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PERFORMANCE SPECIFICATION

HEATER, SPACE - CONVECTIVE, SELF-POWERED, LIQUID FUEL, SHC

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

1. SCOPE

1.1 Scope. This specification covers the performance and acceptance requirements for a self-powered, liquid fuel burning, convective space heater

1.2 Classification.

Type I – Space Heater Convective (SHC 35), 35,000 BTU
Type II – Space Heater Convective (SHC 60), 60,000 BTU

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 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 Department of Defense Index of Specifications and Standards (DoDISS) cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

Comments, suggestions, or questions on this document should be addressed to U.S. Army Soldier Systems Center, Natick, MA 01760-5018 or emailed to Joseph.Mackoul@Natick.Army.Mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil .

AMSC N/A FSC 4520

AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 51 Laboratory Methods of Testing Fans for Rating Purposes

(Application for copies should be addressed to American Society of Heating, Refrigeration and Air Conditioning Engineers, 1791 Tullie Circle N.E., Atlanta, GA 30329. The web address is http://www.ashrae.org .)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D2156 – Standard Test Method for Smoke Density in Flue Gases from Burning Distillate Fuels

(Application for copies should be addressed to American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959. The web address is http://www.astm.org .)

2.3 Government documents. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

MIL-STD-810 - Environmental Test Methods and Engineering Guidelines

(Copies of these documents are available online at http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094)

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. First article. When specified (see 6.2), a sample shall be subjected to a first article inspection in accordance with 4.1.1.

3.2. Conformance. Items furnished under this specification shall be subjected to conformance inspection in accordance with 4.1.2.

3.3 Operating requirements. The heater shall satisfy the following user-oriented requirements.

3.3.1 Operation. The SHC shall operate as specified herein without the use of external electrical power. One switch shall control start and stop of the heater.

3.3.2 Fuel capability. The SHC shall be safely operated with all of the fuels listed in Table I at the corresponding environmental conditions, with no operator adjustments required to accommodate varying fuel types. The primary fuel will be JP-8 and the alternate fuels will be K-1, DF-A, DF-1, JP-5 and DF-2.

TABLE I. Compatible Fuels

Ambient Temperature Range	National Stock Number	Military Symbol CONUS
Above +258 F	9140-01-286-5294	DF-2
Above +108 F	9140-01-286-5286	DF-1
Above -258 F		K-1
Above -608 F	9130-01-031-5816	JP-8
Above -608 F	9140-01-286-5283	DFA

3.3.3 Fuel system. The heater shall operate from fuel supplied by gravity feed from the standard military 5 gallon can (NSN 7240-01-337-5269) with the standard gravity feed adapter (NSN 4520-01-466-0415), fuel can stand (NSN 4520-01-465-4430) and gravity feed fuel supply line (NSN 4520-01-508-5743). The Type II heater shall be capable of operating with two standard military fuel cans simultaneously. The two fuel can operation will be facilitated by the use of an adapter and one tripod type fuel can stand.

3.3.4 Trapped air. Bleeding of any trapped air in the fuel line and fuel system shall be automatic and without fuel leakage.

3.3.5 Fuel filtering. A fuel filtering device shall be incorporated to remove foreign particles, suspended ice crystals and separate water from the fuel. The filtering device housing shall be clear to allow for visual inspection. The filter shall be located within a protected area and shall not break due to freezing of entrapped water.

3.3.6 Automatic fuel shut off capability. Fuel flow shall stop within 2 seconds when the heater start switch is turned to the off position or when a fault is detected by the system controller during operation. When the start switch is in the off position, and the SHC is connected to a full 5 gallon fuel can in the operational position (inverted), no fuel shall flow from the filter assembly when disassembled for cleaning.

3.3.7 Residual fuel. The SHC shall provide a means to drain residual fuel from the fuel system after operation.

3.3.8 Heat exchanger. The heat exchanger shall be a separable modular component. At no time during operation under any environmental condition specified herein, shall ice formation from the exhaust accumulate within or on any of the combustion system components including the exhaust pipe discharge area.

3.3.8.1 Heat exchanger over-temperature protection. The heat exchanger shall incorporate a temperature sensor that shall prevent excessive overheating resulting from possible abnormal operating conditions. The sensor shall positively stop fuel flow to the burner in the event of a heat exchanger over temperature condition. The heat exchanger and related combustion system components shall not suffer any loss of performance or damage when overheated to the point of sensor activation. The sensor shall be capable of being reset from outside of the heater enclosure without the removal of panels or covers.

3.3.9 Exhaust outlet. The exhaust discharge outlet shall be located and positioned to prevent the ingestion of exhaust gases into the heater breathable air inlet area.

3.3.10 Heated air system. The SHC Type I shall provide a minimum of 275 CFM indicated heated air and the SHC Type II shall provide a minimum of 400 CFM. The heater shall automatically shut off if the heated air at the outlet exceeds 275°F. The blower or fan system shall be modular as to permit simple removal for service or maintenance. The heated air inlet area and heated air outlet area shall incorporate a debris and finger guard to prevent any objects larger than ¾” diameter from entering the enclosure. The inlet and outlet areas shall allow for the attachment of flexible ducts for connection to a tent or shelter.

3.3.11 Flexible air ducts. A 6 ft. heated air supply duct and a 6 ft. return duct shall be provided. Attaching the ducts to the SHC shall require no tools and be performed wearing anti-contact gloves NSN 8415-00-227-1220. Any hardware needed for connection shall be attached to the duct. The heater return air duct shall have a debris guard installed in the tent end of this duct assembly preventing debris larger than ¾” diameter entering into the duct.

3.3.12 Operator control panel. A single ON/OFF switch shall be located on the control panel and initiate start and stop functions of the SHC. The control panel shall be connected to the SHC by a separable cable, 10 feet long, to allow attachment of the control box to a horizontal member of the tent while operating the heater outside of the tent. The cable connections shall be weather proof. The control panel and heater shall have protective caps fastened to each connector for use when disconnected from the cable. The control panel shall be designed to provide protection to the controls and indicators from damage if dropped or improperly packed for shipment or storage. A green "ON" indicator light shall illuminate when the ON/OFF switch is in the “ON”

position. A green "CHARGING" indicator light located on the control panel shall illuminate when the battery stops supplying heater power and begins to accept a charge from the internal power generation system. A green "BATTERY CHARGED" indicator light located on the control panel shall illuminate when the battery has reached its normal starting potential. A red "FAULT" indicator light located on the control panel shall illuminate and pulse out a series of flashes in unison with an audible tone during and after a fault condition. The fault code shall repetitively be presented until the ON/OFF switch is positioned to the “OFF” position. A thermostat shall be provided to supply temperature input for control of the heater fire rate in unison with the manually adjusted temperature control knob. By rotation of the control knob the heater shall increase or decrease the burner fire rate in relation to the setting of the control knob and the tent thermostat sensing device. The control shall be manually adjustable within the range 408 (+/- 5) F to 808 (+/- 5) F. A yellow indicator light shall illuminate indicating that the thermostat is satisfied.

3.3.13 Internal power generation system. The SHC shall contain an internal electrical power generation system that is silent, contains no moving parts, is self-contained, and requires no adjustments before, during, or after heater operation. No special periodic maintenance shall be required. The generator output wattage shall provide sufficient electrical power to operate the heater during all thermostat settings during and after battery charging. The generator system shall have built-in “FAIL-SAFE” protection from overheating, overcharging, shock hazards, etc. The generator and related components shall be modular for ease of repair and replacement.

3.3.14 Power storage battery. The power storage battery shall be mounted to the heater and shall not require installation or removal when the heater is in use or in the transport bag. It shall be included in the overall weight of the heater. The battery shall be replaceable by one person within 15 minutes. The battery shall have a minimum storage life of two years.

3.3.14.1 Battery safety. The battery shall be fuse protected within the battery case. The fuse holder(s) shall be weather proof. The fuse(s) shall be easily removable for inspection and maintenance in all temperatures. The battery shall be classified as a non-spillable battery. The battery, when subjected to any attitude, shall display no leakage of caustic, hazardous material or liquid and shall be transportable by all modes of shipment. The power storage battery and stowage location shall be vented to the atmosphere. No fumes or liquid shall enter the heated air stream, combustion air stream or electronic circuits and electrical component areas in the event of a mechanical rupture or battery over heat condition. The battery shall have a minimum storage life of two years.

3.3.14.2 Battery starting and recharge. Sufficient basic cold starting power shall be stored in the battery to provide two complete start cycles at -25°F after being charged by the heater. Once started at -25°F, the battery shall accept a charge in ambient temperatures to -60°F. After the battery charged light is

illuminated during operation and the heater is shut down for refueling and PMCS for 30 minutes in ambient temperatures of -60°F, the battery shall be able to restart the heater. Within an ambient temperature range of -25°F to +60°F, the battery pack shall be 99% recharged within 60 minutes for the Type I heater. With an ambient temperature range of 20°F to 40°F, the battery pack shall be 99% recharged within 90 minutes for the Type II heater. The recharge time is measured from the actuation of the ON/OFF control switch to illumination of the charged light. Prolonged usage in temperatures from -25°F to –60°F, with shut off times of one hour, shall not shorten the life or reduce the charging reliability of the battery.

3.3.15 External battery charge. The power storage battery shall have provisions for being charged using a commercially available 115 volt AC to 12 volt DC battery charger. Any adapter necessary shall be included within the accessory package.

3.3.16 Connectors and electrical wiring. Electrical connections shall be of a quick disconnect type wherever feasible. When the use of connectors of the same shell size in adjacent locations cannot be avoided, differences in the keying arrangement shall be used. Multi-contact connectors, including printed circuit assembly connections, shall be keyed, polarized, or of a contact configuration to prevent improper connection. Wire numbering or color-coding shall be used to the maximum extent to aid in following wiring diagrams and troubleshooting electrical problems. Electrical wiring should be supplied as removable harnesses for ease of replacement. A wiring diagram shall be present on the heater. Wires shall be routed so that they do not contact sharp corners, are not pinched between components, and strain relief is provided. Wire ties shall be used to make wiring look neat and professional. Excess wire tie ends shall be cut off close and straight.

