



Specification for Heating, Ventilation and Air Conditioning Air Outlets

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 establishes the requirements for air outlets used in GM vehicles. All requirements in this standard apply to each unique air outlet design and interface. This specification defines the general requirements, test conditions and test methods for air outlets. Air outlets must also comply with Instrument Panel (IP) Trim and Floor Console Specification GMW14117.

The air outlets performance, appearance, and human interface determine customer perception of the vehicle.

1.2 Applicability. This standard is applicable for Heating, Ventilating and Air Conditioning (HVAC) Interior Air Flow parts, such as HVAC-Outlets, Side Defroster Outlets, Defroster Grilles, HVAC-Grilles, Headliner Outlets, Pillar Outlets, Floor Heater Vent, etc., with and without appearance attributes (color, grain and/or gloss designation). This standard is applicable for all regionally and globally supplied parts.

2 References

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

2.1 External Standards/Specifications.

EU 2000/53/EC

2.2 GM Standards/Specifications.

GMW3059	GMW14011	GMW14444	GMW15272
GMW3116	GMW14117	GMW14797	GMW15424
GMW3172	GMW14149	GMW15010	GMW15443
GMW3425	GMW14264	GMW15049	GMW15760
GMW3600	GMW14334	GMW15118	GMW16331

2.3 Additional References.

- CG2996 HVAC Outlets_1829
- Design Guidelines/Layouts
- Dimensional Technical Specifications (DTS)
- Human Factors Design Objectives (HFDO)
- Heating, Ventilation and Air Conditioning (HVAC) Outlet Design Checklist
- HVAC/Powertrain Cooling (PTC) Subsystem Technical Specification (SSTS)
- Road Load Vibration Profile
- Statement of Requirements (SOR) and Appendices
- Technical Memory Best Practices/Knowledge Sets for Instrument Panel (IP), Console, HVAC, Human Vehicle Interface, Squeak and Rattle, Serviceability Design and other vehicle integration areas. (The supplier shall work with the GM Design Responsible Engineer to comprehend these requirements.)
- Unigraphics (UG) Drawings/Files

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3 Requirements

3.1 System/Subsystem/Component/Part Definition. The HVAC outlets shall provide a subjective thermal comfort for the occupants along with pleasing perceptual quality.

3.1.1 Appearance. SOR Appendices define the program grain, color, and gloss requirements. The components shall also meet the DTS requirements when they are installed together with their interface components.

3.1.2 Content.

3.1.2.1 Physical Content. See the SOR Appendices for a detailed list of components.

3.1.2.2 Functional Content. The HVAC outlet system shall distribute the air from the air distribution module into the passenger compartment. The distribution of the air shall have the following functionality.

- The ventilation outlets shall be able to direct the airflow onto the occupant.
- The ventilation outlets shall be able to direct the airflow off the occupant in both horizontal and vertical directions.
- The defroster outlet shall direct airflow towards the windshield.
- The side window defroster outlets shall direct the airflow towards the side windows.

3.1.3 Ambient Environment.

3.1.3.1 Operational Temperatures. The air outlets shall meet the operating temperatures ranges identified in Table 1.

Table 1: Operational Temperature Ranges

Element	Low	High
Instrument Panel (IP) Top Surfaces Temperature Clear Glass	-30 °C	115 °C ^{Note 1}
IP Top Surfaces Temperature Tinted Glass	-30 °C	110 °C ^{Note 1}
IP Top Surfaces Temperature Absorbing Glass	-30 °C	102 °C ^{Note 1}
IP Vertical Surface and Floor Console Surface Tinted/Absorbing Glass	-30 °C	85 °C
Relative Humidity (RH) ^{Note 1}	0%	100%

Note 1: Percentage RH varies with temperature.

3.1.4 Interfaces. The HVAC outlets can be mounted to the Instrument Panel, Pillar Trim, Roof Trim, Console or Door systems.

3.1.4.1 Human/Vehicle Interface. The air outlets are to be designed so that the adult 5th percentile female through the 95th percentile male, unless otherwise noted, can operate and control the features in an effective manner while in their normal seated positions. Air outlets and their interfaces shall comply with the Human Factors Design Objectives specified in Table 2.

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Table 2: Human Factors Design Objectives Relative to Air Outlets

Component/Subsystem	Section in HFDO	Includes (but not limited to)
General Hand Controls	Controls Section U – Remote Releases	Hand clearances to trim, control sizes, efforts, etc.
General Hand Size	Controls Section U – Anthropometry of the Hand	Hand dimensions for 5 th percentile female to 95 th percentile male, gloved hand, etc.
HVAC Vent Shutoff and Vane Adjustment Controls	Controls Section Q – HVAC	Hand clearances to trim, control sizes, efforts, etc.

3.1.5 Usage Definition. “Air Outlets” are adjustable or non-adjustable apertures used to provide ventilation and/or defrosting/defogging for vehicle interior.

3.2 Product Characteristics.

3.2.1 Performance Requirements. Special vehicle, operational, or ambient conditions may be identified in some performance requirement paragraphs. When applicable, test with trim attached.

3.2.1.1 Miscellaneous Requirements.

3.2.1.1.1 Outlets with illuminated symbol areas shall be shielded in such a way that no additional light emerges except for symbol areas.

3.2.1.1.2 Unless otherwise specified, part deflection shall be less than 0.2 mm under 10 N applied at 23 °C ± 5 °C on any location using a 20 mm flat ram. Validate using Finite Element Analysis (FEA) methods and by testing parts. Although tested at ambient temperature, the air outlet must not break or be damaged when tested at the temperature extremes identified in Table 1.

3.2.1.1.3 Clearly identify covers, features, and their operation to the user with an appropriate International Organization for Standardization (ISO) or GM approved symbol or label (e.g., an arrow indicating which direction to pull).

3.2.1.1.4 Outlet vane adjustability must be capable of directing airflow to assigned target points and be able to direct air off of the occupant.

3.2.1.1.5 Unless otherwise specified, no damage may occur if the individual actuation elements or parts of the outlet are subjected to a force of 45 N at any point of application and in any direction at ambient temperature conditions.

3.2.1.1.6 Parts near an airbag must be securely fastened and must not become projectiles.

3.2.1.1.7 Parts must withstand assembly, disassembly, actuation and abuse forces as defined by this specification. If a part is not defined it shall withstand forces of 200 N minimum unless otherwise specified, without breakage, loss of function or disengagement.

3.2.1.1.8 Part imperfections, manufacturing marks, parting lines and unfinished edges shall not be visible with the doors open, from outside the vehicle, from any vehicle seating position, or while operating features. Parting lines shall fulfill requirement to GMW15424.

3.2.1.1.9 No damage may occur if an external device (air freshener, cell phone/Personal Digital Assistant (PDA) mount, etc.) weighing no more than 0.4 kg is attached and detached to any outlet.

An external device shall be attached to the lamella of the outlet.

The distance from lamellas to the center of gravity of the device shall be 100 mm. Put a weight of 0.4 kg into the holder. No damage may occur when the device is attached and detached to the outlet. Repeat the described procedure for all lamellas and possible positions on the lamellas.

3.2.1.1.10 Part attachment features must be designed to not interfere with vanes, linkages or thumbwheel movement.

3.2.1.2 Adjustable Air Outlets.

3.2.1.2.1 Shutoffs. If shutoffs are provided:

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3.2.1.2.1.1 A closed shutoff door is to allow no more than 1.0 L/s of air flow with a back pressure of 250 Pa and no objectionable whistles or noises.

3.2.1.2.1.2 A closed vane shutoff is to allow no more than 2.0 L/s of air flow with a back pressure of 250 Pa and no objectionable whistles or noises. Spot leaks with a velocity greater than 2 m/s at a distance of 100 mm to the Outlet are not allowed.

3.2.1.2.1.3 Vane/Shutoff Closing. Using vertical vane shutoff, the vanes should close in the direction away from the occupant.

Examples: Driver's outboard outlet should close toward the driver's door. Driver inboard should close toward the passenger side. Passenger inboard should close toward the driver side. Passenger outboard should close towards the passenger door.

For outlets with a layback angle $>10^\circ$, the vanes should close away from the customer.

For all other cases the vanes should close up to down.

3.2.1.2.1.4 Shutoff Identifier. The state of the shutoff shall be visually identified to the customer and comply with best practices.

3.2.1.2.1.5 Shutoff Door Detents. The shutoff door mechanism shall incorporate detents at the valve full open and closed positions to provide tactile feedback while meeting the specifications in 3.2.1.2.5.

3.2.1.2.2 Pressure Drop. The pressure drop of each vent outlet shall be less than 80 Pa with vanes parallel to air flow direction at 29 L/s airflow and 25 °C.

3.2.1.2.3 Adjustment Retention. Parts within an air outlet shall remain in their adjusted position under the following conditions:

- Air flow up to 35 L/s.
- Impact up to 2.5G.
- Temperature of -30 °C to 85 °C.

3.2.1.2.4 Force and Deflection. Adjustable air outlet assemblies must meet the force and deflection requirements listed in Table 3. Validate using FEA methods and testing four parts at 23 °C $\pm$ 5 °C. See Tables 4.3.1 and 4.3.2 in SOR Appendix G2 for deliverables. Although tested at ambient temperature, the air outlet must not break or be damaged when tested at the temperature extremes identified in Table 1.

Table 3: Adjustable Air Outlet Forces and Deflections

Location	Direction	Adapter Size	Force (N)	Deflection (mm)
All Primary Vanes Applied in the middle to each vane individually.	Push normal to flat as assembled in outlet assembly.	20 mm Diameter Flat ^{Note 1}	at 20	≤ 2.5
Any Vane Applied in the middle to each vane individually.	Push normal to flat ^{Note 2} Push on vane thickness ^{Note 2} Pull on vane thickness ^{Note 2}	20 mm Diameter Flat ^{Note 1}	Break away at: ≥ 70 ≥ 70 ≥ 55	- - -
Control Knob/Slider on or between vanes.	Applied perpendicular. Push (in) ^{Note 2} Pull (out) ^{Note 2} Stop Over Ride (in any adjustment direction) ^{Note 2}	20 mm Diameter Flat ^{Note 1}	at 20 Break away at: ≥ 70 ≥ 55 ≥ 70	≤ 1.5 - - -

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