



Inside Rear View Mirrors – Electrical Requirements

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 Scope. This specification establishes the minimum requirements and associated test methods that apply to all Inside Rear View Mirrors (ISRVMS) with electric content for use in passenger cars, multi-purpose passenger vehicles and trucks engineered by General Motors for the worldwide market. Requirements that apply uniquely to other types of mirrors and their features are found in other documents.

1.2 Mission/Theme. Not applicable.

1.3 Classification. Not applicable.

2 References

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

2.1 External Standards/Specifications.

SAE J1211 SAE/USCAR-25

2.2 GM Standards/Specifications.

GMW3059	GMW3191
GMW3089	GMW4710
GMW3091	GMW14082
GMW3097	GMW14241
GMW3103	GMW15626
GMW3104	GMW15760
GMW3107	GMW15841
GMW3110	GMW16044
GMW3122	GMW16157
GMW3172	GMW16158
GMW3173	GMW16159
GMW3176	GMW16344

2.3 Additional References.

- GM Global Best Practice ELEC86-57
- GM Global Best Practice ISRVMS-12

- GM Global Best Practice ISRVMS-16
- GM Global Best Practice ISRVMS-21
- GM Global Best Practice ISRVMS-39
- GM Global Best Practice ISRVMS-40
- GM Global Best Practice ISRVMS-49
- GM Global Best Practice ISRVMS-53
- GM Global Best Practice MFGERGO-18
- GM Global Best Practice NVISR-3
- Global General Assembly Service and Product Engineering (GGSE) ECU Diagnostic Infrastructure Requirements
- Global Bootloader Specification
- Service Programming System (SPS) Interpreter Programmers Reference Manual

3 Requirements

3.1 System/Subsystem/Component/Part Definition.

3.1.1 Appearance. The ISRVMS shall meet the Appearance requirements of GMW16158.

3.1.1.1 Styling. The ISRVMS shall meet the Styling requirements of GMW16158.

3.1.1.2 Perceived Quality (PQ) The ISRVMS shall meet the PQ requirements of GMW16158. For more information regarding ISRVMS PQ enablers, reference GM Global Best Practice ISRVMS-16.

3.1.1.2.1 Wire Management. No wires should be visible in the ISRVMS zone of the vehicle.

3.1.1.2.2 Vehicle Wire Harness to ISRVMS. The wiring from the headliner to the ISRVMS shall be concealed from the occupant's view per GM Global Best Practice ELEC86-57. For more details with respect to this interface, reference 3.1.4.2.

3.1.1.2.3 Trim Cover. Because of the design interface of the ISRVMS with the vehicle-side wire harness, a trim cover is required (reference 3.1.4.2 and 3.1.4.8). If the ISRVMS is the only component mating to the vehicle-side wiring harness, then a simple 2-piece slip-plane trim cover strategy is recommended, as shown in Figure 1. If there are more components in the ISRVMS zone requiring

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electrical connections (i.e., a Sensor Farm), then a larger cover is required as shown in Figure 2.

When a Sensor Farm is present, all the electrical components and the ISRVM wire harness shall be covered with one cover. Multiple covers are not ideal, as shown by Figure 1 (the component to the right of the ISRVM should instead share a common cover with the ISRVM wiring harness). The ISRVM zone shall be designed as part of the primary interior styling theme. It should look like it “belongs” and should not detract from the rest of the vehicle’s interior aesthetics.



Figure 1: Simple ISRVM Wire Trim Cover



Figure 2: Sensor Farm Trim Cover

3.1.1.2.4 Windshield. When electric ISRVMs are present, the windshield shall apply blackout to hide the wire harness from the outside of the vehicle. Similarly, when Sensor Farms are present, the windshield shall apply blackout to hide interior components, mounts, brackets, and wires from being visible from the vehicle’s exterior. Reference 3.1.4.7.2 and GMW16158 for additional requirements.

3.1.1.2.5 ISRVM Component.

3.1.1.2.5.1 Wire Management Strategy. The ISRVM shall hide its wire harness that connects the electrical connector on the “blade” style channel mount to the Printed Circuit Board (PCB) within the ISRVM head.

The highest level of wire management PQ is when this wire harness is completely hidden within the ISRVM assembly. There are multiple design solutions that can accomplish this objective. For example, one potential execution is to thread the pigtail through the ball joints and tube of the double-pivot assembly as shown in Figures 1, 2, 5, 8 and 9.

Note: This “thru-ball” design may be patent protected, which may limit its implementation. Another design solution is to route the pigtail along the double-pivot assembly’s “tube” and hide it with a clip-on cover that has a channel for this harness as shown in Figures 3, 4, 10, and 12. Additional design strategies will also be considered, but all wire-hiding designs must be approved by the GM ISRVM Bill of Material (BOM) Family Owner (BFO), GM Design Studio, and GM PQ.