3.3.17 Fuse protection. Necessary fuse protection shall be incorporated to protect against component damage, electrical shorts, and personnel burns. Fuses shall be readily accessible for removal or replacement and protected from accidental grounding. No special tools shall be required for fuse replacement. Spare fuses shall be included with on-board spare parts and located for easy access without tools.

3.3.18 Automatic built in test (ABIT) capability. The ABIT shall control starting, stopping, power generation, fault shut off and identification, burner modulation and operational functions. All functions shall be automatically executed without input from the user other than activation of the on/off switch and adjustment of the thermostat control. The ABIT system shall provide prediction and detection of malfunction or degradation of systems, subsystems or components specified. When a self monitored function or component falls outside of its safe operating level the ABIT system shall automatically initiate a shut down of the heater. The ABIT system shall isolate the fault to the lowest replaceable component or fuel supply and identify the specific manual diagnostic for correction during pre-start, start, and operation. The fault code shall be displayed by use of a red fault light accompanied by an audible tone as a string of pulses in unison, with a pause between each code (string) presented. The visual and audible fault

codes shall be annunciated on the control panel until the switch is positioned to the "off" position, with the exception of the burner maintenance fault, which shall be presented once after the completion of the post purge cycle during normal shut down.

3.3.18.1 ABIT system controls.

3.3.18.1.1 Pre-purge diagnostic control. The pre-purge cycle in the heater control system shall provide component and electrical operational checks and evacuation of fuel vapors in the burner to insure safe reliable starting. At a minimum, the combustion air flow, low starting voltage, tilt, igniter and ignition power source shall be checked for proper operating ranges. If a safe and reliable burner start is not probable then the burner start sequence shall be terminated and the identifying fault shall be presented. If fuel has been introduced into the burner area, a post-purge cycle shall follow. This pre-purge, pre-run function shall be automatic and shall provide a fault code and tone if terminated, identifying the source of shut down. The fuel flow to the burner shall be stopped within 2 seconds (if initiated) after detection of a fault condition or if the ON/OFF switch is positioned to the "OFF" position. Repeated failed start attempts shall not create a safety hazard.

3.3.18.1.2 Start cycle control. The burner start cycle shall be a consistent automatic timed function. If combustion cannot be initiated within this allotted time, the fuel delivery system shall stop followed by the post-purge and identifying fault code with tone. There shall not be an unsafe or hazardous condition created by a failed start attempt.

3.3.18.1.3 Post-purge diagnostic control. The post-purge cycle shall be a consistently timed function insuring sufficient evacuation of burner fumes and cool down of components for safe relocation, PMCS, or refueling after any time fuel has entered the burner area. When the ON/OFF switch is positioned to the OFF position or a fault is detected after fuel flow has entered the burner, fuel flow shall be shut off, followed by the post purge cycle or post purge cycle and fault code.

3.3.18.1.4 Hot re-light diagnostic control. The SHC shall be controlled so that it cannot be restarted until the completion of the post purge cycle.

3.3.18.2 ABIT system faults. The SHC shall have the capability to identify, at a minimum, the following system faults, each with it’s own distinct fault code

3.3.18.2.1 Low voltage fault. When a voltage level not sufficient for start or to safely continue heater operation is detected, the fuel flow to the burner shall stop, followed by the post-purge cycle, fault code and audible tone. The low voltage shut off value during heater operation (after start) shall provide adequate power reserves for the full post-purge cycle and

repetitive display of the identifying fault code and audible tone for a minimum of 10 minutes.

3.3.18.2.2 High voltage fault. When a voltage level is detected above safe operating levels which will result in unsafe operation or component degradation or failure, the fuel flow to the burner shall stop, followed by the post purge cycle, fault code and audible tone.

3.3.18.2.3 Tilt fault. The heater shall operate up to a 15 degree tilt in any direction. When the heater is operating or a start is attempted at a tilt greater than the maximum angle allowable for normal safe operation, fuel shall be shut off to the burner followed by the post purge cycle, fault code and audible tone.

3.3.18.2.4 Ignition element fault. If the ignition element is or becomes inoperable, the heater shall automatically terminate the start cycle and provide the identifying fault code and audible tone.

3.3.18.2.5 Combustion air fault. If the burner combustion blower motor fails to supply adequate combustion air flow, or is inoperable during start up, the heater shall automatically shut off and the identifying fault code and audible tone shall be presented.

3.3.18.2.6 Loss of flame fault. If the burner flame goes out during start up or operation, the fuel flow shall be shut off, followed by the post-purge cycle. The identifying fault code and audible tone shall be presented.

3.3.18.2.7 Generator over temperature fault. If the operating temperature of the generator becomes high enough to degrade its performance, or becomes hazardous, the fuel shall be shut off to the burner followed by the post-purge cycle, fault code and audible tone.

3.3.18.2.8 Burner maintenance fault. The ABIT shall monitor burner condition after each use. If a condition is detected which requires burner maintenance, a distinct code shall be presented one time on the control panel, after SHC shutdown and post-purge.

3.3.18.2.9 Vent fan fault. If the vent fan fault is provided, and the vent fan motor fails to supply adequate air flow, or is inoperable during start up, the heater shall automatically shut off and the identifying fault code and audible tone shall be presented.

3.3.18.2.10 Fin temperature sensor fault. If the temperature sensor on the TEG is open or shorted, the fuel flow shall be shut off to the burner followed by the post-purge cycle, fault code and audible tone.

3.3.18.2.11 Tent over-temperature fault. If the temperature inside the tent exceeds 908F, the heater will shut off and the identifying fault code and audible tone shall be presented.

3.3.18.2.12 Insufficient voltage to operate microprocessor fault. When a battery voltage level not sufficient for microprocessor or safe operation is detected, the fuel flow to the burner shall stop, followed by the post-purge cycle, fault code and audible tone.

3.3.18.2.13 Burner fuel delivery fault. If the burner fuel delivery fault is provided, and the burner fuel pump or burner fuel control system is open or shorted, the fuel flow shall be shut off to the burner followed by the post-purge cycle, fault code and audible tone.

3.3.18.2.14 Gravity fuel supply fault. If the gravity fuel supply fault is provided, and the main fuel supply control is open or shorted, the fuel flow shall be shut off to the burner followed by the post-purge cycle, fault code and audible tone.

3.3.18.2.15 Battery temperature sensor fault. If a battery temperature sensor is provided, and the battery requires temperature control, the heater will have a safety feature to prevent a battery over-temperature condition. If the safety sensor is open or shorted, the fuel flow shall be shut off to the burner followed by the post-purge cycle, fault code and audible tone.

3.3.18.2.16 Additional sensor faults. When additional sensors are incorporated that provide automatic adjustment or control of heater components, a fault code will be provided. If the sensor is open or shorted, the fuel flow shall be shut off to the burner, followed by the post-purge cycle, fault code and audible tone.

3.3.19 ASHRAE performance.

3.3.19.1 Type I. The Type I heater shall provide a minimum of 35,000 BTU/Hr (±1,500 BTU/hr) heat output when the thermostat is not satisfied using JP8 fuel and a maximum of 25,500 BTU/Hr (±1,500 BTU/hr) heat output with JP8 when the thermostat is satisfied. The heated air discharge rate shall be a minimum of 275 CFM during any heat output setting using both air ducts.

3.3.19.2 Type II. The Type II heater shall provide a minimum of 60,000 BTU/Hr (±2,000 BTU/hr) heat output when the thermostat is not satisfied using JP8 fuel and a maximum of 50,000 BTU/Hr (±2,000 BTU/hr) heat output with JP8 when the thermostat is satisfied. The heated air discharge rate shall be a minimum of 400 CFM during any heat output setting using both air ducts

3.3.20 Indicated efficiency and heat capacity. The burner system shall operate, during any temperature setting, at a minimum of 70 % indicated combustion efficiency. The maximum measured heat capacity shall be 35,000 BTU/hr (±1,500 BTU/hr) for the Type I heater and 60,000 BTU/hr (±2,000 BTU/hr) for the Type II heater.

3.3.21 Burner smoke spot. After 3 minutes of burner operation the heater shall not produce a smoke spot number greater than 3, per ASTM D2156, in any mode of operation under any identified performance test condition.

3.3.22 Operational safety. The SHC and its components shall perform in all modes of operation in a safe manner.

3.3.23 Breathable air. Products of combustion shall remain separated from the breathable heated air stream. Heated air shall be within the 8-hour Threshold Limit Values-Time Weighted Average (TLV-TWA) for carbon dioxide and carbon monoxide.

3.3.24 Electrical shock. The SHC shall have provisions to protect the operator from electrical shock or burns.

3.3.25 Sharp edges/moving parts. Non-functional sharp edges and projections shall be eliminated. The SHC shall provide operator protection from all moving parts.

3.3.26 Surface areas. All surface areas of the heater shall be below 120°F during operation except for the exhaust pipe, heated breathable air outlet duct connection point, and, the heated air duct outlet finger guard.

3.3.27 Minimum run cycle. The minimum run cycle shall consist of operation of the heater for a sufficient time to verify that the green ON light, green CHARGING LIGHT and the green BATTERY CHARGED light are illuminated. Record fuel flow rate, BTU output, smoke number, combustion efficiency, excess air, CO2, and flue temperature.

3.3.28 Noise. Noise levels, as measured from 3 feet from the heater, shall not exceed 85 dB.

3.4 Ownership or Support Requirements.

3.4.1 Mean Time Between Essential Function Failure (MTBEFF)/Maintenance Ratio(MR). The quantitative reliability requirement is a MTBEFF of 560 hours. An essential function failure (EFF) shall be scored when an incident results in the loss or significant degradation of an essential function that can not be quickly (within 15 minutes) corrected by the crew using only on board tools, spares and repair parts. An incident that causes catastrophic or critical hazards shall also be scored as an EFF. The SHC maintainability requirement is a total unit, direct support (DS), general support (GS) MR which shall not to exceed 0.0018 maintenance man-hour per operating hour, not including preventive maintenance checks and services (PMCS).

