



Diesel Fuel to Liquid Cooler Assembly

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This specification establishes the component level requirements for a fuel to liquid type cooler assembly. This type of cooler typically utilizes coolant as a medium for heat transfer from fuel side. Fuel to air type cooler assembly requirements are covered in GMW15048. This document shall be used in conjunction with and complement other requirements documented in the Statement of Requirements (SOR).

1.2 Applicability. This specification only applies to diesel and biodiesel fueled vehicles.

1.3 Remarks. The primary function of a fuel cooler assembly is to cool return fuel from the engine before it enters the fuel tank. The fuel cooler assembly shall carry out this function while meeting specific requirements of the customer, the powertrain, other interfaces, mandated safety and emission standards, and corporate objectives. With direct injection fuel systems being implemented on diesel engines, cooling the return fuel from the engine before it enters the fuel tank is becoming a necessity. There are several options available to cool the fuel (i.e., using fuel air coolers and using fuel coolant coolers). This document provides standard technical requirements for fuel to coolant coolers and shall only be used when invoked by program specific requirements. References to the program specific requirements are included in this document and are expected to exist.

Note: Program specific requirements may include additional requirements not referenced in this document and may supersede any requirements included in this document. In the case of any conflicts between this document and the program specific requirements, the program specific technical specifications take precedence.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM D4169	SAE J1739	SAE J2044	SAE J2886
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2.2 GM Standards/Specifications.

GMW3059	GMW14872	GMW15311	GMW15760
GMW14193	GMW14911	GMW15357	GMW15862
GMW14234	GMW15048	GMW15359	GMW16331
GMW14555	GMW15272	GMW15570	GMW17144

2.3 Additional References.

- CG4762 Validation Cross Reference Index, Diesel Fuel to Liquid Cooler Assembly
- Statement of Requirements (SOR)
- Subsystem Technical Specification (SSTS)

2.3.1 Fuels

- EN 590
- GMPT-1-005B
- GMPT-5-006

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- GMPT-5-008
- GMPT-5-020
- GMPT-5-025
- GMPT-5-036A

3 Requirements

3.1 System/Subsystem/Component/Part Definition.

3.1.1 Appearance. Not applicable.

3.1.2 Content.

3.1.2.1 Physical Content. Fuel passes through a series of plates, which are brazed together to provide a sealed system. The fins provide strength to the plates and also increase the heat transfer rate. Coolant goes through a tube and is also considered a sealed system, which does not allow mixing of fuel and coolant. The coolant is used to reduce the temperature of diesel fuel.

3.1.2.2 Functional Content. The fuel cooler assembly shall cool return fuel from the engine before it enters the fuel tank. The cooler shall have mounting provisions to mount it on the underbody or frame.

3.1.3 Ambient Environment. Sections 3.1.3.1 through 3.1.3.3 specify the environmental conditions that the fuel cooler assembly will be exposed to during its lifetime.

3.1.3.1 The fuel cooler assembly shall be capable of operating in the environments described in Table 1 without adverse effect to functional performance.

Table 1: Operating Environment

Underbody Temperature	-40 °C to 90 °C
Underhood Temperature	-40 °C to 130 °C
Relative Humidity	2% to 100%
Barometric Pressure	56.9 kPa to 106.3 kPa
Precipitation	≤ 4.6 mm/minute
Grade	≤ 30%
Ozone	≤ 0.40 ppm
Altitude	-150 m to 4600 m

3.1.3.2 Corrosives – Chloride Exposure. This requirement applies only to polymers with external exposure. Polymers exposed to the underbody and lower underhood environment must be compared against Table 2 to determine the need for further chloride exposure testing (see 3.1.3.2.1 and 3.1.3.2.2). If the polymer is not identified within the list, GM Materials Engineering shall be consulted to determine the appropriate disposition.

Table 2: Chloride Exposure

Testing Required	Testing Not Required
Polyamide, Polyketone (PK)	Polyacetal (POM), Polyethylene (PE), Polyester (PBT), Polypropylene (PP), Polyphenylene Sulfide (PPS)

3.1.3.2.1 Resistance to Calcium Chloride. The sample shall be fixtured during the test such that a simulated 44 N side load is applied to the part, representative of the part's usage in the assembly. The external surfaces of the fixtured assembly are immersed in a 50% aqueous solution (by weight) of calcium chloride for 200 h at 60 °C ± 2 °C with the ports sealed. The sample is then stored out of solution for 200 h at 60 °C ± 2 °C. The

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sample may be rinsed with fresh water to clear salt residue. There shall be no cracking, crazing, or other damage to the plastic parts.

3.1.3.2.2 Resistance to Zinc Chloride. The sample shall be fixtured during the test such that a simulated 44 N side load is applied to the part, representative of the part's usage in the assembly. The external surfaces of the fixtured assembly are immersed in a 50% aqueous solution (by weight) of zinc chloride for 200 h at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ with the ports sealed. The sample may be rinsed with fresh water to clear salt residue. There shall be no cracking, crazing, or other damage to the plastic parts.

3.1.3.3 Types of Diesel Fuels. Table 3 includes fuels to which the fuel cooler assembly may be exposed. These fuels shall be considered in component design and analysis in considering coatings for fuel cooler. Information regarding GMPT fuels can be obtained by contacting GMPT, Materials Engineering.

Table 3: Types of Fuels

EN 590	European Diesel Fuel
GMPT-1-005B	General Purpose Summer US Diesel
GMPT-5-006	US Cert Fuel
GMPT-5-008	European Stage 4 Cert Fuel (RF-06-99)
GMPT-5-020	Ultra-Low Sulfur B20 Biodiesel
GMPT-5-025	European Biodiesel; B10
GMPT-5-036A	Soy based deposit forming and peroxide B20 Biodiesel

3.1.3.3.1 Fuel Circulation Test. The cooler assembly shall be leak tight as per 3.2.1.8 after 1000 h fuel circulation at $+80\text{ }^{\circ}\text{C}$ using GMPT-5-020 fuel at 90 LPH flow rate. Fuel shall be changed every 200 h. Test fuels shall be purchased from an approved supplier.

3.1.4 Interfaces. Interfaces between the fuel cooler assembly and other vehicle subsystems are depicted at a high level in Figure 1. These interfaces may constrain or drive the design of the fuel cooler assembly and therefore must be addressed during design and development. The entire fuel system implementation and operation in the vehicle must also successfully accommodate the identified interfaces. These physical interface requirements, such as available space for packaging and mounting locations, are further detailed in the program specific documents.

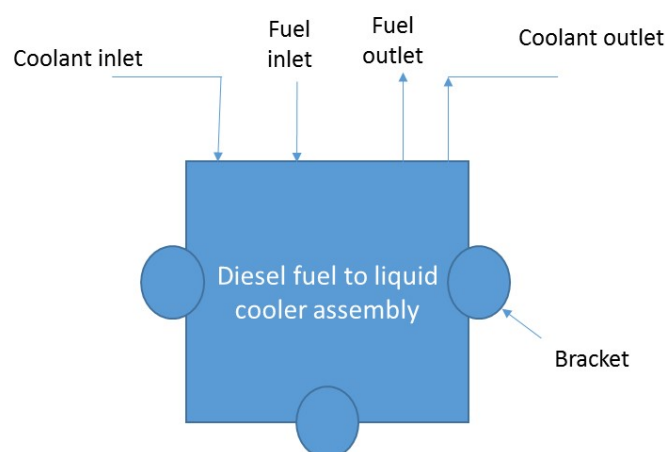


Figure 1: Fuel Cooler Assembly Interaction with Other Subsystems

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