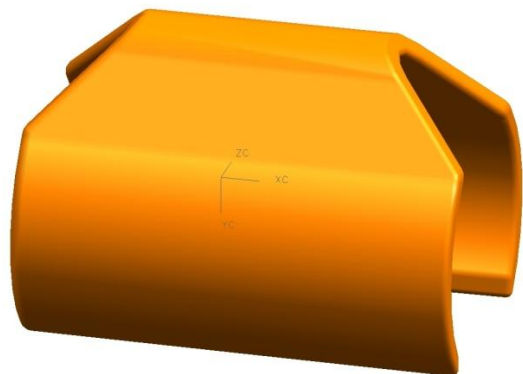


Figure 3: Wire-Hiding Clip Detail

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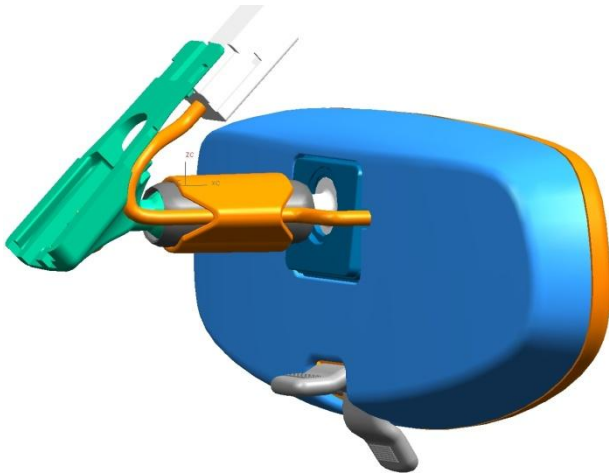


Figure 4: ISRVM with Wire-Hiding Clip

3.1.1.2.5.2 External Wire Harness Concealment.

If the ISRVM has an exposed wire harness (between the ISRVM's PCB and the electrical connector) as shown in Figure 4, the individual (colored) wires within the harness (visible on the vehicle-side wiring harness in Figure 5) must be concealed.

The covering of the wire harness shall be low gloss black. This covering shall be either shrink-fit sheathing, Poly Vinyl Chloride (PVC) vinyl tube, or cloth tape. Usage of vinyl tape to wrap/hide the wiring harness is not permitted. For more details reference GM Global Best Practice ELEC86-57.

3.1.1.3 Color, Gloss, and Grain. The ISRVMs must meet the Color, Gloss, and Grain requirements of GMW16158.

3.1.1.3.1 Plastic Wire-Hiding Clip. If a plastic wire-hiding clip is used (Figure 3 and Figure 4), it must be of the same material as the ISRVM housing and bezel assembly, perform to the same standards of color, gloss, and grain, and meet the same GM Materials Engineering, Appearance Engineering, and PQ requirements.

3.1.1.3.2 Metal Wire-Hiding Clip. If a metal wire-hiding clip is used (Figures 3 and 4), it must be of the same color and gloss as the double-pivot assembly, and must meet all requirements of GM Materials Engineering, Appearance Engineering and PQ.

3.1.2 Content.

3.1.2.1 Physical Content. Not applicable.

3.1.2.2 Functional Content. Not applicable.

3.1.3 Ambient Environment. Unless otherwise specified, tests shall be performed in the as received condition at $T_{room} = 23^{\circ} \pm 5^{\circ} \text{C}$.

3.1.3.1 Nominal Voltage. Unless otherwise specified, when the ISRVM is powered the nominal voltage (U_{nom}) shall be 14 V, per GMW3172 (Operating Type 3.1/3.2, which assumes that the vehicle's generator is operating).

3.1.4 Interfaces. All the interface requirements of GMW16158 shall be met.

3.1.4.1 Vehicle Electrical Architecture. All global Corporate Common Component (CCC) ISRVMs are designed to be integrated into vehicles with GM Global A electrical architectures and beyond. For vehicles with pre-Global A electrical architectures (i.e., GM Common Architecture, 16 bit, etc.) analysis must be completed to ensure all ISRVM functionality will be unaffected by these older vehicle electrical systems. Pay careful attention to telematics (i.e., OnStar) and also to General Motors Local Area Network (GMLAN) operations (if applicable).

3.1.4.2 Wire Attachment Strategy. The ISRVM wire attachment strategy is for the vehicle's wiring harness to drop down from the header and to plug into an electrical connector that is securely attached to the "blade" mount of the double-pivot assembly to prevent the potential for any squeak and rattle, per the requirements of GM Global Best Practice NVISR-3, as shown in Figure 5. This also enables the PQ requirements of 3.1.1.2 by securing the wire harness to the windshield surface and to the ISRVM's mounting bracket so that it can be hidden from view. In addition, this provides a consistent harness connection location for vehicle assembly operators. For more details reference GM Global Best Practice ISRVM-39.



