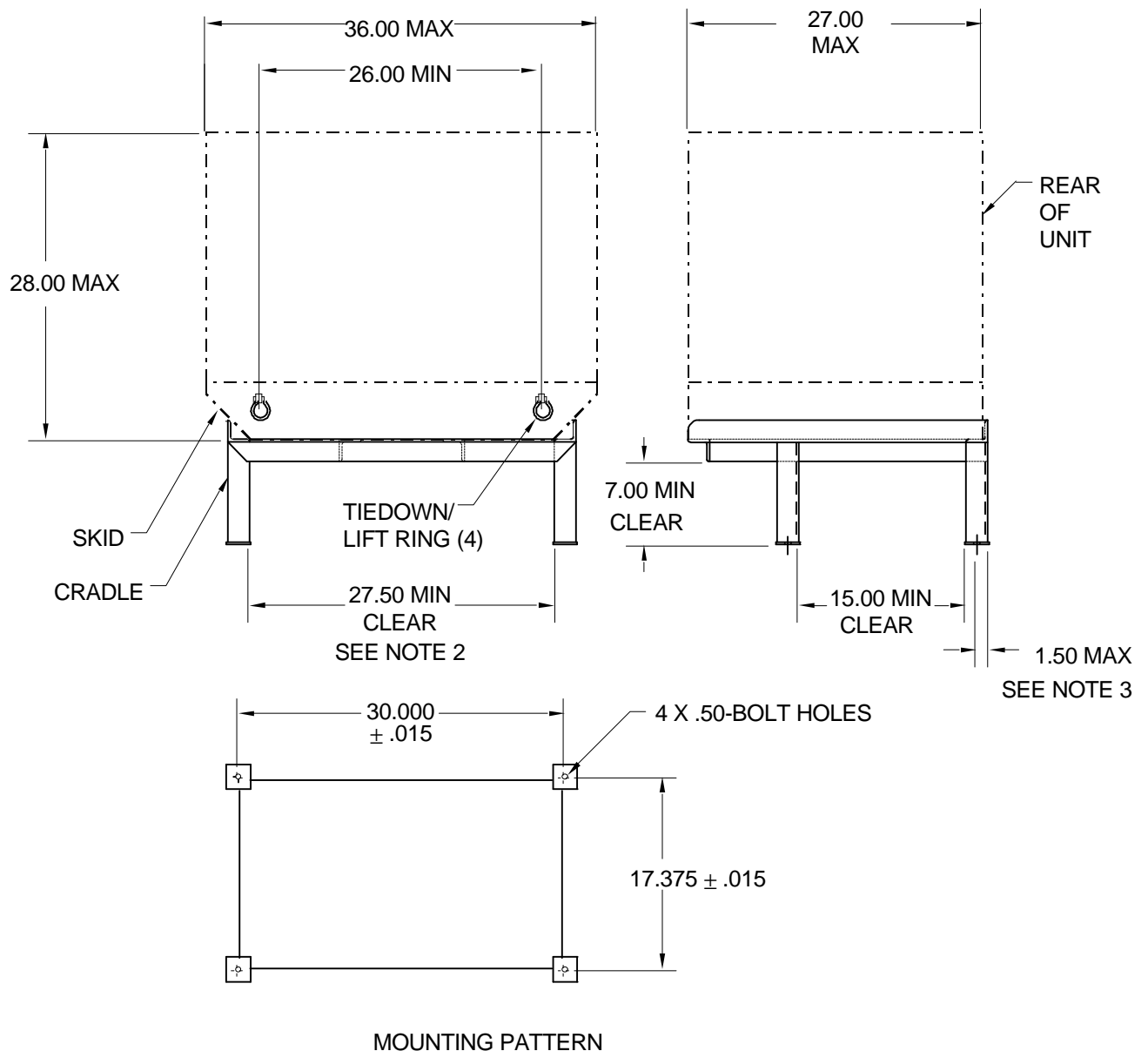
Refrigerant

Tank

Water

6.7 International standardization agreements. Certain provisions of this specification (see 3.3.5.2) are the subject of international standardization agreement (NATO STANAG 4074) When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

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NOTES:

1. DIMENSIONS ARE IN INCHES.
2. AREAS INDICATED "CLEAR" SHALL BE FREE OF OBSTRUCTION.
3. NO COMPONENT OF THE CHILLER OR CRADLE SHALL EXTEND BEYOND DIMENSION SHOWN FROM CENTER OF REAR MOUNTING HOLES.

FIGURE 1. Envelope and interface dimensions.

