



Steering Intermediate Shaft and Boot/Seal Components

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 intermediate shaft and intermediate shaft boot/seal component requirements. The function, performance, reliability and validation required of the intermediate shaft and boot/seal are defined in this document. The interface requirement with the related subsystems of the vehicle are also part of this specification.

1.2 Applicability. The intermediate shaft connects the steering column to the steering gear, allowing non-linear placement of the input and output shafts. In addition to transmitting torque, the intermediate shaft may also provide compliance with noise and vibration isolation, torsional stiffness, collapsibility and vehicle assembly and associated ergonomic requirements.

The intermediate shaft boot/seal prevents contaminants such as water, dust, automotive fluids, engine compartment gases and low-pressure air from entering the passenger compartment through the front of dash opening required for the intermediate shaft and also, depending on its program-specific design, provides attenuation of engine compartment noise, intermediate shaft joint protection against stone impingement and flexibility for vehicle assembly and body movement.

1.3 Remarks. The program-specific technical specification may include additional program-specific requirements that are not referenced in this document and may supercede any requirements included in this document. In the case of any conflicts between this document and the program-specific technical specification, the program-specific technical specification takes precedence.

This document provides the standard technical requirements for the steering intermediate shaft and intermediate shaft boot/seal. This document must only be used when invoked by a program-specific technical specification. References to the program-specific technical specification are included in this document where program-specific requirements are expected to exist.

1.4 Classification. See Program specific CTS.

1.5 Design Concepts. The supplier shall submit design concepts in response to this document. These design concepts shall include both near term and future design solutions. Design submissions should include technical data supporting design mass and system performance.

2 References

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

2.1 External Standards/Specifications.

70/311/EEC	CMVSS 204	FMVSS 204	SAE J200
74/297/EEC	CMVSS 208	FMVSS 208	UN R 12.03
ASTM D1171	CMVSS 302	FMVSS 302	UN R 79.01

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2.2 GM Standards/Specifications.

GMW3059	GMW3116	GMW14101 (ID)	GMW15272
GMW3091	GMW3428	GMW14872	GMW15357
GMW3097	GMW8518	GMW15010	GMW15862

(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 Practices (see Program CTS), The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement
- Component Technical Specification (CTS)
- GM Global Fastening Catalog
- Product Drawings
- Service Manual
- Statement of Requirements (SOR), including Appendices G2 and J
- Vehicle Technical Specification (VTS)

3 Requirements

3.1 System/Subsystem/Component/Part Definition. The major functions, features and capabilities of the intermediate shaft and boot/seal are described in the following paragraphs.

3.1.1 Appearance. The appearance requirements for the intermediate shaft and boot/seal shall comply with Corporate and Design Staff objectives as described in the following paragraphs.

3.1.1.1 Underhood. The parts of the intermediate shaft and boot/seal that reside in the engine compartment shall comply with Corporate Underhood Objectives relative to items such as cosmetic corrosion, color, contrast, finish, etc. See Program CTS.

3.1.1.2 Interior. The parts of the intermediate shaft and boot/seal that reside in the passenger compartment shall have black color, unless otherwise specified in the program-specific technical specification. See Program CTS.

3.1.2 Content. The required physical and functional content for the steering intermediate shaft and boot/seal are identified in the following paragraphs.

3.1.2.1 Physical Content. See Program CTS.

3.1.2.2 Functional Content. See Program CTS.

3.1.3 Ambient Environment. The intermediate shaft and boot/seal shall be designed to operate under the following range of environmental conditions:

3.1.3.1 Temperature. See Program CTS.

3.1.3.2 Relative Humidity. The intermediate shaft and boot/seal shall perform according to the requirements specified within this document when exposed to a relative humidity of 2% to 100%.