Figure 5: ISRVM Wire Attachment Strategy

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3.1.4.3 Mating Connector. The vehicle-side wiring harness shall incorporate a 10-pin electrical connector that meets the requirements of GM Part Number (PN) 13577390. For more details reference GM Global Best Practice ISRVM-53.

3.1.4.3.1 Minimum Contact Surface Area. The minimum Contact Surface Area requirements in SAE/USCAR-25 for Pinch Grip or for Two Finger Push must be met by the mating connector and its wiring harness. For more details reference GM Global Best Practice MFGERGO-18.

3.1.4.3.2 Connector Installation Clearance. The minimum Pinch Grip clearance criteria or the minimum Two Finger Push clearance criteria requirements of GM Global Best Practice ISRVM-40 must be met by the vehicle design. For more details reference 3.3.2.5.3, SAE/USCAR-25 and GM Global Best Practice MFGERGO-18.

3.1.4.3.3 Maximum Engagement Force. If the requirements of 3.1.4.3.1 and 3.1.4.3.2 are both met, then the vehicle connector to ISRVM connector engagement force shall be no greater than 75 N. If either the requirements of 3.1.4.3.1 and/or 3.1.4.3.2 are not met, then the connector-to-connector engagement force shall be no greater than 45 N. For more details reference GM Global Best Practice MFGERGO-18.

3.1.4.4 ISRVM Electrical Connector. The ISRVMs covered by this standard (i.e., with electrical content) shall incorporate a 10-pin electrical connector as specified in 3.3.1.3.2. This electrical connector and its common terminal layout/orientation are shown in Figure 6 and also on the drawing released for PN 19177677. For more details reference GM Global Best Practice ISRVM-53.

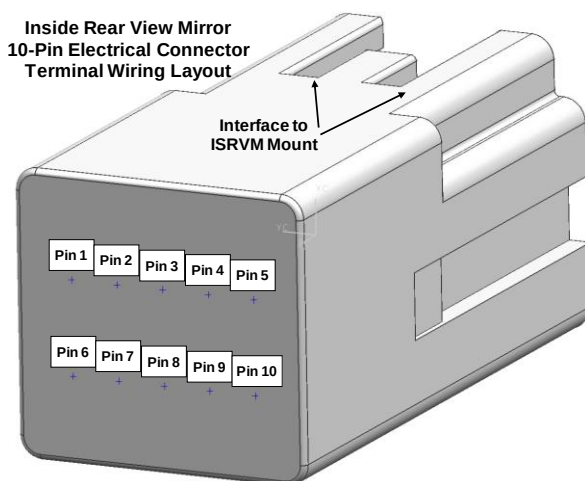


Figure 6: ISRVM Electrical Connector

3.1.4.5 ISRVM Wiring Pinouts. All ISRVMs with electric content shall utilize common wiring pinouts. There are two basic arrangements, depending upon whether GMLAN is part of the ISRVM circuit or not. Care has been taken in the design of these two pinouts to eliminate the potential for ISRVM damage and/or vehicle damage in the event of a “wrong mirror installed” operator error in the vehicle assembly plant.

If there are additional input signals required for a specific application and/or feature that are not covered by the non-GMLAN (hardwired) pin arrangement, then GMLAN must be utilized to accommodate this demand.

Optional feature-driven circuits are labeled as “reserved”. It is not required to install a terminal if the ISRVM’s feature content does not need that particular input/output. Detailed pinouts per ISRVM feature content (listed per Regular Production Option (RPO) codes) are in the Interface Control Document (ICD).

Note: At this time, the Auto-Dimming feature (ElectroChromic (EC) technology) for the Outside Rear View Mirrors (OSRVM) is controlled by the sensors and microprocessor of the ISRVM. This is currently a hardwired master-slave control strategy, but has the potential to be replaced by GMLAN.

3.1.4.5.1 Non-GMLAN Pinout Strategy. The following is the non-GMLAN (hardwired) terminal pinout arrangement:

- Pin 1 = Reserved for Backup Lamp Supply Voltage
- Pin 2 = Reserved for Run/Crank Ignition 1 Voltage
- Pin 3 = Reserved for Telematics Keypad Out
- Pin 4 = Reserved for Telematics Keypad Power
- Pin 5 = Ground
- Pin 6 = Reserved for Telematics Enabled (Green Light Emitting Diode (LED))
- Pin 7 = Reserved for Telematics Fault (Red LED)
- Pin 8 = Reserved for OSRVM ElectroChromic (-)
- Pin 9 = Reserved for OSRVM ElectroChromic (+)
- Pin 10 = Open

3.1.4.5.1.1 Pin 2 and Pin 5 are to be twisted pair wires (highly recommended) on the vehicle’s wire harness.

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3.1.4.5.2 GMLAN Pinout Strategy. The following is the GMLAN-enabled terminal pinout arrangement:

- Pin 1 = GMLAN In
- Pin 2 = GMLAN Out
- Pin 3 = Reserved for Telematics Keypad Out
- Pin 4 = Reserved for Telematics Keypad Power
- Pin 5 = Ground
- Pin 6 = Reserved for NTSC Video Signal (+)
- Pin 7 = Reserved for NTSC Video Signal (-)
- Pin 8 = Reserved for OSRVM ElectroChromic (-)
- Pin 9 = Reserved for OSRVM ElectroChromic (+)
- Pin 10 = Battery

3.1.4.5.2.1 Pin 6 and Pin 7 shall be shielded twisted pair cables (required) on the vehicle's wire harness.

3.1.4.5.2.2 Pin 5 and Pin 10 are to be twisted pair wires (highly recommended) on the vehicle's wire harness.

3.1.4.5.2.3 The video shield shall be terminated at the source (camera end) on the vehicle's wire harness.

3.1.4.6 Interface Control Document (ICD).

3.1.4.6.1 ISRVM Electrical ICD. The ISRVM shall document its electrical interface through an ICD in the GM Global A ICD Database. Each variant shall share the same ICD information, regardless if there are multiple suppliers. Section 3.4.1 has more details with respect to ISRVM Electrical ICD documentation information.

3.1.4.7 Windshield.

3.1.4.7.1 General. The ISRVM shall mount to the windshield per the requirements of GMW16158.

3.1.4.7.2 Perceived Quality Requirements. Per the PQ requirements of GM Global Best Practice ISRVM-16, the blackout on the windshield shall cover any glue joints and hide any wires from being visible from the outside of the vehicle.

3.1.4.8 Trim Covers.

3.1.4.8.1 ISRVM Wire Trim Cover. When there is only an ISRVM wire harness to hide, then the trim cover strategy is to have a 2-piece "slip-plane" style cover that snaps on to the "blade" style channel mount of the ISRVM, as shown in Figure 7. This replaces the attachment strategy previously used at GMNA on double-pivot ISRVMs. For more design details with respect to this interface,

reference 3.3.2.1, and GM Global Best Practices ISRVM-21, and NVISR-3.



Figure 7: ISRVM Wire Trim Cover Interface

3.1.4.8.2 Sensor Farm Trim Cover. "Sensor Farm" is a term for the collection of various electrical modules currently being located in the ISRVM zone on the windshield. When there is a Sensor Farm present, the strategy is to use a large 2-piece trim cover that hides both the Sensor Farm and the ISRVM wire harness together, as shown in Figure 8. Interface information and criteria for Sensor farm covers is documented in GMW16158. Also reference GM Global Best Practice NVISR-3 for squeak and rattle criteria relative to the Sensor Farm cover.



Figure 8: Sensor Farm Trim Cover

3.1.4.9 Software. The ISRVM component shall be preloaded from the supplier with all software that is common among all vehicle usages. Non-GMLAN ISRVMs must also have the program-specific software preloaded as well (since it cannot communicate to on the vehicles network). For GMLAN-capable ISRVMs, program-specific software files (i.e., calibrations, lookup tables, etc.)

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shall have interfaces so that it can be loaded in the GM vehicle assembly plant, and reloaded and/or upgraded with the latest release at GM dealers and/or through GM telematics services (i.e., OnStar). Ideally, the ISRVM shall come preloaded with all software required for all its program usages to minimize warranty risk for “wrong part install” and then use the vehicle assembly plant’s “flash” process to receive information to activate the specific program files/calibrations for each vehicle build. Reference 3.3.2.4.

3.1.4.10 Diagnostic Tools. ISRVMs with GMLAN capability shall have an interface so that GM service diagnostic tools (i.e., GM Tech II) that are in use at GM dealerships and service centers can read and reset ISRVM and related system (i.e., rear vision video, telematics, etc.) diagnostic trouble codes (DTC). ISRVMs with GMLAN shall also be able to support any additional diagnostic procedure and tool interface as required by GM Service Engineering.

3.1.5 Usage Definition. The ISRVM with electric content shall meet the requirements of GMW16158.

3.2 Product Characteristics.

3.2.1 Performance Requirements. The ISRVMs must also meet all the requirements of GMW16158.

3.2.1.1 Regulatory Requirements. The mirrors shall comply with all global regulatory requirements, and shall be certified (when required) for all countries in which GM does business unless otherwise stated in the SOR. The list of governmental documents has to be updated on a regular basis since new editions can always be introduced. If this standard has not been updated recently, check validity of these regulations referenced in 3.2.1.1 before usage and/or distribution. Regardless, the Supplier Integrated Engineer (SIE) and the GM Lead Engineer are co-responsible for meeting all applicable government regulations, as identified in the Validation Cross-Reference Index (VCRI) in Section 4.