3.4.2 Field serviceability. Spare parts shall be capable of being removed and replaced within the operational environment by MOS nonspecific personnel wearing anti-contact gloves NSN 8415-00-227-1220 within 15 minutes. Fielding the SHC shall have no impact on the manpower or personnel structure. Spare parts shall be installed and wired for field maintenance to - 60°F.

3.4.3 Common test equipment. There shall be no new system specific test, measurement, and diagnostic equipment, or special tools to repair or maintain the heater. The heater shall be capable of complete disassembly and reassembled using common hand tools.

3.4.4 Hour meter. An hour meter shall be installed to record hours of operation. The hour meter shall be easily accessible for viewing.

3.4.5 Accessories. The SHC shall include the following accessories as required to meet this performance specification: Two breathable air ducts, control panel, control panel connection cable, battery charging adapter, plastic gravity feed adapter kit NSN 4520-01-466-0415, fuel can stand NSN 4520-01-465-4430 (Type I), dual fuel can stand (Type II), dual fuel can adapter (Type II), gravity feed fuel supply line (NSN 4520-01-508-5743) and the accessories storage bag(s) (NSN 4520-01-506-2148 for the Type I). When specified (See 6.2), a heater transport bag will be provided. All accessories will fit in the accessories bag.

3.4.6 Spares. Spare parts shall include the igniter, fuel filter element, flame sensor, and any other recommended components. Spares shall be located within a secure area with the heater or inside the transport storage bag when specified.

3.4.7 Tools. Tool(s) required to remove or replace any spare part shall be included and stowed within the heater or in the storage transport bag(s).

3.4.8 Weight. The weights of SHC Type I and Type II are listed below.

3.4.8.1 Type I. The weight of the Type I heater and battery without accessories shall not exceed 78 pounds. The Type I heater and all accessories packed in the accessories bag shall not exceed 108 pounds. The Type I heater, all accessories and spares in the accessories bag when packed within a heater transport bag(s), if specified (see 6.2), shall not exceed 128 pounds.

3.4.8.2 Type II. The weight of the Type II heater and battery without accessories shall not exceed 105 pounds. The Type II heater and all accessories packed in the accessories bag shall not exceed 135 pounds. The Type II heater, all accessories and spares in the accessories bag when packed within a heater transport bag(s), if specified (see 6.2), shall not exceed 155 pounds.

3.4.9 Volume. The volumes of SHC Type I and Type II are listed below.

3.4.9.1 Type I The outside dimensions of the Type I heater shall not exceed 6.8 cubic feet.

3.4.9.2 Type II The outside dimensions of the Type II heater shall not exceed 9.2 cubic feet.

3.4.10 Military vehicles. The SHC shall be easily transportable in the High Mobility Multipurpose Wheeled Vehicle (HMMWV), heavy-HMMWV, the Commercial Utility Cargo Vehicle (CUCV), and standard Army cargo trucks (2 1/2 to 5 ton) and all standard Army cargo trailers having a 1/4 to 1 1/2 ton capacity.

3.4.11 Vibration. The SHC and accessories shall remain fully operational after being subjected to the basic vibration profiles.

3.4.12 Loose cargo. The SHC and accessories shall remain fully operational after being subject to loose cargo testing.

3.4.13 Drop. The SHC and accessories shall remain fully operational after being subject to drop testing.

3.4.14 Transport and storage. When specified (see 6.2), a transport/storage bag, which houses the heater and accessories shall be provided. The bag(s) shall house the heater, operators' manual, spares and all accessories. The transport storage bag(s) hand holds shall provide uniform load distribution and ruggedness for dragging the bag perpendicular to the attachment points across a rough concrete or similar surface a distance of 100 feet and carrying the bag with four people. If two bags are used, both bags shall strap together in a shipping configuration. The same transport/storage bag(s) shall be used during all dynamic, environmental testing specified herein. The transport bag shall be padded for protection to allow the heater and all accessories to remain operable after dynamic and environmental testing. The heater and accessories shall be 4 man portable while in the bag(s) with all accessories.

3.4.15 Labels. The SHC shall have warnings and information labels providing quick and easy identification of assembly, maintenance items, safety cautions, operating instructions, electrical wiring diagram, and proper fuels affixed to the heater, accessories, enclosures or panels. Lifting requirements shall be clearly labeled.

3.4.16 Preventive maintenance checks and services (PMCS). PMCS shall not exceed 10 minutes time to accomplish during any climatic condition specified in this performance specification, during daylight or in the dark using a flashlight. Minimum PMCS shall include inspection of fuel filter for water or dirt contamination and cleaning if necessary, secure connections of the ducts and pipes, secure control box connection, gravity fuel

supply for proper connection, snow or ice blockage, fuel leaks and general condition to permit operation.

3.4.17 Component access. All major components shall be accessible within five minutes for inspection, cleaning or repair using no tools or tools supplied with the SHC.

3.4.18 Surface finish. The outside metal surface of the SHC body shall be coated with a corrosion preventative, chemical agent resistant coating. The color of the SHC shall be either green, tan, or white as specified (see 6.2, 6.4 and 6.5).

3.5 Interface requirements.

3.5.1 Outside tent operation. The heater shall be designed for outside tent operation and unprotected climatic exposure. Special consideration shall be given to the heater enclosure and exhaust outlet design to prevent damage or fire to any tent fabric that may come into contact with the enclosure and related components during movement of the tent walls in wind gust conditions. The heater shall be capable of being assembled for operation in 20 minutes or less, and disassembled and repacked for storage by two people in 15 minutes or less.

3.5.2 Tent wall modification kit (TWMK). When specified, (see 6.2), the SHC shall be provided with a kit that shall allow the operator to modify a plain tent wall to interface with the SHC inlet and outlet ducts. The TWMK shall include all necessary components and hardware to modify the tent wall for SHC outside operation.

3.6 Environmental requirements.

3.6.1 Salt Fog. The SHC and accessories shall show no evidence of peeling, blistering paint, possible electrical shorts due to salt deposits, deterioration, clogging or binding of moving parts, or change in tolerance limits of any internal or external parts.

3.6.2 Wind/rain. The SHC shall be operable in winds of 45 mph and rains of 4 inches per hour.

3.6.3 Storage. The SHC and accessories shall remain operable and show no signs of impairment due to storage at 155°F for 4 hours daily.

3.6.4 Basic climate operation.

3.6.4.1 Type I. The Type I SHC and accessories shall be operable in temperatures of +60°F to 0°F and provide a range of 25.5 KBTU/hr maximum (low setting) and 35.0 KBTU/hr minimum (high setting).

3.6.4.2 Type II. The Type II SHC and accessories shall be operable in temperatures of +60°F to 0°F and provide a range of 50,000 KBTU/hr maximum (low setting) and 60.0 KBTU/hr minimum (high setting).

3.6.5 Basic cold operation.

3.6.5.1 Type I. The Type I SHC and accessories shall be operable in temperatures down to -25°F and provide a minimum of 35.0 KBTU/hr.

3.6.5.2 Type II. The Type II SHC and accessories shall be operable in temperatures down to -25°F and provide a minimum of 60.0 KBTU/hr.

3.6.6 Severe cold climate operation.

3.6.6.1 Type I When using specified fuels, the Type I SHC and accessories shall operate outside of a tent and provide a minimum of 35.0 KBTU/hr when cold soaked and started at a threshold ambient temperature of -25°F and operated to –60°F. The Type I SHC and accessories shall operate outside of a tent and provide a minimum of 35.0 KBTU/hr when cold soaked and started at an objective ambient temperature of -40°F and operated to –60°F.

3.6.6.2 Type II When using specified fuels, the Type II SHC and accessories shall operate outside of a tent and provide a minimum of 60.0 KBTU/hr when cold soaked and started at a threshold ambient temperature of -25°F and operated to –60°F. The Type II SHC and accessories shall operate outside of a tent and provide a minimum of 60.0 KBTU/hr when cold soaked and started at an objective ambient temperature of -40°F and operated to –60°F.

3.6.7 Severe cold manipulation. The SHC shall be compatible with temperatures of -60°F allowing unpacking, connection to the MCPS tent and stowage within the heater transport bag, if specified (See 6.2). Breathable air ducts, combustion pipes, battery, flame sensor, igniter, control panel and cable, fuel hose, and hose couplers shall remain flexible, replaceable and operational.

3.6.8 High altitude. The SHC shall operate without loss of performance (70% minimum efficiency and smoke spot less than #3) or component degradation when operated at altitudes of 6,000 feet above sea level.

4. VERIFICATION

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

a. First article inspection (see 4.1.1).
b. Conformance inspection (see 4.1.2).

4.1.1 First article inspection. When a first article inspection is required (see 3.1, 6.2), the SHC shall undergo all the tests and examinations outlined in Table II. Sampling for first article inspection shall be as specified in the contract or purchase order (see 6.2 and 6.8).

4.1.2 Conformance inspection. Conformance inspections shall be conducted according to the tests specified in Table II. The sampling rate for conformance inspection shall be as specified in the contract or purchase order (see 6.2 and 6.9).

4.1.3 End item examination. Each SHC shall be examined for the requirements specified in Table II. Any redesign or modification of the contractor's product to comply with specified requirements, or any necessary redesign or modification following failure to meet the specified requirements shall receive particular attention for adequacy and suitability. The contractor may prepare a test plan to verify all the end item examination requirements in Table II in a manner that best fits their manufacturing practices.

4.2 Verification methods. Verification methods can include visual examination, measurement, testing, simulation, modeling, engineering evaluation, component properties analysis, certification, and similarity to previously approved or previously qualified designs. Unless otherwise specified, all verifications shall be conducted under ambient conditions of 60°+/- 5°F.

4.2.1 Verification alternatives. The contractor may propose alternative test methods, techniques, or equipment, including application of statistical process control, tool control, or cost-effective sampling procedures to verify performance (see 6.7).

