SAE International

SURFACE VEHICLE INFORMATION REPORT

SAE J1310 DEC2011

Issued 1981-04
Stabilized 2011-12

Superseding J1310 JUN1993

Electric Engine Preheaters and Battery Warmers for Diesel Engines

RATIONALE

The technical report covers technology which is mature and not likely to change in the foreseeable future. Also there is no support for revising the documents.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE Common Tests Technical Steering Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/J1310_201112

Foreword—This Document has also changed to comply with the new SAE Technical Standards Board format.

1. Scope—The scope of this SAE Information Report is to acquaint and inform those concerned with cold weather operation of diesel-powered machines and vehicles with the selection and application of electrically powered starting aids currently available.

It deals specifically with the design, function, and application of line voltage electrically powered engine preheaters and battery warmers.

2. References

2.1 Applicable Publication—The following publication forms a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

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

SAE J226—Engine Preheaters

3. General—Diesel engine starting becomes progressively more difficult as the ambient temperature drops below 4 °C. To achieve successful engine starting, the engine combustion chamber temperatures must be sufficient to ensure that the air/fuel mix will ignite under full compression. However, low ambient temperatures affect combustion chamber temperatures for the following reasons:

a. The cylinder wall temperatures are low due to low coolant and block temperatures.

b. The air temperature entering the combustion chamber is at ambient temperature.

c. The cranking speed at low temperature is at a lower rpm because of the greater lube viscosity and decreased battery efficiency.

d. The fuel temperature reduced by low-ambient temperature will reduce combustion chamber temperatures.

Electric engine preheaters and battery warmers are one way of assisting in obtaining consistent successful starts under cold ambient starting conditions, assuming a source of electric power is readily available.

These cold weather aids are designed for permanent installation and are intended to be utilized during normal engine shutdown periods. Engine preheaters heat the engine block by way of raising coolant temperatures and by heating lube oil.

Ideally, engine preheaters should be sized so that they will produce engine temperatures allowing for consistent starting when energized for several hours from a cold-soak condition. Under certain conditions of limited wattage and severe cold conditions, the use of ether in conjunction with preheaters and battery warmers may also be required to achieve starting. An important benefit from the correct application and use of preheaters is a reduction in strain and wear caused to electric starting systems and key engine components.

The engine coolant preheaters should provide successful engine starting at temperatures in the -32 °C range. At lower ambient temperatures, other preheaters will be required in conjunction with coolant heaters.

The engine preheaters can take several forms depending upon the engine application. The heater design depends on engine size and configuration and will generally fall into one of the following categories:

a. Coolant immersion type
b. Oil immersion type
c. External tank coolant type

***4. Heater Design and Construction*—**Electric engine preheaters have three basic components:

a. Heating element
b. Heater casing or adaptor
c. Power supply conductor

4.1 Heating Element—Consists of:

4.1.1 Tubular metallic sheath of steel, copper, stainless steel, or nickel alloy.

4.1.2 Resistance wire helix and terminal pin assembly, a specific length and gage of nickel chromium resistance wire, equipped with heavy gage wire, stainless steel, or plated steel terminal pins welded to the helix.

4.1.3 Suspending medium, magnesium oxide powder, possessing high dielectric strength, high temperature stability, and heat conductivity.

The heating element is generally assembled in the following manner:

The resistance wire helix and terminal pin assembly of a predetermined resistance value is suspended centrally inside a specific length of tube. A controlled flow of magnesium oxide powder is allowed to fill the remaining cavity to physically support and electrically insulate the helix. The assembly is then further compacted by reducing its tubular sheath diameter through a swaging or roll mill operation. Annealing is necessary to relieve work hardening stresses resulting from the previous operation. Bending and final forming are performed after annealing.

4.2 Heater Casing or Adaptor—The heater casing or adaptor may take the form of a tank assembly, flange plate, or threaded adaptor. The heating element is affixed to one of these forms accordingly.

4.3 Power Supply Conductor—The power supply conductor is usually a flexible grounding type electrical power supply cord. The length and gage of conductor, male cap configuration, and conductor jacketing can vary with the final application.