



Component Technical Specification (CTS) - Condenser Radiator Fan Module (CRFM) Air Baffles

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, validation and shipping requirements for Condenser Radiator Fan Module (CRFM) Air Baffles/Air Guides for GM vehicles. All requirements of this specification shall be met in order to demonstrate Design Validation (DV), and Production Validation (PV).

1.2 Applicability. Not applicable.

1.3 Remarks. The operating characteristics of parts covered by this standard are operating continuously in temperatures of -30 °C and up to a maximum continuous temperature. Peak temperatures can exceed the maximum continuous temperature by 20 °C. These peaks can make up 90 h in the life time of the vehicle. Based on maximum continuous temperature in installation position and CRFM configuration, the parts are identified by Class 1 to Class 3 according to Table 1. For different continuous temperatures consult the Material Engineer for guidance.

2 References

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

2.1 External Standards/Specifications.

ISO 8510-2

2.2 GM Standards/Specifications.

GMW3037	GMW14156 (ID)	GMW14889	GMW15862
GMW3059	GMW14157 (ID)	GMW14890	GMW16331
GMW3116	GMW14547	GMW14958	GMW16955
GMW3600	GMW14555	GMW15576	GMW17044
GMW14093	GMW14573		

(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.

- Best Practice FASTHVA-5, Fastener Selection Guide for Air Baffles Attachments.
- Best Practice FASTICE 34, Selection Guidelines for Plastic Push-In Fasteners.
- Best Practice HVACPTC-291, Air Baffles - Design for Manufacturability Guidelines.
- Best Practice HVACPTC-292, Air Baffles & Splash Shields - Structural Performance.
- Best Practice HVACPTC-294, Air Baffles - Material Decision Tree.
- Component Test Specification.
- Design specifications on the detail drawings.
- GM design guidelines approved by GM Labeling Engineering.
- GM Recycling Design Guidelines.
- GM1738, GM Packaging and Identification Requirements for Production Parts.

- GM1829 Analysis/Development/Validation Plan and Report (A/D/V P&R) template.
- Recyclability Checklist.
- Statement of Requirements (SOR).
- Validation Cross Reference Index (VCRI) included in SOR.
- Vehicle Technical Specification.

3 Requirements

3.1 System/Subsystem/Component/Part Definition. All requirements of this specification shall be met in order to demonstrate compliance with DV, PV and in-process evaluations.

- CRFM air baffles must be capable of meeting the Vehicle Technical Specifications (VTS) requirement for Vehicle Exterior Freeze when tested per GMW15576.
- CRFM air baffles must be capable of meeting the VTS requirement for Vehicle Gravel Exposure when tested per GMW14889. Not required for validation of side air baffles, however, they must remain functional, no damage or loss of attachments.
- CRFM air baffles must be capable of meeting the VTS requirement for Dynamic Exterior Vehicle Water Ingestion when tested per GMW14547.
- CRFM air baffles must be capable of meeting the VTS requirement for Snow/Ice Intrusion when tested per GMW14958. Not required for validation of side air baffles, however, they must remain functional, no damage or loss of attachments.
- CRFM air baffles must be capable of meeting the VTS requirement for Vehicle Mud Exposure when tested per GMW14890.
- CRFM air baffles must be capable of meeting the VTS requirement for Powertrain Cooling Performance when tested per GMW14555.
- CRFM air baffles must be capable of meeting the VTS requirement for Interior Cooling Performance when tested per GMW3037.

3.1.1 Appearance. Appearance and finish of parts shall be free of flash and ridges. All air baffles shall have the surfaces free of damage, and foreign material (e.g., paint, dirt, etc.)

3.1.1.1 Marks in the part due to injection gates, ejector pins, or due to any other mechanism of manufacturing process shall be reviewed and agreed with GM Engineering (marks in the part shall not be visible to the Customer including but not limited to neither through the Fascia/Grille opening nor when hood is opened).

3.1.2 Content. Air baffles and corresponding fasteners.

3.1.2.1 Physical Content. Provide pictures/illustrations showing bill of material, air baffles, and fasteners which are part of assembly.

3.1.2.2 Functional Content. See 3.1.3 and 3.2.1.

3.1.3 Ambient Environment. The air baffle shall be capable of withstanding temperature variations as shown in Table 1, and from 0% to 100% Relative Humidity (RH).