TABLE II Requirement and Verification Outline

Requirement	Requirement paragraph	Verification paragraph	First article inspection	Conformance inspection	End item examination
Operating requirements	**3.3**	**4.3**			
Operation	3.3.1	4.3.1	X	X	X
Fuel capability	3.3.2	4.3.2	X	X	
Fuel system	3.3.3	4.3.3	X	X	
Trapped air	3.3.4	4.3.4	X	X	X
Fuel filtering	3.3.5	4.3.5	X	X	
Automatic fuel shut-off capability	3.3.6	4.3.6	X	X	
Residual fuel	3.3.7	4.3.7	X	X	X
Heat exchanger	3.3.8	4.3.8	X		
Heat exchanger over-temperature protection	3.3.8.1	4.3.8.1	X	X	
Exhaust outlet	3.3.9	4.3.9	X		
Heated air system	3.3.10	4.3.10	X	X	
Flexible air ducts	3.3.11	4.3.11	X	X	
Operator control panel	3.3.12	4.3.12	X	X	
Internal power generation system	3.3.13	4.3.13	X		
Power storage battery	3.3.14	4.3.14	X	X	
Battery safety	3.3.14.1	4.3.14.1	X		
Battery starting and recharge	3.3.14.2	4.3.14.2	X		

Requirement	Requirement paragraph	Verification paragraph	First article inspection	Conformance inspection	End item examination
External battery charge	3.3.15	4.3.15	X	X	X
Connectors	3.3.16	4.3.16	X	X	X
Fuse protection	3.3.17	4.3.17	X	X	X
Automatic built-in test capability	3.3.18	4.3.18	X	X	
ABIT system controls	3.3.18.1	4.3.18.1	X	X	
Pre-purge diagnostic control	3.3.18.1.1	4.3.18.1.1	X	X	
Start cycle control	3.3.18.1.2	4.3.18.1.2	X	X	
Post-purge diagnostic control	3.3.18.1.3	4.3.18.1.3	X	X	
Hot re-light diagnostic control	3.3.18.1.4	4.3.18.1.4	X	X	
ABIT system faults	3.3.18.2	4.3.18.2	X	X	
Low voltage fault	3.3.18.2.1	4.3.18.2.1	X	X	
High voltage fault	3.3.18.2.2	4.3.18.2.2	X	X	
Tilt fault	3.3.18.2.3	4.3.18.2.3	X	X	
Ignition element fault	3.3.18.2.4	4.3.18.2.4	X	X	X
Combustion air fault	3.3.18.2.5	4.3.18.2.5	X	X	
Loss of flame fault	3.3.18.2.6	4.3.18.2.6	X	X	X
Generator over temperature fault	3.3.18.2.7	4.3.18.2.7	X	X	
Burner maintenance fault	3.3.18.2.8	4.3.18.2.8	X		
Vent fan fault	3.3.18.2.9	4.3.18.2.9	X	X	
Fin temperature sensor fault	3.3.18.2.10	4.3.18.2.10	X	X	
Tent over temperature fault	3.3.18.2.11	4.3.18.2.11	X	X	
Insufficient voltage to operate microprocessor fault	3.3.18.2.12	4.3.18.2.12	X	X	
Burner fuel delivery fault	3.3.18.2.13	4.3.18.2.13	X	X	
Gravity fuel supply	3.3.18.2.14	4.3.18.2.14	X	X	
Battery temperature sensor fault	3.3.18.2.15	4.3.18.2.15	X	X	
Additional sensor faults	3.3.18.2.16	4.3.18.2.16	X	X	
ASHRAE Performance	3.3.19	4.3.19			
Type I	3.3.19.1	4.3.19.1		X	
Type II	3.3.19.2	4.3.19.2		X	
Indicated efficiency and heat capacity	3.3.20	4.3.20	X	X	X
Burner smoke spot	3.3.21	4.3.21	X	X	
Operational safety	3.3.22	4.3.22	X	X	
Breathable air	3.3.23	4.3.23	X	X	
Electrical shock	3.3.24	4.3.24	X	X	X
Sharp edges/moving parts	3.3.25	4.3.25	X	X	X
Surface areas	3.3.26	4.3.26	X		
Minimum test run	3.3.27	4.3.27		X	X
Noise	3.3.28	4.3.28		X	
Ownership or support requirements	**3.4**	**4.4**			
MTBEFF/MR	3.4.1	4.4.1	X		
Field serviceability	3.4.2	4.4.2	X		
Common test equipment	3.4.3	4.4.3	X	X	
Hour meter	3.4.4	4.4.4	X		
Accessories	3.4.5	4.4.5	X	X	X
Spares	3.4.6	4.4.6	X	X	X
Tools	3.4.7	4.4.7	X	X	X
Weight	3.4.8	4.4.8			

Requirement	Requirement paragraph	Verification paragraph	First article inspection	Conformance inspection	End item examination
Weight Type I	3.4.8.1	4.4.8.1	X		
Weight Type II	3.4.8.2	4.4.8.2	X		
Volume	3.4.9	4.4.9			
Volume Type I	3.4.9.1	4.4.9.1	X		
Volume Type II	3.4.9.2	4.4.9.2	X		
Military vehicles	3.4.10	4.4.10	X		
Vibration	3.4.11	4.4.11	X		
Loose cargo	3.4.12	4.4.12	X		
Drop	3.4.13	4.4.13	X		
Transport and storage	3.4.14	4.4.14	X	X	X
Labels	3.4.15	4.4.15	X	X	X
PMCS	3.4.16	4.4.16	X		
Component access	3.4.17	4.4.17	X		
Surface finish	3.4.18	4.4.18	X		
Interface requirements	**3.5**	**4.5**			
Outside tent operation	3.5.1	4.5.1	X		
Tent wall modification kit	3.5.2	4.5.2	X		
Inside tent operation	3.5.3	4.5.3	X		
Environmental requirements	**3.6**	**4.6**			
Salt fog	3.6.1	4.6.1	X		
Wind/rain	3.6.2	4.6.2	X		
Storage	3.6.3	4.6.3	X		
Basic climate operation	3.6.4	4.6.4			
Type I	3.6.4.1	4.6.4.1	X		
Type II	3.6.4.2	4.6.4.2	X		
Basic cold operation	3.6.5	4.6.5			
Type I	3.6.5.1	4.6.5.1	X		
Type II	3.6.5.2	4.6.5.2	X		
Severe cold climate operation	3.6.6	4.6.6			
Type I	3.6.6.1	4.6.6.1	X		
Type II	3.6.6.2	4.6.6.2	X		
Severe cold manipulation	3.6.7	4.6.7	X		
High altitude	3.6.8	4.6.8	X		

4.3 Operating Requirements Verification.

4.3.1 Operation inspection. Operate the SHC in its normal configuration. Verify automatic operation without external electrical power, one switch to control start up of the heater.

4.3.2 Fuel capability inspection. Verify the SHC operates with all of the fuels listed in Table I under the corresponding temperature ranges during basic climate, basic cold, and, severe cold environmental tests. Verify no manual compensation for varying fuel types or temperatures is necessary for operation.

4.3.3 Fuel system inspection. Verify that the SHC Type I operates with the standard gravity feed adapter, fuel can, and, fuel can stand during all operational testing herein.

Verify the SHC Type II operates with two fuel cans simultaneously facilitated by an adapter and a single tripod type fuel can stand.

4.3.4 Trapped air inspection. Manual bleeding of the gravity feed fuel supply line by the operator in order to operate the SHC during any testing herein shall constitute a failure.

4.3.5 Fuel filtering inspection. Visually inspect the filter for location in a protected area and for a clear filter housing. Verify that the filter element can be removed and replaced. Any shut down related to foreign particles bypassing the filter and entering the burner system shall constitute a failure. Verify filter-housing durability by filling filter and housing with equal amounts of JP-8 and water, then cold soak for two hours at -25°F. Any damage to the filter or housing shall constitute a test failure

4.3.6 Automatic fuel shut off capability test. Verify fuel shut off by operating the SHC for 5 minutes, position switch to OFF position and observe flow of fuel. Failure of fuel flow to stop within 2 second after activating the OFF switch shall constitute a failure. Configure the SHC for operation with a full 5 gallon fuel can and with the ON/OFF switch in the OFF position, then disassemble the fuel filter. Fuel flow through the gravity feed system to the disassembled filter shall constitute a failure.

4.3.7 Residual fuel inspection. Visually inspect the internal fuel system for residual fuel after operation. Any amounts of residual fuel, which cannot be easily drained, which would prohibit the SHC from being transported safely shall constitute a failure.

4.3.8 Heat exchanger test. Remove and replace the heat exchanger. Inability to remove and replace the heat exchanger using only common tools within 1 hour shall constitute a failure. Pressure test all production heat exchangers by blocking the necessary openings, applying 3-5 PSIG of internal pressure and submerse totally in water prior to assemblage into the heater. Any seepage of bubbles from the heat exchanger's surface shall constitute a test failure. Operate a SHC in the outside the tent configuration for a minimum of 3 hours at an ambient of -45°F. Any ice formation within the exhaust outlet on the heat exchanger or the exhaust pipe outlet shall constitute a test failure.

4.3.8.1 Heat exchanger over temperature protection. Completely block off breathable air stream. Operate the heater. The heater shall automatically stop prior to damage of any components by tripping of a temperature sensor. Verify the flame loss fault is presented on the control panel. Remove heat exchanger and pressure test. Any bubbles seeping from the heat exchanger's surface shall constitute a test failure.

4.3.9 Exhaust outlet inspection. Examine the location of the exhaust outlet to assure exhaust gases will be prevented from entering the breathable air inlet area.

4.3.10 Heated air system test. Operate the SHC until the BATTERY CHARGING light is on. Perform test of Appendix B, paragraph. B.2.1. Any readings below 275 CFM for Type I heater and readings below 400 CFM for Type II heater shall constitute a failure.

Place a temperature probe a minimum of 2 inches inside of the finger guard end of the heated air outlet duct. Operate heater, after the BATTERY CHARGING light is on, slowly restrict the air flow to the intake end of the return duct while measuring the temperature of the heated air flow. Inability of the heater to stop fuel flow to the burner, provide a post-purge and the identifying fault code before the outlet air temperature exceeds 275°F shall constitute a failure. Verify blower system is modular and protected with an inlet and outlet guards.

