



Air Conditioning Refrigerant System Connections

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 describes the functions, performance, and validation requirements for Air Conditioning Refrigerant System Connections.

A connection consists of a sealing element and a fastening mechanism described as follows:

1.1.1 Component to Base (C/B). A connection between any component and any base. (e.g., charge valve to base, switch to switch port).

1.1.2 Component to Component (C/C). A connection between any two air conditioning (A/C) refrigerant components (e.g., switch to compressor).

1.1.3 Line to Component (L/C). A connection between any A/C refrigerant line and any component (compressor, condenser, etc.)

1.1.4 Line to Line (L/L). A connection between any two A/C refrigerant lines (e.g., serviceable orifice tube fitting in center of evaporator tube).

1.2 Applicability. This global specification pertains to air conditioning refrigerant subsystem component connections in all vehicle models, across all platforms, in all regions.

2 References

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

2.1 External Standards/Specifications.

SAE D1703

SAE J639

2.2 GM Standards/Specifications.

9985129

9985912

GMW3059

GMW3431

9985751

9986153

GMW3116

GMW14872

9985752

9986181

GMW3286

GMW15272

9985809

2.3 Additional References.

- Arizona Dust GM No.1543637
- Fluorescent Dye GM No.12346303
- GM1738 GM Packaging and Identification
- GM Engine Degreaser No. 1052107
- GM Tracer Dye No.12346303
- Vehicle Technical Specification

3 Requirements

3.1 System/Subsystem/Component/Part Definition. All requirements of this specification must be met in order to demonstrate compliance with Design Validation, Production Verification and In-process (IP) evaluations.

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3.1.1 Appearance. See 3.3.2.1.

3.1.2 Content. See 3.3.2.1.

3.1.2.1 Physical Content. See 3.3.2.1.

3.1.2.2 Functional Content. See 3.1.3.1 and 3.2.1.

3.1.3 Ambient Environment. The connection shall withstand exposure to the environmental extremes in 4.1.6 and meet the mechanical requirements as designated in this section.

3.1.3.1 Corrosion Resistance. The metal retainer of the sealing washer must meet the requirements of GMW15272 Table B4 for Cosmetic Corrosion Resistance and Functional Corrosion Resistance per validation procedure GMW14872.

Cosmetic Corrosion Resistance: Underhood, All (splash protection not defined), 4 sprays, Method 1 and 2, Exposures 0 and B.

Functional Corrosion Resistance: Underhood, All (splash protection not defined), 4 sprays, Method 1 and 2, Exposures D.

3.1.4 Interfaces. Not applicable.

3.1.5 Usage Definition. Not applicable.

3.2 Product Characteristics.

3.2.1 Performance Requirements.

3.2.1.1 Design Validation (DV). A/C refrigerant system connections shall be tested for conformance with the sections in Table 1.

Table 1: Test Table

Section	Test	Number of Samples
4.3.1	Design Tolerance	12
4.3.2	Hydrostatic/Burst Pressure	12
4.3.3	Tensile Strength	12
4.3.4	Leakage	12
4.3.5	Serviceability	1
4.3.6	Insertion and Removal Force	12
4.3.7	Vacuum	12
4.3.8	Flow	3
4.3.9	Vibration	12
4.3.10	Over Clamp	12
4.3.11	Contamination	12
4.3.12	Dust	12
4.3.13	Salt Spray	12
4.3.14	Harsh Fluid	12
4.3.15	Heat Age	6
4.3.16	Cold Age	6

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3.2.1.1.1 Design Level Requirements. A/C refrigerant system connections manufactured for testing to this specification for Engineering Source Approval purposes shall be completely representative of production level materials, components, processes and tooling. Any exceptions to this requirement or to any criteria referenced in 3.2.1.2.1 or 3.4.3 must be reviewed beforehand and approved by the GM Heating, Ventilation and Air Conditioning (HVAC) Global Plumbing Bill of Material (BOM) Family Owner (BFO).

3.2.1.2 Production Verification (PV). A/C refrigerant system connections shall be tested for conformance with the sections in Table 2.

Table 2: Test Table

Section	Test	Number of Samples
4.3.1	Design Tolerance	12
4.3.2	Hydrostatic/Burst Pressure	12
4.3.3	Tensile Strength	12
4.3.4	Leakage	12
4.3.5	Serviceability	1
4.3.6	Insertion and Removal Force	12
4.3.7	Vacuum	12
4.3.8	Flow	3
4.3.9	Vibration	12
4.3.10	Over Clamp	12
4.3.11	Contamination	12
4.3.12	Dust	12
4.3.13	Salt Spray	12
4.3.14	Harsh Fluid	12
4.3.15	Heat Age	6
4.3.16	Cold Age	6

3.2.1.2.1 Test Samples. Production test samples, produced on production representative equipment, shall be used.

3.2.1.2.2 Production Verification (PV) Approval. PV approval shall be provided by either the appropriate GM Supplier Quality Engineer or GM Program Validation Engineer.