3.1.3.2.1 Temperature Shock (Water Spray). The intermediate shaft and boot/seal as manufactured and after heat aged 60 h at Maximum Temperature (TMAX) excursion, as defined in 3.1.3.1, shall withstand water jet spray of 100 Bars and 15 L/minute for 2 minutes through a 1.25 mm diameter nozzle from any direction at a distance of 150 mm with no leakage. The water spray/wand shall be moved continuously about the span of the part in all direction at a speed of approximately 250 mm/second until the test is complete.

3.1.3.2.2 Temperature Shock (Water Submersion). The intermediate shaft and boot/seal shall have no leakage after being exposed to temperature shocks which occur when the components encounter submersion in 0 °C to 5 °C water for at least 60 s while the components are at TMAX excursion, as defined in 3.1.3.1.

3.1.3.3 Atmospheric Pressure. The intermediate shaft and boot/seal shall perform according to the requirements specified within this document when exposed to pressures between 427 mm and 797 mm of mercury.

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Vehicles shipped by air transport may be exposed to minimum absolute pressures listed in Table 1 depending on the altitude (above sea level) at which the aircraft flies.

Table 1: Atmospheric Pressure versus Altitude

Altitude	Absolute Atmospheric Pressure	
	millimeters of mercury	kPa
4921	429	57.1
6562	349	46.5
8202	282	37.6
9843	226	30.1
11 483	179	23.8
13 123	141	18.7
14 764	111	14.7
16 404	87	11.6

Note: This is atmospheric pressure, NOT cabin pressure (cabins are normally pressurized at high altitudes). In general, aircraft used in this application fly below 11 900 m above sea level, but can fly up to a maximum of 13 700 m under special circumstances.

3.1.3.4 Corrosives. Corrosion resistance will meet the requirements of GMW15272.

3.1.3.5 Shock (Mechanical Drop). The steering intermediate shaft and boot/seal, as shipped to vehicle/module assembly plant, shall withstand a 1 m drop onto concrete at three (3) orientations without visible or hidden damage. Orientations shall represent most damaging positions per agreement between supplier and GM validation engineer. Components unable to operate for their full intended life following this exposure shall have appropriate handling requirements specified in the Master Process Documents (MPD).

3.1.3.6 Vibration. See Program CTS.

3.1.3.7 Chemical Exposure. The steering intermediate shaft and boot/seal shall withstand exposure to the fluids described in the following paragraphs without degrading the performance described in the applicable GM specifications.

3.1.3.7.1 Underhood Exposure. The steering intermediate shaft and boot/seal shall withstand exposure to the fluids shown in Table 2.

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Table 2: Underhood Contaminant Exposure

Engine oil and additives	Steam
Automatic transmission fluid	Battery acid
Transaxle lubricant	Water and snow
Brake fluid	Salt water
Power steering fluid	Starting fluid
Washer solvent	Air Conditioning (A/C) refrigerant
Gasoline	Spray paint
Engine Coolant	Ether
Degreasers	Vinyl plasticizers
Soap, detergents and cleaners	Undercoating material
Chassis lube (grease)	Rear Axle Oil
Mud, dirt, grit, sand and gravel	-

3.1.3.7.2 Passenger Compartment Exposure. The parts of the intermediate shaft and boot/seal that reside in the passenger compartment shall withstand exposure to the fluids shown in Table 3.

Table 3: Passenger Contaminant Fluid Resistance

Water, snow and ice	Steam
Salt (both NaCl and CaCl ₂)	Degreasers
Soap and detergents	Dirt, grit and sand
Spray Paint	Engine oil and additives
Ether	Vinyl Plasticizers
Carpet cleaners	Machining Lubricants

3.1.3.8 Dust. The steering intermediate shaft and boot/seal shall be designed to withstand exposure to severe sand and dust conditions as specified in applicable GM specifications and as shown in Table 4.

Table 4: Dust Exposure

Dust Concentration (mg/m ³)	Exposure Time (Driving Hours)
70	745
350	250
1600	50
3900	10

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