3.2.1.2 General Electrical Requirements.

3.2.1.2.1 Hardware and Interface Requirements. The ISRVM shall meet the requirements of GMW14082.

3.2.1.2.2 Software and Interface Requirements. Reference the Service Programming System (SPS) Interpreter Programmers Reference Manual for more details on software development and standards.

3.2.1.2.2.1 GM Software Warehouse. All data files that are to be flashed in the GM vehicle assembly plant shall meet the Global General Assembly Service and Product Engineering (GGSE) Electronic Control Unit (ECU) Diagnostic Infrastructure Requirements.

3.2.1.2.2.1.1 Bootloader Software. All ISRVMs that are to be flash programmed must meet the Global Bootloader Specification.

3.2.1.2.2.2 GM Dealer and Service Center Software Support. All data files that are to be loaded, reloaded, replaced, and/or upgraded in GM dealers and/or service centers shall meet the GGSE ECU Diagnostic Infrastructure Requirements.

3.2.1.2.2.2.1 Bootloader Software. All ISRVMs that are to be flash programmed must meet the Global Bootloader Specification.

3.2.1.2.2.3 GM Telematics Remote Software Support. All data files that are to be remotely loaded, reloaded, replaced, and/or upgraded through a GM telematics service such as OnStar shall meet the requirements of GMW3110.

3.2.1.2.3 Analysis Requirements. Analysis shall be used to aid in designing reliability into the component during the time when physical components are not yet available. Analysis should be the earliest activity in the Analysis/Development/Validation (ADV) process and provides the earliest component design learning and improvement opportunity. All Analytical activities shall be documented in the Analysis, Development, Validation Plan & Report (ADVP&R), including results. Analytical activities shall be completed prior to the design freeze for building development level hardware.

3.2.1.2.3.1 Electric Analysis.

3.2.1.2.3.1.1 Nominal and Worst Case Performance Analysis. The ISRVM shall meet the Nominal and Worst Case Electric Performance Analysis requirements of GMW3172.

3.2.1.2.3.1.2 Short and Open Circuit Analysis. The ISRVM shall meet the Short/Open Circuit Analysis requirements of GMW3172.

3.2.1.2.3.2 Mechanical Analysis.

3.2.1.2.3.2.1 Printed Circuit Board (PCB) Natural Frequency Analysis. The ISRVM shall meet the Resonant Frequency Analysis requirements of GMW3172.

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3.2.1.2.3.2.2 High Altitude Shipping Pressure Effect Analysis. All ISRVMs that are hermetically sealed and/or have hermetically sealed subcomponents (i.e., the ElectroChromic glass assembly, etc.) shall meet the High Altitude Shipping Pressure Effect Analysis requirements of GMW3172.

3.2.1.2.3.2.3 Plastic Snap Fit Fastener Analysis. All ISRVMs with 2-piece housing constructions and/or that contain snap fits (i.e., housing/bezel construction, electrical connector, etc.) shall meet the Plastic Snap Fit Fastener Analysis requirements of GMW3172. For more information and details with respect to 2-piece housing construction ISRVMs, reference GMW16158.

3.2.1.2.3.2.4 Crush Analysis. This test is not required of ISRVMs because elbow or foot loading is low risk in customer usage and also during component and vehicle assembly. In addition, the requirements of GMW16158 will result in an ISRVM that is robust relative to elbow and foot loads.

3.2.1.2.3.3 Temperature Analysis.

3.2.1.2.3.3.1 High Altitude Operation Overheating Analysis. All ISRVMs with significant heat-generating elements on their PCBs (i.e., LED backlighting, etc.) shall meet the High Altitude Operation Overheating Analysis requirements of GMW3172.

3.2.1.2.3.3.2 Thermal Fatigue Analysis. All ISRVMs with PCBs shall meet the Thermal Fatigue Analysis requirements of GMW3172.

3.2.1.2.3.3.3 Lead-Free Solder Analysis. All ISRVMs with PCBs shall meet the Lead-Free Solder Analysis requirements of GMW3172.

3.2.1.2.4 GM Local Area Network (GMLAN) Subsystem Requirements.

3.2.1.2.4.1 Background. The in-vehicle GMLAN subsystem provides a reliable, cost effective, flexible and modular way to handle information sharing between different Electronic Control Units (ECU) in the vehicle through the means of a family of serial communication buses. GMLAN is capable of supporting the range from simple control modules up to highly complex units. The communication system also supports the transfer of diagnostic services and the transformation from and to a specified set of globally accepted standards for diagnostic tester access and communication.

3.2.1.2.4.2 General. All GMLAN-capable ISRVMs shall operate within the framework and requirements defined in GMW3104.

3.2.1.2.4.3 GMLAN Single Wire Controller Area Network (CAN). An ISRVM that operates on the GMLAN single wire CAN shall meet the requirements of GMW3089.

3.2.1.2.4.4 GMLAN Dual Wire CAN. An ISRVM that operates on the GMLAN dual wire CAN shall meet the requirements of GMW3122.

3.2.1.2.4.5 GMLAN Software. All GMLAN-capable ISRVMs shall operate within the framework and requirements defined in GMW3107.

3.2.1.2.4.6 GMLAN Diagnostics. All GMLAN-capable ISRVMs shall operate within the framework and requirements defined in GMW3110.

3.2.1.2.4.6.1 All GMLAN-capable ISRVMs shall operate within the framework and requirements defined in GMW16344.

3.2.1.2.4.7 GMLAN Traceability and Verification Data. All GMLAN-capable ISRVMs shall meet the requirements of in GMW4710.

3.2.1.3 Electromagnetic Compatibility (EMC). The requirements according to GMW3091, GMW3097 and GMW3103 shall be met (both Component and Vehicle Requirements).

3.2.1.3.1 Requirements, Performance, and Deviation Classification. The component/part shall pass both the component level GMW3097 and vehicle level GMW3091 EMC test procedure(s) for verification of compliance to EMC requirements as defined in component level GMW3097 and vehicle level GMW3091. In the event that a part passes the component level test procedure(s), but does not pass the vehicle level test procedure(s), the vehicle level test results shall be the determining factor for validation test pass/fail status.

All part immunity performance criteria and deviation classification shall be defined in accordance with the requirements of GMW3097.

3.2.1.3.2 Test Plan. A test plan per the requirements of GMW3103 shall be submitted to GM engineering before performing the tests. Because there may be iteration required before a test plan is approved, be sure to include enough lead time so that the timing targets/milestones are met.

The test plan shall include details such as transient injection application points and Device Under Test (DUT) monitoring. The test plan shall detail all differences between the planned tests and those described within GMW3097. All outputs shall be monitored to detect any deviations from their required states. Bus (GMLAN) communications shall be monitored to detect any inadvertent

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message transmissions or communications deviations. The test plan shall also include a listing of deviation conditions and criteria for each of the Deviation Classifications shown in GMW3097.

If other ISRVM GMW standards define additional applicable EMC component tests, the supplier shall develop a comprehensive EMC control plan (reference GMW3103) that integrates these external EMC tests in addition to those required in this standard.

3.2.1.3.3 Test Facilities. The test facilities and equipment shall be in good working order and shall have a valid calibration label. Alternate (non-GM) test facilities and equipment may also be used, as long as the laboratory meets the requirements of and has achieved the certification and recognition per GMW3097.

3.2.1.3.4 Test Setup. The part shall be powered and wired as if installed in the vehicle. All loads, actual or simulated (actual loads are preferred), shall be connected to the part through a wire harness. The wire harness shall be similar to the production harness. If a production intent harness is not defined, the harnessing shall be as defined in the related GMW3097 test procedure. Visual indicators (lamps or light emitting diodes) can be used to monitor the operation of a relay. Test reports and/or deviation data shall be reported in a format which meets the intent of GMW3097.

3.2.1.4 Electrical Abuse. The majority of these tests follow the "Development; Electrical" and "Design Validation (DV); Electrical" requirements sections of GMW3172. Reference the Functional Status Classification (FSC) system of GMW3172, and reference GMW14082 for additional electrical hardware requirements and guidelines.

3.2.1.4.1 Jump Start. Perform the Jump Start test and meet the performance criteria per GMW3172.

3.2.1.4.2 Reverse Polarity. Perform the Reverse Polarity test and meet the performance criteria per GMW3172.

3.2.1.4.3 Over Voltage. Perform the Over Voltage test and meet the performance criteria per GMW3172.

3.2.1.4.4 Over Load; All Circuits. Perform the Over Load – All Circuits test and meet the performance criteria per GMW3172.

3.2.1.5 Circuit Protection. The majority of these tests follow the "Design Validation (DV); Electrical" requirements sections of GMW3172. Reference the FSC system of GMW3172, and reference GMW14082 for additional electrical hardware requirements and guidelines.

Unless stated otherwise, all requirements in this section shall apply the conditions of GMW3172 code letter sequence ("Electrical Loads", "Mechanical Loads", "Temperature Loads", "Climatic Loads", "Chemical Loads", "Internal Protection by Enclosures" for Dust and Water):

- C C E E A IP5K2.

3.2.1.5.1 Parasitic Current. Perform the Parasitic Current test, and meet the performance criteria per GMW3172.

3.2.1.5.2 Battery Voltage Dropout. Perform the Battery Voltage Dropout test and meet the performance criteria per GMW3172.

3.2.1.5.3 Sinusoidal Superimposed Voltage. Perform the Sinusoidal Superimposed Voltage test and meet the performance criteria per GMW3172.

3.2.1.5.4 Pulse Superimposed Voltage. Perform the Pulse Superimposed Voltage test and meet the performance criteria per GMW3172.

3.2.1.5.5 Intermittent Short Circuit to Battery and to Ground. Perform the Intermittent Short Circuit to Battery and to Ground test and meet the performance criteria per GMW3172.

3.2.1.5.6 Continuous Short Circuit to Battery and to Ground. Perform the Continuous Short Circuit to Battery and to Ground test and meet the performance criteria per GMW3172.

3.2.1.5.7 Open Circuit; Single Line Interruption. Perform the Open Circuit – Single Line Interruption test and meet the performance criteria per GMW3172.

3.2.1.5.8 Open Circuit; Multiple Line Interruption. Perform the Open Circuit – Multiple Line Interruption test and meet the performance criteria per GMW3172.

3.2.1.5.9 Ground Offset. Perform the Ground Offset test and meet the performance criteria per GMW3172.

3.2.1.5.10 Power Offset. Perform the Power Offset test and meet the performance criteria per GMW3172.

3.2.1.5.11 Sneak Circuits, Supply Path. Sneak circuits shall not cause any damage or undesired behavior to either the ISRVM or to the vehicle. The ISRVM must meet the Sneak Circuits, Supply Path requirements of GMW14082.

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3.2.1.5.12 Sneak Circuits, Ground Path. Sneak circuits shall not cause any damage or undesired behavior to either the ISRVM or to the vehicle. The ISRVM must meet the Sneak Circuits, Ground Path requirements of GMW14082.

3.2.1.6 Robust Operation. The majority of these tests follow the "Development" and "Design Validation (DV) Electrical" requirements sections of GMW3172. Reference the FSC system of GMW3172, and reference GMW14082 for additional electrical hardware requirements and guidelines.

3.2.1.6.1 State Change Waveform Characterization. Perform the State Change Waveform Characterization test and meet the performance criteria per GMW3172.

3.2.1.6.2 Ground Path Inductance Sensitivity. Perform the Ground Path Inductance Sensitivity test and meet the performance criteria per GMW3172.

3.2.1.6.3 Temperature Measurement. This requirement applies to all ISRVMs with significant heat-generating elements on their PCBs (i.e., LED backlighting, etc.) Perform the Temperature Measurement test and meet the performance criteria per GMW3172.

3.2.1.6.4 Power Supply Interruptions. Perform the Power Supply Interruptions test and meet the performance criteria per GMW3172.

3.2.1.7 Environmental Exposure. The majority of these tests follow the "Climatic" and "Enclosure" requirements sections of GMW3172. Reference SAE J1211 for industry recommendations for environmental practices for electronic equipment design.

Unless stated otherwise, all requirements in this section shall apply the conditions of GMW3172 code letter sequence ("Electrical Loads", "Mechanical Loads", "Temperature Loads", "Climatic Loads", "Chemical Loads", "Internal Protection by Enclosures" for Dust and Water):

- C C C E A IP5K2.

3.2.1.7.1 General. The ISRVM shall meet all the Environmental Exposure requirements of GMW16158.

3.2.1.7.2 Frost Condensation. Perform the Frost test per GMW3172, also ensuring that one cycle of the functional test is to be performed after a uniform coating of frost is observed on the test samples and is to be completed before this coating of frost disappears. The ISRVM's Functional Status Classification shall be A. In addition, the ISRVM shall operate within specifications when evaluated

at +23 °C after test, including the variable reflectance transition time requirement of GMW16159 (if applicable).

3.2.1.7.3 Thermal Shock (TS) Air-to-Air. The ISRVM shall meet the TS requirements of GMW16158, except that the number of cycles shall now be increased to 50.

3.2.1.7.4 Power Temperature Cycle (PTC). The ISRVM shall meet the PTC requirements of GMW16158, except that the number of cycles shall now be increased to 50.

3.2.1.7.5 Storage Performance. For this requirement, apply the GMW3172 code letter sequence: C C E E A IP5K2.

3.2.1.7.5.1 Low Temperature Wakeup. Perform the Low Temperature Wakeup test and meet the performance criteria per GMW3172. In addition, the ISRVM shall operate within specifications when evaluated at +23 °C after test, including the variable reflectance transition time requirement of GMW16159 (if applicable).

3.2.1.7.5.2 High Temperature Wakeup. Verify ISRVM functionality at +23 °C prior to start of test. Soak the ISRVM for at least one hour at +105 °C. The ISRVM's Functional Status Classification shall be A. In addition, the ISRVM shall operate within specifications when evaluated at +23 °C after test, including the variable reflectance transition time requirement of GMW16159 (if applicable).

3.2.1.7.6 Fretting Corrosion Degradation. Reference the Humid Heat Constant test requirements of GMW16158 and GMW3172. Perform the Fretting Corrosion Degradation test, and meet the performance criteria per GMW3172.

3.2.1.8 GMLAN Performance.

3.2.1.8.1 General. All ISRVMs with GMLAN capability shall meet the requirements of GMW14241.

3.2.1.8.2 Discrete Digital Input Threshold Voltage. Perform the Discrete Digital Input Threshold Voltage test, and meet the performance criteria per GMW3172.

3.2.1.9 ISRVM Wiring Harness. This section covers the requirements for the wiring harness that is Part of Assembly (POA) to the ISRVM. This POA wiring harness can either be physically internal to the ISRVM (i.e., when using a completely-hidden wire management strategy) or partially external (i.e., running along the outside of the double pivot assembly, connecting the PCB inside the ISRVM head to the electrical connector on the "blade style" channel mount). This section does not apply to the

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vehicle side wiring harness that mate to the ISRVM.

3.2.1.9.1 Circuit Identification. The wires in the ISRVM shall be numbered and identified, both in the ICD and physically (i.e., colored) per the requirements of GMW3176.

3.2.1.9.2 Wire Cable Requirements. The individual wire cables of the POA ISRVM wiring harness shall meet the requirements of GMW15626.

3.2.1.9.2.1 GMLAN Wire Cable Requirements. The wire cables used in GMLAN circuits (either single or dual wire CAN) shall meet the requirements of GMW3173.

3.2.1.10 ISRVM Electrical Connector. It is the responsibility of the ISRVM supplier to ensure that the following requirements are met. It is acceptable for the ISRVM to provide validation information to GM from the electrical connector supplier proving compliance (the ISRVM supplier is not required to rerun tests if credible validation has been established by the electrical connector supplier).

3.2.1.10.1 Connector Design Requirements. The electrical connector that is released as POA to the ISRVM must meet the requirements of GMW15841.

3.2.1.10.2 Connector Performance. The electrical connector that is released as POA to the ISRVM must meet the requirements of GMW3191.

3.2.1.10.3 Connector Installation Abuse; Side Force. Perform the Connector Installation Abuse - Side Force test and meet the performance criteria per GMW3172.

3.2.2 Physical Characteristics.

3.2.2.1 Dimensions and Capacity. Not applicable.

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.

3.2.3.2.1 Reliability: 98%, Confidence: 50%.

3.2.3.2.2 The preferred approach to meeting this requirement is to test 6 mirror assemblies minimum to 2 lives with no failures, stop testing after 3 lives with operational checks after each completed life. The VCRI in Section 4 lists minimum sample sizes.

3.2.3.2.3 The sample selection procedure is to conform to GMW15760.

3.2.4 Serviceability.

3.2.4.1 General. The ISRVM shall meet the serviceability requirements of GMW16158.

3.2.4.2 Software Support. All ISRVM software shall be designed so that it can be serviced at the dealer and remotely through GM telematics services. Both common software and program-specific software shall be able to be reloaded and also upgraded if newer versions/revisions exist.

3.2.4.3 Diagnostic Requirements. ISRVMs with GMLAN capability shall be serviceable through GM diagnostic tools (i.e., GM Tech II) that are in use at GM dealerships and service centers. ISRVMs with GMLAN must support service diagnostic procedures and requirements, and shall meet the requirements of GMW16344.

3.2.5 User System/Subsystem/Component/Part Interface. The ISRVM shall be designed to meet all Human Vehicle Integration (HVI) requirements and criteria of GMW16158.

3.3 Design and Construction.

3.3.1 Materials, Processes and Parts Selection Guidelines.

3.3.1.1 Material Guidelines. The ISRVM shall meet the Material guidelines requirements of GMW16158.

3.3.1.2 Processes Guidelines. The ISRVM shall meet the Process guidelines requirements of GMW16158.

3.3.1.3 Parts Guidelines.

3.3.1.3.1 General. The ISRVM shall meet the Parts guidelines requirements of GMW16158.

3.3.1.3.2 ISRVM Electrical Connector. The ISRVMs covered by this standard (i.e., with electrical content) shall incorporate a 10-pin electrical connector that meets the requirements of GM PN 19177677. For more details, reference GM Global Best Practice ISRVM-53.

3.3.2 Design Guidelines and Constraints. The ISRVM must meet all the Design Guidelines and Constraints requirements of GMW16158.

3.3.2.1 Blade-Style Channel Mount. All ISRVMs with electric content shall have a "blade" style channel mount as shown in Figures 9 and 10.

3.3.2.1.1 One-Piece Die Cast Construction. This "blade" channel mount shall be a one piece die cast subcomponent to provide a stable mounting structure to which the wire connector can be mechanically clipped as shown in Figure 10. Securing the electrical connector with tape is not an acceptable alternative, nor is it permissible to clip a plastic extension to a non-blade channel.

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