4.3.11 Flexible air duct inspection. Configure SHC for outside tent operation. Inability to connect both air ducts to the heater, with no tools while wearing anti-contact gloves shall constitute a failure. Verify hardware for attachment of ducts to heater is captive to the ducts. Run a metal sphere no larger than ¾ inch diameter across the inlet guard. Inability of the guard to prevent the sphere from passing through any area shall constitute a failure.

4.3.12 Operator control panel inspection. Configure the SHC for outside tent operation. Inspect control cable for adequate length. Inspect panel for a retained protective cap on control panel/cable interface. Verify presence of a single ON/OFF switch. Verify presence of all indicator lights as specified. Install a properly sized shunt in the battery lead wires and attach a volt meter. Observe the current direction and the CHARGING light on the control panel during operation. Failure of the CHARGING light to illuminate when the current reverses and the battery is accepting a charge from the internal generator shall constitute a test failure. When the BATTERY CHARGED light is illuminated, turn the heater off and allow it to run the normal post-purge cycle. Remove the battery and perform a state of charge test as recommended by the battery manufacturer. A battery charge of less than 99% of full capacity shall constitute a test failure. Verify the fault light and tone, activate during a fault and present the correct diagnostic code in unison for identifying the cause of shut down. Verify presence of a manual temperature control knob and a thermostat temperature-sensing device. Attach a temperature sensor and meter to the outside of the control box adjacent to the thermostat temperature sensor. Operate the heater at 20 (+/- 2)°F. Position the control knob to the lowest (1) setting. Failure of the SET POINT light to illuminate as the tent temperature rises and the attached temperature sensor indicates 40 (+/- 5)°F shall constitute a failure. Position the control knob to the highest (5) setting. The amber SET POINT light shall go off and remain off until the attached temperature sensor indicates 80 (+/- 5)°F. Failure of the switch to activate a pre-purge and start the heater when turned to the ON position shall constitute a failure. Failure of the switch to shut off the heater and provide a post-purge shall constitute a test failure. Verify knobs, indicator lights, and switches on the panel are protected from damage.

4.3.13 Internal power generation system inspection. Failure of the generator to supply sufficient power to conform to all testing parameters shall constitute a test failure. Adjustment of the generator for proper operation at any time shall constitute a test failure. Inability of the generator to be removed and replaced within one hour using only standard tools shall constitute a test failure. A power regulation system shall control system power in conjunction with the power generation system. Any electrical voltage or current

induced heater component failure, or fault related shut down (low voltage, high voltage) during any specified performance testing shall constitute a failure. If a generator voltage converter, regulator or power conditioner is used; failure to be removed and replaced within one hour using only standard tools shall constitute a test failure.

4.3.14 Power storage battery inspection. Visually inspect for a protected and secure battery housing located on the SHC. Examine battery manufacturer's certification. A shelf life of less than 2 years shall constitute a failure. Confirm the battery is replaceable by one person within 15 minutes.

4.3.14.1 Battery safety inspection. Verify battery is fuse protected within the battery case and fuses are easily replaced. Inspect the battery manufacturer's specifications, installation and shipping instructions. Inability for the battery to be in compliance with the vibration and pressure differential test contained in 49 CFR 173.159(d) shall constitute a failure. Inspect all batteries used after vibration and drop testing. Any signs of punctured cells, or caustic liquid leakage shall constitute a test failure. Inspect the battery housing and mounting location. Any design, which could allow a direct path of battery fumes and or liquid to enter the breathable air stream or contaminate electrical components, shall constitute a failure.

4.3.14.2 Battery starting and recharge test. Verify a fully charged battery can provide a minimum of two complete start cycles at –25°F. Verify the SHC can fully charge the battery during operation at an ambient temperature of –60°F. Operate the SHC at 40°F until the CHARGED light comes on. Adjust the temperature of the chamber to -25(+/- 2)°F and cold soak the Type I heater and battery for 4 hours. Start the Type I heater and run until the BATTERY CHARGED light on the control panel is illuminated. A time to charge longer than 60 minutes for the Type I from the time the ON switch is activated to the CHARGED light is illuminated shall constitute a test failure. Adjust the temperature of the chamber between 20°F and 40°F, and cold soak the Type II heater and battery for 4 hours. Start the Type II heater and run until the BATTERY CHARGED light on the control panel is illuminated. A time to charge longer than 90 minutes for the Type II from the time the ON switch is activated to the CHARGED light is illuminated shall constitute a test failure. Shut down heater and verify the battery is at least 99% charged. Repeat this test in an ambient of +60°F. Connect a voltmeter to the battery leads to monitor the voltage during heater operation. Using the battery manufacturer’s minimum charge voltage as a baseline, operate the heater in basic climatic conditions to +60 (+/- 2) °F with the tent thermostat set to the lowest setting (tent satisfied position 1). During operation the battery voltage shall increase and remain no less than the manufacturer’s minimum charging voltage. Failure of the battery to charge and remain above the recommended minimum voltage during or after battery charge shall constitute a test failure.

4.3.15 External battery charge inspection. Use a standard 12 VDC battery charger to charge a partially discharged battery to a fully charged state. Failure to recharge the battery shall constitute a test failure.

4.3.16 Connector and electrical wiring inspection. Inspect the assembly of a completed heater. Adjacent identical connectors shall be cause for rejection. Inspect the manufacturer's construction and assembly of contact configurations. Any assembly connections, which display the possibility of improper electrical connection, mating or positioning, shall constitute a test failure. Inspect for presence of a wiring diagram. Check for presence of wiring harnesses. Check for clear identification of wiring patterns and ability to follow wiring diagram to troubleshoot electrical problems. Examine the wire routing to make sure wires do not contact sharp corners, are not pinched between components, and that strain relief is provided. Examine for presence of wire ties that make wiring look neat and professional and that excess wire tie ends are cut off close and straight.

4.3.17 Fuse protection inspection. Inspect the electrical system for necessary fuse protection and onboard spare fuses, which are accessible and replaceable without tools.

4.3.18 Automatic built-in test (ABIT) capability inspection. Any requirement for the operator to adjust for fuel type, combustion air flow, generator electrical power routing or any other function that would require periodic operator intervention for efficient and safe heater operation, during any run mode, other than connection of the necessary air ducts, control cable, combustion pipe, and fuel supply, shall constitute a failure. Verify a visual and audible fault code is annunciated on the control panel during all fault conditions until the switch is positioned to the "off" position.

4.3.18.1 ABIT system controls test. ABIT operation shall be verified as follows:

4.3.18.1.1 Pre-purge diagnostic control test. Configure heater for outside tent operation and perform a. through c.

a. Combustion air flow. If a combustion air blower is used to provide burner air flow, disconnect the blower electrical connector then start heater, leave the connector(s) hanging free. Repeat with the combustion motor fan/rotor blade frozen (artificially jammed) with the electrical system connected. If a combustion motor is not used, block the combustion air inlet. Failure of the ABIT system to identify combustion motor or combustion air as a cause for shut down through the fault light and audible tone on the control panel shall constitute a failure.

b. Low starting voltage. Start the heater, after burner operation, but before the battery charging light is illuminated shut off the heater. Repeat until the battery is discharged to the point of low voltage. Failure of the ABIT system to shut off the heater, during the burner start cycle, and identify

low voltage as a cause for shut down through the fault light and audible tone on the control panel shall constitute a test failure.

c. Tilt the heater past the allowable angle for safe operation. Activate on switch. Failure of the ABIT system to identify a tilt fault through the fault light and audible tone on the control panel shall constitute a test failure. Perform this test pitch up and down and roll left and right.

4.3.18.1.2 Start cycle control test. Empty heater of fuel and disconnected from the external fuel supply. Activate the ON switch. Measure the time between the actuation of burner fuel pump to the stoppage of fuel pump. Without changing the battery repeat test. Failure of the ABIT system to shut off the fuel pump within 2 seconds of the last timed cycle and identify the fault as a start time out or start failure shall constitute a test failure.

4.3.18.1.3 Post purge diagnostic control test. Configure the heater for operation. Shut the heater off after five minutes of operation as measured from the actuation of the ON switch. Measure the time from the switch off position to the end of the post purge cycle. Repeat this test using the same battery. Post-purge times shall be consistent within 5 seconds of the last timed cycle. Burner fuel flow shall consistently stop within 2 seconds of switch activation to the off position. Failure of the ABIT to accurately provide a post-purge, which sufficiently evacuates burner fumes and cools heater for safe relocation, PMCS, or refueling, shall constitute a failure.

4.3.18.1.4 Hot re-light diagnostic control test. Operate the heater until the BATTERY CHARGING light is on. Position the ON/OFF switch to the off position for two seconds then to the on position. Failure of the heater to stop fuel flow to the burner, provide a post-purge and lock out (will not start until switched to the off position then back on) shall constitute a test failure. Position the ON/OFF switch to the off position, then to the on position. Operate the heater until the BATTERY CHARGED light is on, then position the ON/OFF switch to the off position. Ten seconds before the end of the post-purge cycle, position the switch back to the on position. Failure of the heater to finish post-purge and lock out shall constitute a failure.

4.3.18.2 ABIT system faults test. The ABIT system faults shall be verified as follows:

4.3.18.2.1 Low voltage fault test. Unplug the internal generator then operate heater using a fully charged battery. Operate until heater shuts down due to low voltage. Failure of the ABIT system to shut off the heater, provide a post-purge, and, correctly identify low voltage as the cause of shut down for a minimum of 10 minutes shall constitute a test failure.

4.3.18.2.2 High voltage fault test. Operate the heater until BATTERY CHARGING light is illuminated. Induce an above normal voltage level in the system by disconnection of a voltage regulation device or component. Failure of the ABIT system to shut off the heater, provide a post-purge, and correctly identify high voltage as the cause of shut down for a minimum of 10 minutes shall constitute a test failure.

