GM	WORLDWIDE ENGINEERING STANDARDS	General Specification	GMW18195

Specification for Refrigerant Plumbing Combi Sensors (Pressure and Temperature)

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 document describes the quality, reliability, durability, and performance requirements of the solid-state air conditioning Temperature sensor, herein referred to as the Refrigerant Combi Sensor (Pressure and Temperature), to sense refrigerant temperature in an automotive air-conditioning (A/C) system. This sensor contains an Application Specific Integrated Circuit (ASIC) as a subcomponent. The sensor shall be located on the High/Low-temperature side of the air conditioning system.

This specification is to establish the functional, packaging and interface requirements for a common Refrigerant Plumbing High/Low Side Combi Sensor (Pressure and Temperature). The verification part is to help the supplier develop the correct test plan for their validation testing.

The sensor is to be used with the following Refrigerants and Oils:

1.1.1 Refrigerants:

- R134a (GM Part Number (P/N) 9985751 or equivalent).
- HFO1234yf (GM P/N 9986319 or equivalent). See Global Product Description System/Area Parts Manager (GPDS/APM).

1.1.2 Oils:

- Polyalkylene Glycol (PAG) compressor oil (material specification 9986181 for R134a) and (material specification 9986479 for HFO1234yf) - PAG oil specification, refer to the following:
  - PSD1 - material specification 9986364 (USA Service P/N 19260643, Canada Service P/N 19260644).
  - PAG46 - material specification 9986365.
  - ND12 - material specification 9986366 (USA Service P/N 19299051, Canada Service P/N 19299052).
  - SP-A2 - material specification 9273590 (USA Service P/N 19333249, Canada Service P/N 19333250).
  - Polyolester (POE) compressor oil - material specification 9986277 (USA Service P/N 88862657, Canada Service P/N 88862658).
  - Reference Statement of Requirements (SOR) Appendix C for details.

1.2 Applicability. This specification applies to Refrigerant Combi Sensor (RCS) for use on applications that meet all of the following criteria:

a. Global Car and Light/Heavy Duty Trucks applications, for applications in developed and developing road regions

b. 15 year and 150 000-mile reliability evaluation point

c. General Motors Global B Electrical Architecture.

d. OBD-II Smart Device Compliance. This means RCS communicates live, unfiltered sensor data to another module in the vehicle such that the other module is able to diagnose the Refrigerant Combi Sensor in compliance with OBD-II requirements.

e. Electrical requirements as defined in 3.5, including high voltage bus characteristics defined in 3.5.4.1

f. Usages with refrigerants R134a and R1234yf with Synthetic Polyol Ester Lubricant (POE) oil and Polyalkylene Glycol (PAG) oil.

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g. BEV and FCEV applications, including moderate and low temperature and high vibration environments such as expected to occur when Refrigerant Combi Sensor is mounted to electric drive unit. Also suitable for applications where ACCM is mounted to, but vibrationally isolated from, the vehicle chassis. Refrigerant combi sensor located Underhood (not in a passenger or luggage compartment), low mount, sprung mass. Ambient environment as defined in 3.3.

If an application does not match all of these criteria, then this document must be modified accordingly by the GM Refrigerant Sensor Bill of Materials Family Owner (BFO). The requirements in this document and other specified documents may be insufficient or too severe for applications that do not match all of these criteria.

1.3 Remarks.

1.3.1 The refrigerant combi sensor is used to detect the operating temperature and pressure of the A/C system to determine operating conditions and potential system failures.

1.3.2 The sensor can be assembled at the manufacturing plant or be delivered as a subassembly on another component.

2 References

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

2.1 External Standards/Specifications.

SAE D1703

2.2 GM Standards/Specifications.

9985670	GMW3097	GMW14133 (ID)	GMW15841
9985751	GMW3172	GMW14234	GMW15923
9986181	GMW3191	GMW14375	GMW16449
9986277	GMW8241	GMW14727	GMW16955
GMW3059	GMW14057	GMW14872	GMW18074
GMW3091	GMW14058	GMW15272	GMW18192

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions.

2.3 Additional References.

- Electrical Wiring Component Applications Partnership (EWCAP) Electrical Connector references, http://ewcap.uscarteams.org, USCAR-2, -21 and -25. United States Council for Automotive Research (USCAR); www.uscar.org/guest/teams/10/Electrical-Wiring-Component-Applications-Partnership, www.ewcap.uscarteams.org/EWCAP_part_number_list_current.XLS
- GM P/N 1543537, Arizona Dust.
- GM P/N 9986319, 88862657, 88862658.
- GM1829 - ADVP&R - Analysis/Development/Validation Plan and Report
- IRM 903 oil, previously known as ASTM Number 3 oil; www.astm.org/Standards/D5964.htm.
- Part Numbers (Canada Service); 19299052, 19333250.
- Part Numbers (GM); 13531645, 9986479, 9986364, 9986365, 9986366, 9273590, 22678731, 22634172, 09131721.
- Part Numbers (USA Service); 19260643, 19260644, 19299051, 19333249.
- Society of Automotive Engineers (SAE) 2004-01-0892 Robust Electronic Control System Design Requires Signal Delivery Analysis by D. Bogden et al.
- Statement of Requirements (SOR) Appendix C, G and G2 (GM1829).
- UL94 specification or equivalent per ASTM D 3801 or IEC 60695-11-10UL94 specification or equivalent per ASTM D 4986 or ISO 9772.

