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SURFACE VEHICLE STANDARD

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(R) FUEL-FIRED HEATERS--AIR HEATING--FOR CONSTRUCTION AND INDUSTRIAL MACHINERY

1. ***Scope—***This standard covers off-road, self-propelled work machines as categorized in SAE J1116.

This standard outlines requirements that must be met in order for the heating equipment to perform satisfactorily on construction and industrial machinery.

1.1 **Purpose—**This standard describes a general set of parameters covering fuel-fired heaters for heating and defrosting cabs on construction and industrial machinery.

2. ***References***

2.1 **Applicable Publications—**The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J551 OCT85—Performance Levels and Methods of Measurement of Electromagnetic Radiation from Vehicles and Devices (30-1000 MHZ)
SAE J1116 JUN86—Categories of Off-Road, Self-Propelled Work Machines

3. ***Design Requirements***

3.1 **Performance**

3.1.1 CAPACITY—Heat output requirements cover a range of 15 000–60 000 Btu/h (4395–17 584 W).

3.1.2 ENVIRONMENTAL OPERATING CONDITIONS—The heater shall be designed to operate in the following environment:

a. Temperature: –60 to +60°F (–51 to + 16°C).
b. Altitude: 0–10 000 ft (0–3048 m).
c. Wind: 0–60 mph (0–97 km/h).

3.1.3 FUELS—The heater shall operate from the same fuel used to power the equipment it is installed on.

3.1.4 POWER SUPPLY—Batteries and the charging system shall be of sufficient size to include heater operation as well as other machine electrical components.

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3.1.4.1 Heater operating voltage:

a. 12 V system: 10–15 V.
b. 24 V system: 20–30 V.

3.1.4.2 The heaters should be able to ignite and operate at the minimum voltages in an emergency.

3.1.4.3 Best practice is to start the machine engine first, then start the heater. The heater should not be operated for any great length of time after the engine is stopped.

3.1.5 OPERATING LIFE—The operating life of all major components (for example, burner, heat exchanger) should be a minimum of 2000 h. The blower motor brushes may have to be replaced and other minor components may require replacement or adjustment as recommended by the manufacturer at specified time intervals.

3.1.6 EASE OF MAINTENANCE—The heater should be designed to permit accessibility for servicing, maintenance, and repair with common tools. Replacement of the igniter or adjustment of any control should be possible without removal of the heater.

Any special tools required for “on machine” maintenance or adjustment shall be provided and stored in or near the heater compartment.

3.1.7 ELECTROMAGNETIC INTERFERENCE—Where required, the heater shall be radio-suppressed to meet the requirements of the machine it is installed on. The Heaters should be radio-suppressed within the limits described in SAE J551.

3.2 Safety Requirements—Adequate safety features shall be provided, some of which are listed below:

3.2.1 Fail-safe devices shall be built in or added to the heating system to assure shutdown of the heater in the event of overheating or loss of flame or failure to ignite for any reason.

3.2.2 The heater shall be installed with clearances to combustible materials, and to prevent contact burns to operators.

3.2.3 The fuel shall not be supplied to the heater by gravity. The fuel supply system shall be arranged so that in the event of the machine overturning, the fuel to the burner will be shut off.

3.2.4 The heaters shall be provided with a remote fuse or circuit breaker to shut down the heater in the event of a short circuit or overload.

3.2.5 All heaters shall be equipped with a “tell-tale” light to indicate to the operator that the heater is operating properly.

3.2.6 The heater controls shall be located to permit the operator to operate them without taking attention from the road or work area.

3.2.7 All combustion air shall be drawn in via a separate duct from outside the machine. All products of combustion shall be exhausted outside the machine to open air in such a manner that they cannot reenter.

3.2.8 Circulating fresh air may be drawn from inside or outside the machine, but any fresh air duct which passes through the engine compartment shall be sealed so that no fumes may enter the circulating air.

3.2.9 Electrical components and wiring shall meet all environmental requirements and shall be sized in accordance with SAE Recommended Practices. Wire and insulation shall be flexible to –60 °F (–51 °C).

3.3 Mounting Position—The manufacturer's recommendations will govern the mounting position.

3.4 Sizing of Heater to the Application—Due to the wide variety of operating conditions to be considered, the heating system should be designed for the most extreme condition. A means shall be provided for the operator to control the comfort level by means of a combination of thermostat and airflow dampers.

3.5 Shock and Vibration—The heater shall withstand and absorb shock and vibration as indicated without structural damage, visual misalignment or malfunction of components, leaks, abnormal vibration, or irregular operation.

3.5.1 SHOCK—The heaters shall be capable of withstanding at least 8 g shock on the three principle axes.

3.5.2 VIBRATION—The heaters shall be capable of operating satisfactorily in vibration frequencies of 10-55 Hz at loads up to 1.4 g in three planes relative to its normal mounting position, that is, one vertical and two horizontal drives.

4. Application Considerations

4.1 General—Manufacturers shall include installation guidelines with their heating equipment.

The following recommendations apply to most fuel-fired heaters and should be given consideration.

4.2 Fuel Supply—Most automotive-type heaters require a pressure feed of 3–15 psi (21-103 kPa). This pressure is supplied by the engine fuel pump or by a separate fuel pump.

4.2.1 A nonbreakable sediment bowl fuel filter is recommended between the fuel tank and heater fuel inlet. The filtration size is recommended by the heater manufacturer.

4.2.2 Flare fittings and low-temperature compound hoses with swivel connectors are good practice. This type of hose is preferable to metal hose and causes fewer problems due to vibration. Hoses should be secured to prevent flexing or strains that could produce leaks.

4.2.3 Care should be taken to avoid all dips or low spots in the fuel lines where moisture can accumulate and freeze.

4.2.4 The addition of a fuel supply pet cock at the heater inlet to check for fuel supply to the heater is good practice.

4.3 Electrical Supply—Batteries and a charging system adequate to provide the necessary power for heater ignition and to sustain heater operation are requirements to be considered in selecting a heater for a particular application.

4.4 Air Supply—Care must be taken to provide adequate air supply. Manufacturer's specifications will dictate maximum allowable restrictions or attaching duct work to air and exhaust systems.

5. Notes

5.1 Marginal Indicia—The change bar (I) in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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