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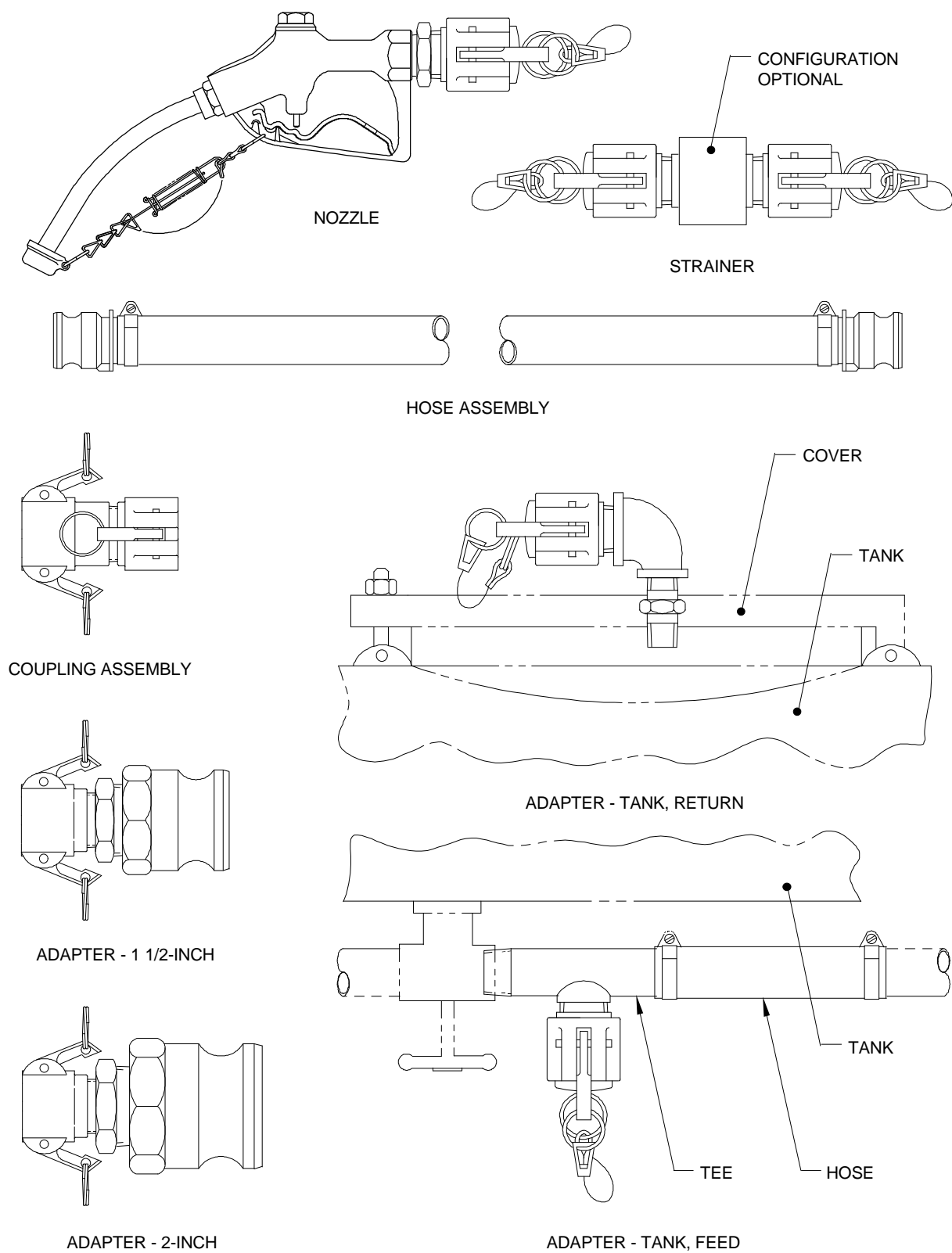


FIGURE 2. Interface items.

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Custodian:
Army-AT
Air Force-99
Navy-YD1

Preparing activity:
Army-AT
(Project 4130-A317)

Review Activity:
DLA-GS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL**INSTRUCTIONS**

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter must be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

I RECOMMEND A CHANGE:

 1. DOCUMENT NUMBER
MIL-PRF-53047B

2. DOCUMENT DATE (YYMMDD)

3. DOCUMENT TITLE

WATER CHILLER, SMALL, MOBILE, DIESEL ENGINE DRIVEN (DED)

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

(1) Commercial

(2) AUTOVON

(If applicable)

7. DATE SUBMITTED

(YYMMDD)

8. PREPARING ACTIVITY

a. NAME

USA TACOM, AMSTA-TR-D/210 (PWQT)

b. TELEPHONE (Including Area Code)

(1) Commercial

(810)574-4206

(2) AUTOVON

DSN 786-4206

c. ADDRESS (Include Zip Code)

 US Army Tank-automotive
and Armaments Command
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Warren, MI 48397-5000

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 Defense Logistics Agency (DLSC-LM) , 8725 John J. Kingman Rd. , Suite 2533
Fort Belvoir, VA 22060-6221
(703)767-6888 or DSN 427-6888