Table 2 defines the validation procedures that are required to confirm that Air Conditioning Refrigerant System Connections meet the specified requirements. Each individual test shall be run with statistically based sample size such that the reliability requirements stated in 3.2.3.2 are satisfied. Parts must be manufactured from production tooling and processes such that potential variations from both are evaluated. Parts to be used for Product Validation testing must be manufactured to print tolerances representing the potential manufacturing variation.

3.2.1.3 In-Process (IP) Testing. These tests shall be completed satisfactorily with parts from normal production runs.

Parts shall be selected from a normal production run or 500 pieces, whichever is smaller.

Samples shall be selected at random to represent the entire production quantity.

Every six month period, the supplier shall run the tests in Table 3.

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Table 3: Test Table

Section	Test	Number of Samples
4.3.1	Design Tolerance	12
4.3.3	Tensile Strength	12
4.3.7	Vacuum	12
4.3.11	Contamination	12
4.3.12	Dust	12

3.2.1.3.1 IP Approval. IP tests are self-approved by the supplier, subject to audit by GM Supplier Quality Engineering.

3.2.1.3.2 Lot Retention. In case of IP test non-conformance, the affected production lot shall be retained by the supplier until Root Cause Analysis is complete. The supplier shall then decide the disposition of the affected production lot. The supplier has 3 options for this retained lot. It shall be either 1) scrapped; or 2) corrected and certified (which may mean lot testing the revised part again) based on the root cause analysis, or, 3) shipped without correction if deemed to be acceptable based upon the root cause analysis. In any event, GM Supplier Quality Engineering shall be notified whenever any of these options is exercised.

3.2.1.3.3 Record Retention Records shall be maintained for one year from date of test.

3.2.1.3.4 Alternative IP Compliance. Supplier may request an exception from IP testing provided supplier can demonstrate that sufficient process controls are in place so as to make IP testing unnecessary. Approval to be provided by either GM Supplier Quality Engineering or the GM Design Responsible Engineer. The period of testing (six months) may vary depending on data shown by supplier. GM Supplier Quality Engineering or the GM Design Responsible Engineer will determine final IP period.

3.2.1.3.5 Deviations from this Standard. Deviations from the requirements of this standard shall have prior written approval from the responsible GM Validation Engineer and BFO. Such requirements shall be specified on component drawings, test certificates, reports, etc.

3.2.2 Physical Characteristics. See 3.3.2.1.

3.2.2.1 Dimensions and Capacity. See 3.3.2.1.

3.2.2.2 Mass Properties. Not applicable.

3.2.3 Reliability.

3.2.3.1 Reliability Evaluation Point. Not applicable.

3.2.3.2 Reliability Requirements. The reliability (probability of success) for a mission of 15 years/241 400 km (150 000 mi), starting at age zero, shall be at least 97% at a confidence level of 50%. Any supplier performed laboratory testing based on vehicle level usage data, and which suggests correlation to 10 years/241 400 km (150 000 mi) life, shall be documented and submitted to the responsible GM Validation & Supplier Quality Engineers as part of both design validation and Production Part Approval Process (PPAP).

3.2.4 Serviceability. Not applicable.

3.2.5 User System/Subsystem/Component/Part Interface. Not applicable.

3.3 Design and Construction.

3.3.1 Materials, Processes and Parts Selection Guidelines. See 3.3.2.1.

3.3.1.1 Material Recycling Guidelines (GMW3116). Materials developed to this specification shall be optimized to provide maximum end-of-life cycle value utilizing the Recyclability Checklist and GM Recycling Design Guidelines. Recycled content shall be reported to the approving and procuring Materials Engineering Department utilizing the Recycled Content Report Form. Reference the Recyclability/Recoverability Guidelines, GMW3116.

3.3.1.2 Processes Guidelines. All production Air Conditioning Refrigerant System Connections must be manufactured using the same materials and processes used to manufacture the originally approved sample Air

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Conditioning Refrigerant System Connections. No change is permissible without prior written approval from the responsible GM Supplier Quality Engineer and BFO.

3.3.1.3 Parts Guidelines. Not applicable.

3.3.2 Design Guidelines and Constraints.

3.3.2.1 Drawing Requirements. Air Conditioning Refrigerant Systems Connections must meet the design specifications on the detail drawings approved by GM.

3.3.3 Identification and Marking.

3.3.3.1 Supplier Identification. Air Conditioning Refrigerant System Connections supplied under this specification must be visually identified in a manner exclusive and unique to each supplier to permit rapid identification of each respective Air Conditioning Refrigerant System Connections manufacturer by the responsible GM Supplier Quality Engineer. Identification methods must be submitted to and approved by the GM BFO.

3.3.4 Workmanship. Key Product Characteristics (KPC) will be defined on the GM approved engineering drawings. The Air Conditioning Refrigerant System Connections shall have manufacturing capability such that all dimensions are targeted at print nominal. The supplier shall submit a detailed improvement plan which describes how their manufacturing process for each part/operation shall achieve a process distribution of 12 sigma, which must be less than or equal to the tolerance spread as specified on the detailed drawing. The improvement plan shall be submitted to the responsible GM Global Technology Engineering (GTE) Engineer.

3.3.5 Interchangeability. Not applicable.

3.4 Documentation.

3.4.1 Failure Mode and Effects Analysis (FMEA). Detailed design and process FMEA shall be submitted to the GM Release Engineer and GM Validation Engineer, and it will be maintained as part of the records of the Design and Product Validation. The FMEA shall be updated each time a change occurs. FMEA shall be submitted with the GM Production Part Approval Process documentation.

3.4.2 Design Validation. All test samples must be qualified dimensionally. All data points must be reported. All test specimens must be retained by the supplier for a minimum of one year and supplied to the GM HVAC Supplier Quality Engineer, Validation Engineer, and BFO for review upon request. Test Procedures referencing specific minimum test values, must be met by the -3 sigma limit of the sample population tested.

Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Design/Release Engineer prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture, requires a new release approval of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process and to apply for a new release approval.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases a shorter test can be agreed to between the responsible GM HVAC Validation Engineer and the supplier.

All requirements contained in Table 1 must be met to pass Design Validation. Any non-compliance during this phase must be documented and resolved before validation is considered complete.

3.4.3 Product Verification. Documentation shall be through the normal PPAP process.

3.4.4 In-process Documentation. IP reports will follow the internal supplier documentation process, subject to audit by GM Supplier Quality Engineering.

3.4.5. Revalidation Requirements. Any change in design, material, or processing from that previously approved for production, requires prior approval and revalidation as determined by the applicable GM Validation Engineer and BFO. Carryover designs may be revalidated for subsequent model year production using the results of tests from previous month's production.

3.5 Support of System/Subsystem/Component/Part After Sale. Not applicable.

3.6 System/Subsystem/Component/Part Operator Training. Not applicable.

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3.7 System/Subsystem/Component/Part Characteristics. Not applicable.

3.7.1 System/Subsystem/Component/Part Definition. Not applicable.

4 Validation

4.1 General.

4.1.1 Safety. This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the potential safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Note: This specification refers to the usage of testing pressurized vessels and due to the high pressures inherent with fluorocarbons, testing should be performed only by properly trained qualified personnel in using equipment capable of withstanding the pressures, temperatures and exposure of these tests with adequate safety margins. Standard Laboratory Safety precautions must be followed to prevent accidental bodily injury. All material should be used in accordance with the supplier Material Safety Data Sheet (MSDS).

4.1.2 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

4.1.3 Alternatives. Alternative test facilities and equipment may also be used with prior approval by GM HVAC Validation Engineer. However, all measuring variables as specified in this specification shall be determined correctly with respect to their physical definition.

4.1.4 Conditions. All tests are to be run per the A/C Connection Test Matrix in Figure C1. All tests in a given column in Figure C1 are to be run sequentially on the same samples.

4.1.5 Air Conditioning Refrigerant System Connections must be compatible with R134a and R1234YF refrigerant and the lubricants used in the air conditioning system. Reference: R134a 9985751, Polyalkylene Glycol (PAG) Lubricant 9985752, and Polyolester (POE) Lubricant.

4.1.6 Air Conditioning Refrigerant System Connections must perform in the following environment:

Temperature	-40 °C to +135 °C (-40 °F to 275 °F) for Front A/C. -40 °C to +82 °C (-40 °C to 150 °F) for Rear A/C.
Relative Humidity	0% to 100%
System Pressure	Hi Side -101 kPa to +4140 kPa (-14.7 psig to 600 psig) Low side -101 KPa to +1400 kPa (-14.7 psig to 203 psig)
Mechanical Inputs	Dust, fluid, shock and vibration normal to a vehicle underhood environment.

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