4.3.18.2.3 Tilt fault test. Start the heater. Verify the heater operates normally at a 15 degree tilt on all four sides. Tilt the heater past 15 degrees to the angle required for shut off. Failure of the ABIT system to shut down the heater and identify the fault code as tilt and provide a normal post-purge shall constitute a test failure. Perform this test on four sides. Verify there is no hazardous condition or spillage of fuel from the heater after tilt testing. Inspect the attitude sensing device using the manufactures product sheet. A mercury sensor shall not be used.

4.3.18.2.4 Ignition element fault test. Configure the heater for outside tent operation. Unplug the igniter and activate start switch. Failure of the ABIT system to identify igniter, spark plug, or ignition as the fault shall constitute a failure.

4.3.18.2.5 Combustion air fault test Disconnect the combustion fan in the heater, or if no fan is used, totally block the combustion air inlet. Start the heater. Failure of the ABIT system to shut down the heater, provide the normal post-purge, and correctly identify the fault code as combustion air shall constitute a failure.

4.3.18.2.6 Loss of flame fault test. Operate the heater until the BATTERY CHARGED light is illuminated. Disconnect the external fuel supply. Failure of the ABIT system to shut down the heater, provide the normal post-purge and correctly identify the fault code as flame loss shall constitute a failure.

4.3.18.2.7 Generator over temperature fault test. Operate the heater until the BATTERY CHARGED light is illuminated. Gradually block off the inlet of the return air duct until heater shuts down. Failure of the ABIT system to shut down the heater, provide the normal post-purge and correctly identify the fault code as generator over temperature shall constitute a failure.

4.3.18.2.8 Burner maintenance fault test. Verify ABIT system is capable of detecting burner characteristics that would indicate burner maintenance is due.

4.3.18.2.9 Vent fan fault test. Disconnect the vent fan. Failure of the ABIT system to shut down the heater, provide the normal post-purge and correctly identify the fault shall constitute a failure.

4.3.18.2.10 Fin temperature sensor fault test. Disconnect the fin temperature sensor. Start the heater. Failure of the ABIT system to shut down the heater, provide the normal post-purge and correctly identify the fault code as fin temperature sensor fault shall constitute a failure.

4.3.18.2.11 Tent over temperature fault test. Start the heater and allow the tent temperature to exceed 90F. Failure of the ABIT system to shut down the heater, and correctly identify the fault code as tent over temperature shall constitute a failure.

4.3.18.2.12 Insufficient voltage to operate microprocessor fault test. Start the heater, after burner operation, but before the battery charging light is illuminated shut off the heater. Repeat to discharge the battery. Failure of the ABIT system to shut off the heater, during the burner start cycle, and identify low voltage as a cause for shut down through the fault light and audible tone on the control panel shall constitute a test failure.

4.3.18.2.13 Burner fuel delivery fault. Disconnect the fuel control. Start the heater. Failure of the ABIT system to identify the burner fuel delivery open or short circuit as the cause for shutdown, provide the fault light and an audible tone on the control panel shall constitute a test failure.

4.3.18.2.14 Gravity fuel fault. Disconnect the fuel supply control. Start the heater. Failure of the ABIT system to identify fuel solenoid open or short circuit as the cause for shutdown, provide the fault light and audible tone on the control panel shall constitute a test failure.

4.3.18.2.15 Battery temperature sensor fault. Disconnect the battery temperature sensor. Start the heater. Failure of the ABIT system to identify battery temperature sensor open or short circuit as the cause for shutdown, provide the fault light and audible tone on the control panel shall constitute a test failure.

4.3.18.2.16 Additional sensor control fault. If any additional sensor faults are provided, disconnect the sensor. Start the heater. Failure of the ABIT system to identify the sensor open or short as the cause for shutdown, provide the fault light and audible tone on the control panel shall constitute a test failure.

4.3.19 ASHRAE performance test. Perform test in Appendix A in accordance with ASHRAE Standard 51 in ambient temperatures above +40°F.

4.3.19.1 Calculated values shall conform to those stated in 3.3.19.1.

4.3.19.2 Calculated values shall conform to those stated in 3.3.19.2.

4.3.20 Indicated efficiency and heating capacity test. Perform test in Appendix B, paragraph. B.2.2 and B.2.3. Efficiency readings below 70% at any firing rate shall constitute a test failure. Maximum heat capacity below 35,000 BTU/hr (±1,500 BTU/hr) for the Type I heater and 60,000 BTU/hr (±2,000 BTU/hr) for the Type II heater shall be considered a test failure.

4.3.21 Burner smoke spot test. Perform a smoke spot test per ASTM D 2156. The Bacharach oil burner smoke tester and scale (see Appendix B) is acceptable for this test. The readings shall be taken after a minimum of 3 minutes of heater operation. Any smoke readings greater than a #3 shall constitute a test failure.

4.3.22 Operational safety inspection. Observe test records and performance of all test and inspections within this performance specification. Injury to personnel or damage to equipment or property resulting from testing shall constitute a failure.

4.3.23 Breathable air test. Test for, at a minimum, carbon dioxide and carbon monoxide while the heater is set up in the outside the tent configuration and operating for a minimum of 8 hours. Any readings above the TLV-TWA as established by the American Conference of Industrial Hygienists shall constitute a failure.

4.3.24 Electrical shock inspection. Inspect the SHC for exposed wires, absence of fuses and operation of the control panel indicator light during all phases of operation. Any exposed wires, missing fuses and failure of the indicator light to be illuminated during heater operation, pre-purge and post-purge shall constitute a failure.

4.3.25 Sharp edges/moving parts inspection. Inspect the SHC for presence of any non-functional sharp edges or exposure of moving parts. Any presence of non-functional sharp edges or exposure of moving parts shall constitute a failure.

4.3.26 Surface areas inspection. After one hour of operation measure all surface areas of the heater and the handles. Any temperature readings above 1208 F, other than the immediate exhaust pipe outlet, exhaust pipe connection point, heated air duct connection point and the finger guard, shall constitute a test failure.

4.3.27 Minimum run cycle test. Operate the heater for a sufficient time to verify that the green ON light, green CHARGING light and the green BATTERY CHARGED light are illuminated. Measure and record fuel flow rate, indicated BTU output, smoke number, combustion efficiency, excess air, CO2, and flue temperature.

4.3.28 Noise test. Operate the heater at the high fire rate. Measure sound levels at a 3-foot distance around the outside of the heater on four sides and the top. Any readings in excess of 85 dB shall constitute a failure.

4.4 Ownership or Support Requirements.

4.4.1 MTBEFF/Maintenance ratio test. Four heaters shall each be placed on a reliability test for a minimum of 600 hours each for a total of 2400 hours collective. There shall be no more than two chargeable essential function failures (cumulative). Fuel type used for test shall be divided equally among DF-2 and JP-8. The GFE furnished plastic five gallon can shall be used for the fuel source and refilled as needed. Perform burner smoke spot, during the start and each 100 hour interval (+/- 10 hours) and once during the last start cycle at the conclusion of this test for each unit operated. A maintenance ratio greater than .0018 maintenance man-hour per operating hour for any maintenance other than PMCS shall constitute a test failure.

4.4.2 Field serviceability test. Time the removal and replacement of each of the following; the flame sensor, igniter, fuel filter, battery fuses and battery. Use the spares included in the transportation bag except for the battery, which shall be reinstalled. Inability to remove and replace each component within 15 minutes shall constitute a test failure. Remove and replace circulation fan(s) or blower(s), failure to remove and replace within 1 hour shall constitute a failure. After each component removal and replacement the heater shall be returned to the operational configuration. Repack/stow all components to the transportation configuration. Perform this test cycle 3 times. After completion perform a functionally check of the heater.

4.4.3 Common test equipment inspection. Inspect the SHC and maintenance manual. Any requirement for the use any special hand tools and meters shall constitute a failure.

4.4.4 Hour meter inspection. Inspect the SHC for an hour meter. Absence of an hour meter that can be easily read and accessed without tools shall constitute a failure.

4.4.5 Accessories inspection. Inspect for accessories required for operation including two breathable air ducts, battery charging adapter (if needed), control panel, control panel cable, gravity feed adapter kit, fuel can stand assembly, dual fuel can stand (Type II), dual fuel can adapter (Type II), gravity feed fuel supply line, and accessories storage bag. If specified (See 6.2), inspect for a heater transport bag.

4.4.6 Spares inspection. Inspect for a securely stowed igniter, fuel filter element and flame sensor.

4.4.7 Tools inspection. Inspect for securely stowed tools necessary to remove and replace the spares.

4.4.8 Weight inspection. Weigh SHC Type I and Type II.

4.4.8.1 Weight inspection Type I. Weigh the SHC and battery without accessories. Any weight readings greater than 78 pounds shall constitute a test failure. Weigh the SHC and all accessories in the accessories bag. Any weight readings greater than 108 pounds shall constitute a failure. Weigh the SHC with all accessories, and accessory bag in the heater transport bag, if specified (See 6.2). Any weight readings greater than 128 pounds shall constitute a test failure.

4.4.8.2 Weight inspection Type II. Weigh the SHC and battery without accessories. Any weight readings greater than 105 pounds shall constitute a test failure. Weigh the SHC and all accessories in the accessories bag. Any weight readings greater than 135 pounds shall constitute a failure. Weigh the SHC with all accessories, and accessory bag in the heater transport bag, if specified (See 6.2). Any weight readings greater than 155 pounds shall constitute a test failure.

4.4.9 Volume inspection. Measure the outside envelope dimensions of Type I and Type II heaters.

4.4.9.1 Volume inspection Type I. Measure the outside envelope dimensions of the heater. A measurement greater than 6.8 cubic feet shall constitute a test failure.

4.4.9.2 1 Volume inspection Type II. Measure the outside envelope dimensions of the heater. A measurement greater than 9.2 cubic feet shall constitute a test failure.

4.4.10 Military vehicles inspection. Inspect the volume of the SHC in the transport configuration with all accessories. Assess the ability to be transported by the required vehicles listed in 3.4.10 through inspection of vehicle literature defining cargo storage dimensions and comparing with overall dimensions of the SHC. Inability to transport the SHC with any of the vehicles listed shall constitute a failure.