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3 Requirements

3.1 System/Subsystem/Component/Part Definition.

a. The part shall meet all requirements specified in this document as well as meet all requirements in the released outline drawing.

b. Supplier needs to meet with the requirements of GMW14375, GMW14133, GMW15923.

3.1.1 Appearance.

a. The Sensor shall meet all appearance requirements stated on the GM Part Number 84817088(high) and 84817089(low).

b. Underhood cosmetic corrosion protection is required for vehicle operation in severe corrosive environments. The external areas of the Sensor shall meet the requirements in GMW15272 (Underhood, High Visibility) and GMW14872 (Underhood, High and Protected from direct Splash, 1 salt spray, Method SH/SM and Exposures B).

3.1.2 Content.

3.1.2.1 Physical Content.

a. The Sensor shall be made of a connector with four (4) terminals.

b. The Refrigerant Combi Sensor (RCS) is securely fastened onto subcomponents of the A/C Lines Subsystem and positioned to detect the temperature of the refrigerant. The output of Refrigerant Temperature Sensor (RTS) shall be a resistance proportional to temperature. In addition to requirements, these signals shall satisfy diagnostic algorithm requirements.

c. The Refrigerant Combi Sensor (P+T) basically consists of the following parts:

- Pressure measurement cell and temperature measurement cell
- Electrical plug-connection: Plastic housing
- Threaded Metal housing, waterproof, with sensor opening to refrigerant.
- Electronic signal response for the pressure sensor.

3.1.2.2 Functional Content.

a. The Refrigerant Temperature Sensor shall translate the temperature that is read from the A/C system into a percentage of the reference voltage. The Sensor shall operate with an A/C High pressure system from 0 kPa to 3500 kPa, for Low pressure system from 0 kPa to 770 kPa absolute and refrigerant Temperature from -40 °C to 140 °C.

b. The mounting position/orientation shall have no influence on the electrical characteristic or tolerance of the transducer output. The signal voltage shall not drop below 5% of the reference voltage or increase above 95% of the reference voltage in normal operating conditions. The controller shall determine that there is a failure if it reads voltage outside this range (below 5%, above 95%).

c. The device shall perform the following functions:

1. Provide electrical indication of fluid or metal temperature (primary and redundant if applicable)
2. Comprehend operating environment (i.e., temperature, vibration, splash etc.)
3. Provide attachment to A/C Lines
4. Provide sealing to prevent leakage of fluid or vapor being measured (not applicable for MTS)
5. Interface to Engine Wire harness electrical connector
6. Accommodate electrical interface to Controller
7. Comprehend service aspects

3.1.3 Ambient Environment.

3.1.3.1 Outside Vehicle Ambient Temperature. During operation of the temperature sensor, the free air temperature shall be -48 °C to 52 °C.

3.1.3.2 Operating Temperature. The temperature sensor shall operate normally from -40 °C to 140 °C. The RTS shall operate normally at 150 °C (extreme) for at least 15 minutes without damage or loss of function.

3.1.3.3 Storage Temperature. The Temperature sensor shall operate normally after being stored in temperatures from -40 °C to 150 °C.

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3.1.3.4 Electromagnetic Environment.

a. The Sensor design shall comprehend an optional set of subcomponents required for Electromagnetic Compatibility (EMC) environments. Associated costs and re-validation will be addressed when needed.

b. The Sensor shall satisfy component level requirements in GMW3097 and vehicle level requirements in GMW3091.

c. The Sensor is classified as a device requiring evaluation to Level 2 disturbances.

d. Applicable load circuits will align with Controller interfaces described in 3.1.4.2.

e. A GMW3097 test plan shall be approved and test number assigned by the GM EMC Group prior to commencing any testing.

f. The steady output baseline test condition shall not be either the high or low range of device output or align with power-on engine-off condition.

g. Test conditions and criteria other than those stated herein are allowable provided sufficient data and concurrence of the EMC Group.

3.1.3.5 Altitude. The pressure transducer shall operate at any altitude with 0.0% shift due to altitude in a sealed A/C system.

3.1.3.6 Electromagnetic Environment - Temperature. The following EMC tests in Table 1 and Table 2 are required; see also Table A2.1 of GMW3097.

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