Table 1: Operating Temperatures

Class	Peak Temperature °C	Maximum Continuous Temperature °C	Minimum Temperature °C
	A	B	C
Class 1	< 100	< 80	-30
Class 2	< 110	< 90	-30
Class 3	< 130	< 110	-30

3.1.4 Interfaces. Provide interfaces between air baffle with other components like the radiator, condenser, aero shutters, bumper beam, electrical harness, plumbing, fascia, etc.

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3.1.5 Usage Definition. The air baffle and or air guide is to direct the air from the front of vehicle opening into the heat exchanger devices.

3.2 Product Characteristics. Non-styled component; shall be black color, plastic part made of hard material, soft material or a combination of hard and soft material.

3.2.1 Performance Requirements. Air baffles shall be tested at component and vehicle level; component level per GMW17044, and vehicle level per vehicle and system level GMWs, as listed in 3.1.

3.2.1.1 Air Baffles Computer Aided Engineering (CAE) Structural Requirements. Air baffles shall also meet structural performance per Best Practice HVACPTC-292 (the supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.)

- Modal Frequency Test: Air baffle frequency stays in a range between 25 Hz to 30 Hz
- Stress due to maximum constant accelerations in the three (3) global vehicular axis ($X = Y = 8G$, $Z = 12G$): All stresses in the air baffle shall be below the yield strength of the air baffle material
- Pedestrian Protection (PedPro) requirements

3.2.1.2 Air Baffle Sealing, Efficiency. Include Computational Fluid Dynamics (CFD) test results, this data provides air leaks determined at vehicle speed of 110 km/h and ram fan condition.

3.2.2 Physical Characteristics. Include information on baffle design, attachment strategy, clearance to surrounding components, and Geometric Dimensioning and Tolerance (GD&T) requirements which will comprehend manufacturing and build variation, ergonomic fasteners to be used and material specification, including single shot or dual shot.

3.2.2.1 Dimensions and Capacity. Perform dimensional study and provide supplier (as appropriate) with a drawing specifying dimensions and tolerance.

3.2.2.2 Mass Properties. Mass properties shall be reported at all synchronous points and all gateways (program milestones), according to GM Design Engineer program timeline.

3.2.2.3 Air Baffle Design for Manufacturability. Air baffles shall also meet design for manufacturability per Best Practice HVACPTC-291 (the supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.)

Provide information showing main die draw vector, die draw vectors for actions, and slop analysis results.

3.2.3 Reliability. This section contains the reliability requirements for the component and/or subsystem. Reliability is defined as the probability of a product performing its intended function(s) in a manner which meets customer expectations, for a given period of time and/or miles, under stated conditions.

3.2.3.1 Reliability Evaluation Point. The Reliability Evaluation Point, for this component is per VTS requirements.

3.2.3.2 Reliability Requirements. Reliability requirements apply to DV and PV.

The supplier is responsible for demonstrating the reliability statistically for both DV and PV separately by means of either analytical methods or physical tests.

Refer to GMW3600 for DV and PV details.

This specification, as written, supports the demonstration of the required reliability of 99% or greater at a 50% confidence (R99C50) assuming Weibull slope of two (2), at the Reliability Evaluation Point for the component name. The supplier shall utilize "vehicle equivalent" laboratory test setups to simulate in-vehicle orientations. If the orientation is different from one vehicle to another, use the orientation which will provide the worst case loads for all physical level reliability demonstration testing.

Note: Test to failure is always the preferred method. Failure is defined as, but not limited to, the loss of function, unacceptable performance degradation and non-conformance of the component as stated in this specification.

Note: The required number of test samples may be negotiable if it is not practical to run. An example of sample size is given in Table 2. Statistical analysis (i.e., Weibull) shall be used to estimate reliability from the observed failure data. Weibull slope assumption for identical design is acceptable but requires documentation. This example is for a component specified as R99C50, assuming Weibull slope of one. The negotiation of sample size shall consider test equipment limitations, physical size of test samples, test duration, etc. However, reduction of the sample size may require inclusion/use of longer test durations or other test methods such as Highly Accelerated Stress Screening (HASS), Highly Accelerated Stress Testing Calibrated Accelerated Life Testing, Highly Accelerated Life Testing (HALT), etc. Weibull slope values available from previous failure testing