4.4.11 Vibration test. Subject SHC unit to basic transportation vibration test IAW the requirements and conditions set forth in MIL-STD-810, Method 514.5, Category 1.

(1) Visually check all contents of the SHC and functionally check the heater per 4.3.27 minimum run cycle, prior to vibration test.

(2) Mount the SHC in the transportation configuration to the vibration table and instrument with a tri-axial accelerometer mounted on the SHC frame. Subject the SHC to the vibration environments in all three mutually perpendicular axes (vertical, transverse, and longitudinal).

(3) Test 32 minutes in the two-wheel trailer spectra and 40 minutes for the composite wheel vehicle spectra for a total of 72 minutes of vibration in each of the three axes.

(4) Upon completion of the 216 minutes of testing, perform a visual check of all SHC contents and a functional check of the SHC per 4.3.27 minimum run cycle.

Any component damage which prevents the heater from operating after vibration testing, or any damage on the heater or accessories which may lead to unsafe operation shall constitute a test failure.

4.4.12 Loose Cargo Test. Subject SHC unit to loose cargo testing IAW the requirements and conditions set forth in MIL-STD-810, Method 514.5, Category 5.

(1) Visually check all contents of the SHC unit and functionally check the heater per 4.3.27 minimum run cycle, prior to the loose cargo test.

(2) Place SHC in the transportation configuration on tester using fences and a plywood bed configured IAW MIL-STD-810. The package tester speed shall be 300 RPM, 1". Total test time of 45 minutes shall be divided into the four major loading configurations by stopping the test and rotating SHC 90 degrees and continuing the test as needed.

(3) Upon completion of the 45 minutes of testing, perform a visual check of all SHC contents and a functional check of SHC per 4.3.27 minimum run cycle.

Any component damage which prevents the heater from operating after loose cargo testing, or any damage on the heater or accessories which may lead to unsafe operation shall constitute a test failure.

4.4.13 Drop test. Subject SHC unit to drop testing IAW MIL-STD-810, Method 516.5, Procedure IV.

(1) Visually check all contents of SHC and perform the minimum run cycle per 4.3.27.

(2) Suspend SHC in the transportation configuration by a drop hook such that the desired edge, corner or face is 30 inches from the impact surface. The drop hook shall be triggered allowing the SHC to free fall to the drop surface.

(3) The drop surface shall be a 2-inch thick plywood surface backed by concrete.

(4) A total of seven drops to the following orientations: each bottom corner, the bottom, fuel inlet side bottom edge, exhaust side bottom edge.

(5) Upon completion of the drop testing, perform a visual check of all SHC contents and a functional check of SHC per 4.3.27.

Any component damage, which prevents the heater from operating after drop testing, or any damage on the heater or accessories, which may lead to unsafe operation shall constitute a failure.

4.4.14 Transport/storage bag(s) inspection. When specified (see 6.2) transport and storage bag(s) shall be provided. The bag(s) shall house the heater, operators' manual, spares and all accessories. Inspect the transport storage bag(s) hand holds for uniform load distribution and ruggedness by dragging the bag perpendicular to the attachment points across a rough concrete or similar surface a distance of 100 feet and carrying the bag with four people. If two bags are used, strap both bags together in a shipping configuration. The same transport/storage bag(s) shall be used during all dynamic, environmental testing specified herein. Inability of the bag to withstand all environmental and durability tests shall constitute a failure. Inability of the heater and accessories to be 4 man portable while in the bag(s) with all accessories shall constitute a failure.

4.4.15 Label inspection. Verify that all labels can be read quickly and easily from left to right. Verify label placement is on or very near the items they identify. Controls shall not obscure labels. Labels shall be located in a consistent manner throughout the SHC system. Labels shall be printed in capitals. All letters shall be black, except when using a black background the letters shall be white. Label backgrounds shall be red for danger, yellow for caution and black for information. Verify letter size and color are sufficient to be easily read from a distance of six feet in day light or with the aid of a flashlight when dark. Verify access panels are labeled identifying the component protected inside. Verify presence of lifting requirement labels. Verify presence of a wiring diagram. Omission of any required labels, per 3.4.15, shall constitute a failure.

4.4.16 Preventive maintenance checks and services (PMCS) test. Configure the heater for outside tent operation. Perform a walk around inspection of the duct work to the heater and tent, verify a secure control box connection, the gravity fuel supply for proper connection, inspect for snow or ice coverage or blockage, fuel leaks, fuel filter for contamination and general condition. A thorough examination shall not exceed 10 minutes. No panels or covers shall be removed or opened to gain visual access.

4.4.17 Component access inspection. Verify all major components are accessible within five minutes for inspection, cleaning or repair using no tools or tools supplied with the SHC.

4.4.18 Surface finish inspection. Verify the SHC is coated with a corrosion preventative chemical agent resistant coating. Verify the color of the SHC is either green, tan, or white as specified (see 6.2, 6.4 and 6.5).

4.5 Interface requirements verification.

4.5.1 Outside tent operation inspection. Set up shall be conducted by no more than two people. Position the heater adjacent to the outside wall, run the air ducts through two

sleeved entrance holes. If no entrance holes are present, and a Tent Wall Modification Kit is not available, run duct underneath the tent wall. Unpack and install all necessary components for operation. Average set up times greater than 20 minutes (not including TWMK setup) shall constitute a failure. Observe the heater while operated in this configuration, presence of any safety hazards or loss of heater performance shall constitute a failure. Any signs of tent fabric discoloration due to heat shall constitute a failure. Turn off heater and repack for storage, disassembly times greater than 15 minutes shall constitute a failure.

4.5.2 Tent wall modification kit inspection (TWMK). (See 6.2) Following manufacturer's instructions, install the modification kit to a tent wall. Any need for hardware other than provided shall constitute a failure. Set up SHC for outside operation using the modified wall. Inability of the SHC ducts to pass through the duct openings, or any gaps between the duct opening and the duct shall constitute a failure. Remove air ducts and close duct openings. Inability to close duct openings or presence of gaps shall constitute a failure.

4.6 Environmental requirements. The environmental requirements shall be verified as follows:

4.6.1 Salt fog test. SHC unit with accessories shall be tested IAW the requirements and conditions set forth in MIL-STD-810, Method 509.4. Provide 48 hours of salt fog exposure, followed by 48 hours of dry out.

(1) Expose SHC with dust covers installed, air ducts, exhaust and combustion pipe, control panel and connection cable outside of the storage transport bag(s). Subject the remaining items inside the storage bag(s).

(2) Upon completion of the testing, perform a visual check of all SHC contents, and internal components of the SHC for evidence of peeling, blistering paint, possible electrical shorts or impairment due to salt deposits, evidence of deterioration, clogging or binding of moving parts, or change in tolerance limits of any internal or external parts which could prevent the unit from meeting operational and maintainability requirements. Minor oxidation, which can easily be removed, on exposed fasteners and hardware in permissible, provided performance of the part is not adversely affected.

(3) Operate the SHC per the minimum run cycle of 4.3.27. Failure to remain operational after salt fog testing shall constitute a test failure.

4.6.2 Wind/rain test. Subject the SHC unit from salt fog testing (if properly functioning) to wind/rain testing IAW the requirements and conditions set forth in MIL-STD-810, Method 506.4, Procedure I-Blowing Rain.

(1) Provide 4 in/hr of rain along with 40-45 mph winds for 30 minutes with the SHC in each of the following three configurations.

a) The storage configuration, inside the heater transport bag if specified (See 6.2) (storage protected).
b) The SHC outside of the heater transport bag with all dust covers installed (storage unprotected).
c) The SHC outside of the heater transport bag with both air ducts, and external fuel attached (operational).

(2) After each of the three test exposure configurations the item(s) shall be unpacked or opened and checked for water penetration.

(3) During the last 10 minutes of testing in configuration c) the SHC shall be started and operated per 4.3.27 minimum run cycle.

Any signs of water penetration, which may cause component degradation or prohibit safe operation of the SHC, shall constitute a failure. Failure of the heater to operate after wind/rain exposure shall constitute a failure.

4.6.3 Storage test. Subject one SHC to testing IAW MIL-STD 810, method 501.4, Procedure I-Storage. Bring chamber air temperature up to 155 degrees F (+/- 3) and 75% relative humidity (+/- 5%), once these conditions are attained, hold for a 4 hour storage period. Remove the SHC and perform functionally check per 4.3.27 minimum run cycle. Failure of the heater to operate due to damage during storage testing shall constitute a test failure.

4.6.4 Basic climate operation test. Perform the basic climate operation test for the Type I and Type II heater as detailed below.

4.6.4.1 Type I. The basic climate operation test shall be run in accordance with MIL-STD 810, Method 502.4, Procedure II-Operation. Set up SHC per 4.5.1. Provide temperatures of 40°F (+/- 2) to operate heater. Use fuels as specified in Table I. Perform heat capacity test of Appendix B. Values not meeting the requirements of 3.6.4.1 for Type I heater shall constitute a failure.

4.6.4.2 Type II. The basic climate operation test shall be run in accordance with MIL-STD 810, Method 502.4, Procedure II-Operation. Set up SHC per 4.5.1. Provide temperatures of 40°F (+/- 2) to operate heater. Use fuels as specified in Table I. Perform heat capacity test of Appendix B. Values not meeting the requirements of 3.6.4.2 for Type II heater shall constitute a failure.

4.6.5 Basic cold operation test. Perform the basic cold operation test for the Type I and Type II heater as detailed below.

4.6.5.1 Type I. The basic cold operation test shall be run in accordance with MIL-STD 810, Method 502.4, Procedure II-Operation. Set up SHC per 4.5.1. Provide temperatures of -25°F (+/- 2) to operate heater. Use fuels as specified in Table I. Perform heat capacity test of Appendix B. Values not meeting the requirements of 3.6.5.1 for Type I heater shall constitute a failure.

4.6.5.2 Type II. The basic cold operation test shall be run in accordance with MIL-STD 810, Method 502.4, Procedure II-Operation. Set up SHC per 4.5.1. Provide temperatures of -25°F (+/- 2) to operate heater. Use fuels as specified in Table I. Perform heat capacity test of Appendix B. Values not meeting the requirements of 3.6.5.2 for Type II heater shall constitute a failure.

4.6.6 Severe cold climate operation test. Perform the severe cold operation test for the Type I and Type II heater as detailed below.

4.6.6.1 Type I. The severe cold climate operation test shall be run in accordance with MIL-STD 810, Method 502.3, Procedure II-Operation. Set up SHC per 4.5.1. Provide a threshold temperature of -25°F (+/- 2) to start the heater, then, bring test chamber temperature down to -60°F while operating. Provide an objective temperature of -40°F (+/- 2) to start the heater, then, bring test chamber temperature down to -60°F while operating. Use fuels as specified in Table I. Perform heat capacity test of Appendix B. Values not meeting the requirement of 3.6.6.1 shall constitute a failure.

4.6.6.2 Type II. The severe cold climate operation test shall be run in accordance with MIL-STD 810, Method 502.3, Procedure II-Operation. Set up SHC per 4.5.1. Provide a threshold temperature of -25°F (+/- 2) to start the heater, then, bring test chamber temperature down to -60°F while operating. Provide an objective temperature of -40°F (+/- 2) to start the heater, then, bring test chamber temperature down to -60°F while operating. Use fuels as specified in Table I. Perform heat capacity test of Appendix B. Values not meeting the requirement of 3.6.6.2 shall constitute a failure.

4.6.7 Severe cold manipulation test. Perform a severe cold manipulation and component replacement test. The test shall run in accordance with MIL-STD 810 Method 502.4, Procedure III manipulation. Cold soak the SHC with transportation bag and all additional SHC accessories to -60°F. After component temperature stabilization remove battery then re-install, replace igniter, then the flame sensor using spares included in the transportation bag. Connect the SHC fuel line to the gravity feed adapter and heater. Repack all components to the transportation configuration. Perform this test cycle 3 times. Any evidence of damage to wires, components and accessories or any inability to manipulate components while wearing the appropriate cold weather clothing shall constitute a test failure.

4.6.8 High altitude test. Conduct test in accordance with MIL-STD 810, Method 500.4, Procedure II-Operation. Provide a field site that is 6,000 feet altitude minimum for

operational checkouts. Operate heater for a minimum of one hour. Perform smoke spot test within three minutes after starting and again before shut down. There shall be no operator adjustments required for altitude compensation for proper operation. Perform indicated efficiency test. Any degradation in performance as demonstrated by the efficiency test and smoke test, failure of the battery to charge within 60 minutes for the Type I and 90 minutes for the Type II or failure of the heater to operate shall constitute a failure.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or purchase 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 Departments System Command. Packaging data retrieval is available from the managing Military Departments or Defense Agency's automated packaging files, CD-ROM products, or by contracting 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 SHC is military unique in that it is required to circulate heated air without external electrical power, operate on logistical fuels, interface with military tents and shelters, and operate down to –608 F. There are no commercial items that can satisfy these requirements. The SHC Type I with accessories is intended to heat personnel and equipment housed in the Modular Command Post System (MCPS) and similarly sized shelters. It provides approximately 35 KBTU of circulated heated air without the use of external electrical power. The SHC Type II with accessories is intended to heat personnel and equipment housed in the MCPS, TEMPER, GP tents and MGPTS shelters. It provides approximately 60 KBTU of circulated heated air without the use of external electrical power.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Operators manual requirements
c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.3).
d. When a first article is required (see 3.1.).
e. When transport or storage bags are required (see 3.4.14)
f. Color of heater required (see 3.4.18).
g. When tent wall modification kit is required (see 3.5.2)

h. Sampling plan size for first article and conformance test (see 4.2 and 4.3).
i. End item examination requirements
j.. Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.

Multi-fuel
Self-powered
Tent heating

6.4 Color or SHC. Colors approximating the following color chip number of FED-STD-595 have been used to satisfy the requirement of 3.4.18:

Color required	Color chip No.
Green 383	34094
Tan 686	33446
White (aircraft)	37875

6.5 Corrosion preventive paint. The use of MIL-P-53022 or MIL-P-53030 as a first coat, then top coating all surfaces with a Chemical Agent Resisting Coating (CARC) conforming to MIL-C-46168 or MIL-C-53039 has been found to satisfy the requirement of 3.4.18.

6.6 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, specifications and standards that have been cleared and listed in DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.7 Verification alternatives. Contracting documents should provide guidance to offerers regarding the submission of alternatives to specified verification methods.

6.8 First article. When requiring a first article, contracting documents should provide specific guidance to offerers. This guidance should cover whether the first article is a first article sample, a first production item, or the number of test items. These documents should also include specific instructions regarding arrangements for examinations, approval of first article results, and disposition of first articles. Pre-solicitation documents should provide government waiver rights for first article inspection to bidders offering a previously acquired or tested product. Bidders offering such products that wish to rely on previous testing must furnish evidence with the bid that prior government approval is appropriate for the pending contract.

6.9 Conformance inspection. During acquisition, contracting documents should indicate the designated frequency of conformance tests listed in Table II based on risk assessment for the procurement. Some of these risk factors include contractor past performance, government schedules and budget, product material and design maturity, manufacturing equipment and

processes applied, labor skill and training, and uniformity of measuring processes and techniques.

6.10 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

APPENDIX A
ASHRAE Performance Test Procedure

A.1 SCOPE

A.1.1 Scope. This appendix details the ASHRAE procedures for air discharge rate, heating capacity, and measured efficiency; and is a mandatory part of this specification.

A.2 APPLICABLE DOCUMENTS.

AMERICAN SOCIETY OF HEATING, REFRIGERATION
AND
AIR CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 41 - Standard Method for Temperature Measurement

(Application for copies should be addressed to American Society of Heating, Refrigeration and Air Conditioning Engineers, 1791 Tullie Circle N.E., Atlanta, GA 30329. The web address is http://www.ashrae.org .)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

ASME PTC 19.5 - Application, Part II of Fluid Meters

(Application for copies should be addressed to American Society of Mechanical Engineers, Information Central Orders/Inquiries, P.O. Box 2300, Fairfield, NJ 07007-2300. The web address is http://www.asme.org .)

A.3 PROCEDURE

A.3.1 Air discharge rate.

a) Assemble test setup in accordance with ASHRAE Standard 51. The test chamber shall be insulated so that the calculated heat leakage through the walls of the chamber does not exceed 2% of the capacity of the tested heater.
b) Test heater in both inside and outside configurations and high and low fire rates.
c) The heater under test shall be operated until equilibrium conditions are attained before test data are recorded.
d) Measure the air flow and pressure flow losses in accordance with ASHRAE 51 or ASME PTC 19.5.
e) Measure barometric pressure and temperatures in accordance with ASHRAE 51 and ASHRAE 41.
f) Measure the fuel flow rate.

APPENDIX A (continued)

g) Calculate the air discharge rate (CFM) in accordance with section 9 of ASHRAE Standard 51.

A.3.2 Heating capacity.

a) Use the same setup, data and calculations recorded in A.3.1.
b) Test results shall be corrected to standard conditions using the following properties.

Density	=	0.075 lb. per cubic foot [lbs/ft^3]
Pressure	=	29.92 inches of Mercury [in. Hg]
Temperature	=	68 ^oF

c) Calculate the heating capacity using the following equation:
Heating capacity (BTU/Hr) = 60 x Q x d x C_p x (t_{out} - t_{in})
Q = Air discharge rate [SCFM]
d = 0.075 [lbm/ft^3]. Density of air at standard conditions.
C_p = 0.240 [BTU/lbm dry air-^oF]. Average specific heat of the ventilating air from temperature rise across heater
(t_{out} - t_{in}) = Air temperature rise across heater [^oF]

A.3.3 Measured efficiency.

a) Use the same setup, data, and calculations as recorded in A.3.1 and A.3.2.
b) Calculate an equivalent heat input value (BTU/Hr) based on the energy content of the fuel (from the fuel certification) and the measured flow rate.
c) Calculate the measured efficiency using the following equation:
Measured efficiency (%) = (H / Equivalent heat input) x 100
where H = Heating capacity (BTU/Hr)

APPENDIX B
Indicated Performance Test Procedures

B.1 SCOPE

B.1.1 Scope. This appendix details the procedures for measuring indicated air discharge rate, indicated heating capacity and indicated efficiency, and is a mandatory part of this specification.

B.2 PROCEDURE

B.2.1 Air discharge rate.

a) Test Type I and Type II heaters in the outside tent configurations, and at high and low firing rates.
b) The heater under test shall be operated until equilibrium conditions are attained before test data are recorded.
c) Measure the air discharge flow speed using a portable vane anemometer and calculate the air discharge rate (CFM), remove any finger guards prior to testing with air ducts. Ambient airflow into the heater shall be 40 to 60 degrees F.

B.2.2 Indicated efficiency.

a) Measure indicated efficiency with a Bacharach Fyrite test kit, P/N 10-5000, Kane-May Ltd. combustion analyzer Model 9003, or equivalent equipment following manufacturer's instructions.
b) Exhaust samples shall be taken no farther than10 inches from where the exhaust exits the heat exchanger.

B.2.3 Heating capacity.

a) Measure fuel flow into the heater.
b) Calculate an equivalent heat input value (BTU/Hr) based on the energy content of the fuel (manufacturer's certification) and the measured flow rate.
c) Calculate the heating capacity using the following equation:
Heat capacity (BTU/Hr) = (Equivalent heat input x Indicated efficiency) / 100

B.2.4 Burner smoke spot test. At the sampling hole, measure the smoke spot using a Bacharach Fyrite test kit, P/N 10-5000, smoke tester or equivalent meeting ASTM D2156, and compare to the smoke spot scale. The heater shall be operating for a minimum of 15 minutes before taking the smoke sample.

Custodians:

Army - GL
Navy - YD
Air Force - 99

Review activities

Army - MD1, QM1
Navy - MC
Air Force - 35, 84
DLA-CC

Preparing activity:

Army - GL

(Project 4520-2006-007)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil .