



Inside Rear View Mirrors - General/Mechanical 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 standard establishes the minimum requirements and associated test methods that apply to all Inside Rear View Mirrors (ISRVs) for use in passenger cars, multi-purpose passenger vehicles and trucks, engineered by General Motors (GM), for the worldwide market. Requirements that apply uniquely to different types of mirrors and/or 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.

ASTM D523-62T	ISTA 1A 2001
CMVSS 302	KMVSS Article 108
FMVSS 302	Korea TP14
ISO 5740	SAE J964a

2.2 GM Standards/Specifications.

GMW3059	GMW14233
GMW3172	GMW14264
GMW3205	GMW14444
GMW3232	GMW14651
GMW8502	GMW15760
GMW8505	GMW15804
GMW14162	GMW16157
GMW14181	GMW16159
GMW14201	

2.3 Additional References.

- **General Assembly Engineering, PCP** at <http://gae.me.gm.com/main/pcp/index.jspx>

- **GM Supply Power** at www.gmsupplypower.com
- **GM Global Fasteners Catalogue** at <http://gmna1.gm.com/eng/globfast/supplypower/globalcat/globalcatalog.pdf>
- **GM Human Factors Design Objectives: Inside Rear View Mirror Adjustment requirements** at <http://gmna1.gm.com/vp/vapi/hhf/GlobalStuff/index.htm>
- GM Global Best Practice FXGLASS-39
- GM Global Best Practice FXGLASS-72
- GM Global Best Practice ISRV-1
- GM Global Best Practice ISRV-3
- GM Global Best Practice ISRV-9
- GM Global Best Practice ISRV-10
- GM Global Best Practice ISRV-12
- GM Global Best Practice ISRV-14
- GM Global Best Practice ISRV-15
- GM Global Best Practice ISRV-16
- GM Global Best Practice ISRV-18
- GM Global Best Practice ISRV-20
- GM Global Best Practice ISRV-23
- GM Global Best Practice ISRV-31
- GM Global Best Practice ISRV-34
- GM Global Best Practice ISRV-35
- GM Global Best Practice ISRV-38
- GM Global Best Practice ISRV-51
- GM Global Best Practice ISRV-52
- GM Global Best Practice ISRV-54
- GM Global Best Practice ISRV-110222
- GM Global Best Practice MATINTR-37
- GM Global Best Practice NVISR-3
- GM Global Best Practice ROOFTR-13

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March 2011

Originating Department: North American Engineering Standards

Page 1 of 38

3 Requirements

3.1 System/Subsystem/Component/Part Definition.

3.1.1 Appearance. The following appearance requirements apply to all ISRVMs. There may be additional appearance related requirements that are specific to certain types of mirrors, which (if applicable) will be documented in another document or elsewhere in the Statement of Requirements (SOR).

3.1.1.1 Styling. To further clarify the requirements of GMW16157, since GM ISRVMs are released as global Corporate Common Components (CCC), the styling of ISRVMs is specifically co-developed by the ISRVM Product Development Team (PDT) and the GM Global Cross-Interior Studio of the Global Component Design Strategy Center (not a program-specific or a regional-specific Interior Design Studio).

3.1.1.2 Perceived Quality (PQ). All perceived quality requirements for ISRVMs are specifically co-developed and approved by the ISRVM PDT and the GM Global Interior and CCC PQ team of the Global Advanced PQ Strategies and Standards group (not a program-specific or a regional-specific PQ organization).

In addition to the PQ requirements of GMW16157, all ISRVMs shall meet the Global Interiors low gloss strategy, as specified in 3.1.1.3.2.

All ISRVMs shall have their identification marks in a location and size determined per 3.3.3.2.

Parting lines and molding gate locations shall be located and sized per 3.3.1.2.1.

For additional information, please reference GM Global Best Practice ISRVM-16.

3.1.1.2.1 Bezel to Housing Flushness. All ISRVMs that are of a two-piece construction (i.e., with a forward-facing bezel and a rear housing, reference Figure 1) shall be designed and assembled so that these parts are flush with each other (preferred), or so that the front bezel is proud relative to the rear housing by no more than 0.5 mm. It is not acceptable for the rear housing to be proud relative to the front bezel at this joint.

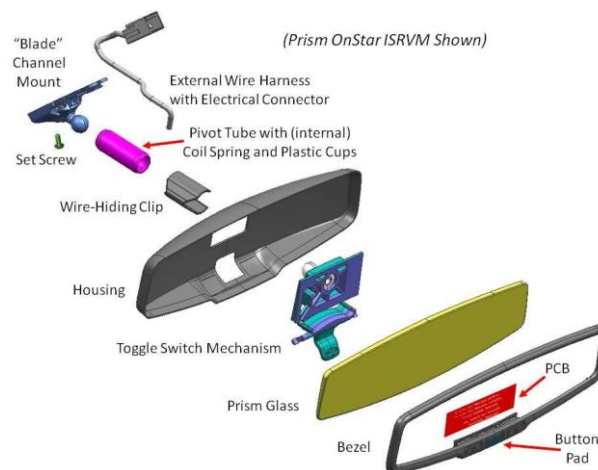


Figure 1: Two Piece Housing/Bezel ISRVM Construction

3.1.1.2.2 Transition between Mating Parts. All ISRVMs shall be assembled so that there is a smooth transition and acceptable tactile feel between mating parts (for example, the joint between the ISRVM housing and bezel, where it snaps together) and along tooling lines.

3.1.1.2.3 Maximum Gap between Mating Parts. All ISRVMs shall be designed to minimize gaps, with none >1.0 mm.

3.1.1.2.4 Interior Subcomponents Noticeability. All ISRVMs shall be designed so that any openings are minimized to reduce the visibility and noticeability of the interior subcomponents; if any interior subcomponents (i.e., Printed Circuit Boards (PCB), wires, anti-shatter coating, etc.) are visible by the customer when in vehicle position, then these exposed subcomponents must be black.

3.1.1.2.5 Surface Flushness in Day Position. All ISRVMs with prism glare reduction technology shall be designed so that any moving surface (i.e., the toggle body in the rear of the housing) is flush with all adjacent parts when in the "day" position, as shown in Figure 2. When in the "night" position, it can either be proud or subflush, depending upon the required mechanics.

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March 2011

Page 2 of 38



Documents

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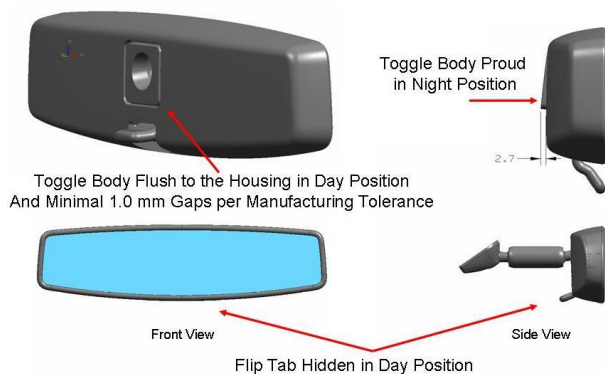


Figure 2: PQ Attention to Detail; Flip Tab Style Prism ISRV Example

3.1.1.2.6 Minimal Visibility of Prism Activation Mechanism. All ISRVs with prism glare reduction technology shall be designed so that the driver's perceived visibility of the day-night actuator is minimized when in the "day" position.

If a "flip tab" prism toggle design is used, then this shall be completely hidden behind the ISRV head when in the "day" setting, as shown in Figure 2.

If a flat blade "twist knob" rotating toggle is used, then this shall be designed so that it is as thin as possible (minimizing its profile), so that it is as short as possible (height), and so that it shall be pointed fore-aft when in the "day" position, as shown in Figure 3, and cross-car when in the "night" position.

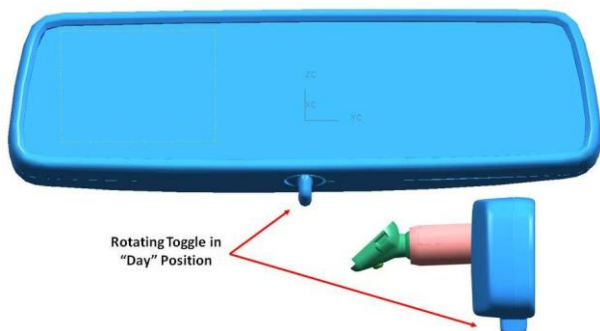


Figure 3: PQ Forward Visibility; Twist Knob Style Prism ISRV Example

3.1.1.3 Color, Gloss, and Grain. All ISRVs must meet the requirements of GMW16157 relative to Color, Gloss, and Grain.

3.1.1.3.1 Color. Unless otherwise specified by the GM Appearance Engineer in Appendix F5 of the SOR, the color of all exterior surfaces of the ISRV shall be 600R "Jet Black".

3.1.1.3.2 Gloss. Unless otherwise specified by the GM Appearance Engineer in Appendix F5 of the SOR, the gloss of all exterior surfaces of the ISRV shall be PGF (i.e., GLG in the pre-2008 gloss designation system). Reference Table 1 which maps out the gloss lettering system; the current ISRV requirement is in red, and the previous gloss level targets (legacy ISRVs) are in blue. For more details reference GM Global Best Practice ISRV-16.

3.1.1.3.3 Specular Gloss. The specular gloss of the surface of the materials used for the inside rear view mirror frame and mounting bracket shall not exceed 40 units when measured by the 20 degree method of ASTM Standard D523-62T.

3.1.1.3.4 Grain. Unless otherwise specified by the GM Appearance Engineer in Appendix F5 of the SOR, the grain of all molded exterior surfaces of the ISRV shall be GMGF 001 BRAZIL.

3.1.1.3.4.1 Secondary Graining. In addition to the primary grain, there are secondary graining processes (i.e., "Micro Mat" technology) which add faint micro cross-hatches or other similar features on the top surfaces of the primary grain to further diffuse reflectivity and therefore reduce gloss. While this secondary graining is not specifically required, its usage is acceptable because depending upon the materials selected, it may be useful to help achieve the low gloss requirement in 3.1.1.3.2.

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March 2011

Page 3 of 38



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Table 1: Gloss Level Identification

Measured by 60° Angle	2005-2008 Designation	08/08/2008+ Designation
0	GLB	
1	GLC	
2	GLD	PGC
3	GLE	PGE
4	GLF	
5	GLG	PGF
6	GLH	
7	GLA	PGH
8	GLI	
9	GLJ	
10	GLK	
11	GLL	
12	GLM	PGM
	GLN	
	GLO	
20	GLP	
30	GLR	
40	GLS	
50	GLT	
60	GLU	
70	GLV	
80	GLW	
90	GLY	
100	GLZ	

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 $23 \pm 5^\circ\text{C}$.

3.1.4 Interfaces.

3.1.4.1 ISRVM Mount Interface.

3.1.4.1.1 Windshield Button Design. The ISRVM shall mate to a wedge-type metallic button that is adhered as part of assembly (POA) to the windshield. This windshield button design combines two features to provide a snug mechanical fit to the ISRVM's channel mount: a dovetail with a wedge, as shown in Figure 4 and Figure 5, respectively. The ISRVM shall be installed to the Windshield button by sliding it on from the top, as shown in Figure 6.

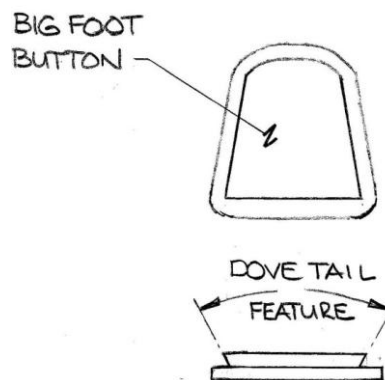


Figure 4: Windshield Button Dovetail Feature

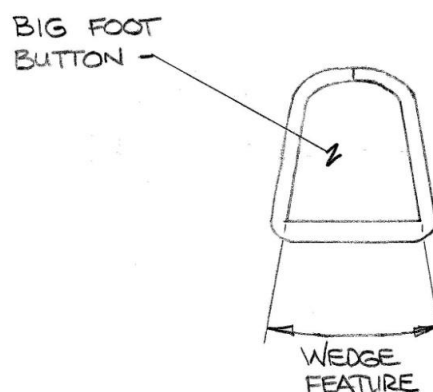


Figure 5: Windshield Button Wedge Feature

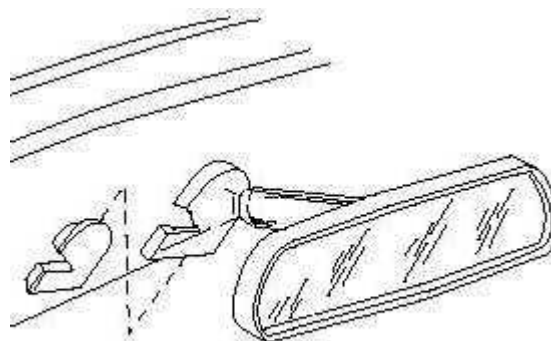


Figure 6: ISRVM Mounts to Windshield Button

3.1.4.1.1.1 Mating Conditions. The windshield buttons' math data shall have a local coordinate system or some other similar reference point at common location. The ISRVM's channel mount shall place a similar feature in its math data to enable quick and consistent mating of the ISRVM to the windshield button. Reference 3.3.2.2.2.1 and 3.3.2.5.4.

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March 2011

Page 4 of 38

3.1.4.1.2 Windshield Button Size. These wedge type windshield buttons can either be “standard” size (Figure 7) or a “bigfoot” (Figure 8), as the two are interchangeable at the ISRVM mounting interface. “Bigfoot” has a larger surface area (approximately 88%) on the side bonding it to the windshield glass, but is dimensionally similar to the standard button where it fits to the ISRVM. Detailed component drawings and GM Part Numbers (PNs) of both windshield buttons will be provided in the SOR. For more details reference GM Global Best Practice FXGLASS-72.



Figure 7: “Standard” Windshield Button

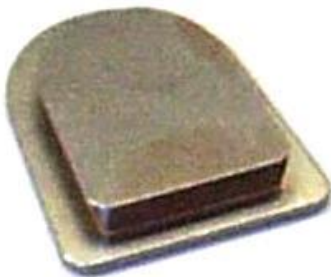


Figure 8: “Bigfoot” Windshield Button

3.1.4.1.3 Windshield Button PQ. While the windshield button is not released by the ISRVM team, its execution affects the PQ of the ISRVM zone. Additional PQ requirements and their affect on glass performance for the windshield button are detailed in GM Global Best Practice FXGLASS-39.

3.1.4.2 Integration Strategy to Prevent Squeak and Rattle. All components in the ISRVM zone (i.e., windshield, windshield button, ISRVM, trim covers, wire harnesses, etc.) shall be designed as a system to prevent squeak and rattle. For more details reference GM Global Best Practice NVISR- 3.

3.1.4.3 Supplemental Inflatable Restraint (SIR) Interface. These system-level requirements apply to the non-ISRVM components in the vehicle. The

ISRVM component requirements relative to SIR deployment are in 3.2.1.5.3.

3.1.4.3.1 SIR Deployment Travel Path. The SIR system shall be designed so that the deploying airbag cushion avoids contact with the ISRVM. This prevents the potential for the ISRVM to become a projectile as well as prevents the potential for the ISRVM becoming damaged where sharp or otherwise unfriendly surfaces may result. It shall not be assumed that the ISRVM's wire harness (if present) will act as a “tether” if the ISRVM is impacted by the SIR's air bag cushion.

3.1.4.3.2 Windshield Button System Integrity. The windshield, button adhesive, and the windshield button itself shall be designed so that this subsystem remains intact after SIR deployment, and that the ISRVM does not become a potential projectile.

3.1.5 Usage Definition. The range of physical dimensions of the user population shall be bounded by the dimensions of the 5th percentile female and the 95th percentile male.

3.1.5.1 ISRVM Feature Usage. ISRVM features and usage guidelines are detailed in GM Global Best Practice ISRVM-110222.

3.2 Product Characteristics.

3.2.1 Performance Requirements. All ISRVMs must also meet all the requirements of GMW16157.

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 the validity of these regulations referenced below before usage. Regardless, the Supplier Integrated Engineer (SIE) and the Buyer (GM) Lead Engineer are both co-responsible for meeting all applicable government regulations, as identified in the Validation Cross-Reference Index (VCRI) in Section 4.

3.2.1.1.1 Canada.

- CMVSS 302, Flammability of Interior Materials.

3.2.1.1.2 Korea.

- KMVSS Article 108, Rear View Mirror Impact.

3.2.1.1.3 United States.

- FMVSS 302, Flammability of Interior Materials.

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3.2.1.2 Handset Adjustment Effort.

3.2.1.2.1 Mirror End Torque. This is for the ball joint at the ISRVM head.

3.2.1.2.1.1 Minimum. The minimum adjustment effort at the mirror end shall be at least 0.7 N·m.

3.2.1.2.1.2 Maximum.

3.2.1.2.1.2.1 ISRVM Variants with a One-Piece Housing Construction. For an example of an ISRVM with a one-piece housing construction, reference Figure 9.

The maximum adjustment effort at the mirror end shall be no more than 2.2 N·m.

3.2.1.2.1.2.2 ISRVM Variants with a Two-Piece Housing/Bezel Construction. For an example of an ISRVM with a two-piece housing/bezel construction, reference Figure 1.

The maximum adjustment effort at the mirror end shall be no more than 3.2 N·m.

3.2.1.2.2 Support End Torque. This is for the ball joint at the ISRVM's channel mount.

3.2.1.2.2.1 Minimum. The minimum adjustment effort at the channel mount end shall be at least 0.11 N·m greater than the corresponding mirror end torque.

3.2.1.2.2.2 Maximum. The maximum adjustment effort at the channel mount end shall be no more than 5.5 N·m.

3.2.1.2.3 Degradation of Performance. Table 2 defines the allowable degradation of component performance for the requirements in 3.2.1.2 after completing the durability testing of 3.2.1.6.



Figure 9: One-Piece Housing Construction

Table 2: Degradation of Performances

Requirement	% Allowable Degradation at 1/2 Customer Usage	% Allowable Degradation at 1 Customer Usage
Adjustment Effort - Handset	10%	40%

3.2.1.3 Stability.**3.2.1.3.1 Component Level.**

3.2.1.3.1.1 Rotation; White Noise Method. Following the procedure in GMW14201 and using the input values in Table 3, apply a shaped random (enveloped white noise) input to the ISRVM.

Rotations shall be:

- $< 0.0036 \cdot 160/D$, but never > 0.0036 degrees when G_{rms} (energy under curve) = 3.55 m/s^2 , applied in the direction of the lowest mode; D = diagonal mirror glass dimension.

3.2.1.3.1.2 Natural Frequency.**3.2.1.3.1.2.1 One-Piece Housing ISRVMs.**

3.2.1.3.1.2.1.1 Vertical. The first mode of natural frequency ω_n on a rigid fixture shall be $> 70 \text{ Hz}$.

3.2.1.3.1.2.1.2 Horizontal. The first mode of natural frequency ω_n on a rigid fixture shall be $> 60 \text{ Hz}$.

Table 3: ISRVM Vertical Acceleration

Frequency (Hertz)	Acceleration $((\text{m/s}^2)^2/\text{Hz})$
8	0.59994
11	2.13307
22	0.1203
48	0.03003
71	0.02005
100	0.00026
$\text{m/s}^2 \text{ RMS}$	2.91

3.2.1.3.1.2.2 Two-Piece Housing ISRVMs, Except Video Display Variants.

3.2.1.3.1.2.2.1 Vertical. The first mode of natural frequency ω_n on a rigid fixture shall be $> 60 \text{ Hz}$.

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March 2011

Page 6 of 38

3.2.1.3.1.2.2.2 Horizontal. The first mode of natural frequency ω_n on a rigid fixture shall be > 45 Hz.

3.2.1.3.1.2.3 Video Display ISRVMS.

3.2.1.3.1.2.3.1 Vertical. The first mode of natural frequency ω_n on a rigid fixture shall be > 60 Hz.

3.2.1.3.1.2.3.2 Horizontal. The first mode of natural frequency ω_n on a rigid fixture shall be > 40 Hz.

3.2.1.3.2 Vehicle Level. Both objective and subjective requirements shall be met by the vehicle.

3.2.1.3.2.1 Objective. The 95% Confidence Interval of the Upper Specification Limit (USL) of rotation shall be no greater than $0.0036 \times 160/D$, but never greater than 0.0036 degrees, when the vehicle is driven on test roads and speeds as specified in procedure GMW8502, where D = diagonal mirror glass dimension. Maximum test speeds should not exceed legal maximum values for market in which vehicle is to be sold.

3.2.1.3.2.2 Subjective. Following the procedure for mirror stability testing in GMW15804 and the GM Subjective Rating Scale in GMW14264, the vehicle must perform to achieve an ISRVM subjective rating of at least 8 for each evaluator on each test event. (This means not using averages or overall ratings.) In addition, no vehicle shall have an ISRVM subjective stability rating less than 5. If a GM Region does not have access to the road surfaces listed in GMW15804, then the test roads in GMW8502 may be substituted, but the subjective procedure in GMW15804 must still be followed.

3.2.1.3.2.3 Convertibles, and Other Vehicle Types with Minimal Roof Structures (i.e., Targa Tops, T-Tops, etc.) All vehicles are expected to perform to the same ISRVM stability requirements regardless of roof structure (i.e., fixed roof, targa top, convertibles, etc.)

In all cases, vehicle teams are expected to provide a sufficient structure to support the Windshield, as the function of the Windshield Button is to provide a stable mounting platform for the ISRVM. Please refer to GM Global Best Practice ISRVM-18 for more details on the vehicle-level design variables that affect ISRVM stability.

If the same ISRVM meets the vehicle level stability requirements on a fixed roof vehicle, but does not on that vehicle's convertible, targa top, or T-top variant, the ISRVM component is considered validated to meeting this vehicle level requirement, but the vehicle team is still responsible to provide a

stable mounting platform for the ISRVM by modifying the rest of the subsystem to compensate for the lost structure relative to its fixed roof variant.

3.2.1.4 Head Droop Stability. The ISRVM shall not change viewing position during normal operating conditions.

3.2.1.4.1 Tipping Angle; Prism ISRVMS. The tipping angle is the angle that is formed by the differences between the central planes as the ISRVM is toggled between its day and night settings, as measured by the procedure of 3.2.1.14.5.1.2.

The tipping angle shall be measured by using a projector or laser beam in the same method as in the wedge angle test of 3.2.1.14.5.1.2 and the measured values must conform to the ones in the drawings.

The tipping angle must be ± 0.5 degrees between the central projected plane of three projected planes on the screen before controlling the prism day-night actuating mechanism (i.e., twist knob or flip tab) and the lower projected plane after controlling the mechanism.

3.2.1.4.1.1 Virgin Parts. The angular deviation between the initial "day" image setting and the subsequent "day" image setting after 1 day-night-day actuation cycle shall not exceed ± 0.5 degrees.

3.2.1.4.1.2 Parts after Durability Testing. After completing the prism actuation durability test of 3.2.1.13.4, the angular deviation between the initial "day" image setting and the subsequent "day" image setting after 1 day-night-day actuation cycle shall not exceed ± 1.5 degrees.

3.2.1.4.2 Tipping Angle; Push Button ISRVMS. The tipping angle shall be measured by using a projector or laser beam in the same method as in the wedge angle test of 3.2.1.14.5.1.2 and the measured values must conform to the ones in the drawings.

The tipping angle must be ± 0.5 degrees between the central projected plane of three projected planes on the screen before depressing the push button and the lower projected plane while the button is fully depressed.

The angular deviation between the initial image setting and the subsequent image setting after 1 push button actuation cycle shall not exceed ± 0.5 degrees.

3.2.1.5 Impact.

3.2.1.5.1 Static Head Impact; Breakaway and/or Deflect-Away. Must meet all applicable regulatory

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March 2011

Page 7 of 38

requirements as highlighted in 3.2.1.1 and in GMW16157.

3.2.1.5.2 Dynamic Head Impact; Pendulum. Must meet all applicable regulatory requirements as highlighted in 3.2.1.1 and in GMW16157.

3.2.1.5.3 SIR Interface. These requirements apply to the ISRVM as a component. The system-level requirements concerning SIR impact performance are in 3.1.4.3.

3.2.1.5.3.1 SIR System Integrity. The ISRVM or any of its components separated during an SIR deployment event shall not compromise the integrity of the SIR system nor degrade the performance of the SIR system during deployment.

3.2.1.5.3.2 Projectile Avoidance. While 3.1.4.3 requires that the SIR system be designed to avoid the ISRVM during deployment, if the ISRVM is impacted by the air bag cushion, the ISRVM's mounting system should maintain its structural integrity to avoid the potential of the ISRVM from becoming a projectile.

3.2.1.5.3.3 Post SIR Deployment Surfaces. While 3.1.4.3 requires that the SIR system be designed to avoid the ISRVM during deployment, if the ISRVM is impacted by the air bag cushion, the ISRVM's structure should maintain its integrity to avoid the potential of the occupants being exposed to "unfriendly" surfaces (i.e., sharp edges, hard surfaces with edge radius smaller than permitted ECE regulations, etc.)

3.2.1.6 Handset Cycling Durability. During and after the test, test samples must not make any objectionable noise by movement or show any sudden jerking and functional problems such as mirror detachment. After the test, the hand-set adjust effort requirements of 3.2.1.2 and the day/night toggle effort requirements of 3.2.1.14 shall be met.

3.2.1.6.1 Definitions. Either of the following two definitions of a complete cycle is acceptable.

3.2.1.6.1.1 Center to Individual Cross Points. Begin with the ISRVM head centered (straight out) relative to the mounting assembly. Then rotate until the ball stud reaches a minimum of 70% of its maximum travel in the following directions: center, to upper end, to center, to lower end, to center, to left end, to center, to right end, returning again to center. A full cycle must be completed before repeating any test direction; in other words, it is not acceptable to test multiple iterations of a partial cycle (i.e., from center, to upper end, to center, to upper end, to center, etc.)

3.2.1.6.1.2 Circular Sweep. Begin with the ISRVM head centered (straight out) relative to the mounting assembly. Then rotate up until the ball stud reaches a minimum of 70% of its maximum travel to reach the starting point for this test. Move the ISRVM along a rotational cycle sweeping through these same quarterly points of 3.2.1.6.1.1 that represent the maximum range of ISRVM adjustability.

3.2.1.6.2 Rate. Test must be run at a rate between 3 to 5 complete cycles per minute.

3.2.1.6.3 Procedure. Test 5 000 cycles at 25°C, then 1 000 cycles at -40°C, then 1 500 cycles at 85°C.

3.2.1.7 Structural Strength.

3.2.1.7.1 Ball Stud Torsion.

3.2.1.7.1.1 Mounting Bracket Ball Stud. The mounting bracket (channel mount) ball stud shall withstand a rotational torque of 13.2 N·m (torsional strength).

3.2.1.7.1.2 Mirror End Ball Stud. One of the two requirements must be met, depending upon ISRVM construction.

3.2.1.7.1.2.1 The mirror end ball stud shall withstand a minimum torque of 8.8 N·m when applied in a plane 90 degrees to the axis of the ball stud.

3.2.1.7.1.2.2 Prism ISRVMs with Mirror End Ball Studs that are Integrated into the Day/Night Toggle Mechanism. A torque shall be applied in a plane 90 degrees to the axis of the ball stud. The load shall be increasing, creating a torque about the centerline of the ball stud. Test to the point of destruction. The mirror shall meet the torque strength requirement by withstanding a minimum of 8.8 N·m applied torque.

3.2.1.7.2 Ball Stud Beaming Strength. The mirror base (channel mount) shall withstand a minimum force of 667.2 N (150 lb) applied in a direction 90 degrees to the centerline of the ball stud.

3.2.1.7.3 Ball Joint Tensile Strength. The force required to pull the mirror head pivot-ball bracket from the mirror foot pivot-ball bracket shall be a minimum of 625 N applied along the axis of the tube. After the load has been applied, check for separation and looseness of parts. The mirror head and foot (channel mount) pivot-ball torque requirements of 3.2.1.2 shall be satisfied up to destruction (i.e., up to a minimum load of 624 N).

3.2.1.7.3.1 Procedure. The pull force shall be applied at a rate of 38.1 mm/minimum between the mirror foot pivot-ball bracket and the mirror head

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March 2011

Page 8 of 38

pivot-ball bracket. Test to the point of destruction so that the pull-apart force is measured definitively. If the test is performed with a complete mirror assembly, the load on the rear of the housing shall be spread over a sufficient area to prevent damage to the housing.

3.2.1.7.4 Glass-to-Housing Pull-out. This requirement applies to only one-piece housing ISRVs. The mirror glass must be secure in the housing at +90°C, and the glass must not become detached from the housing when a pull of 50 N is applied.

3.2.1.7.5 Housing Static Bending.

3.2.1.7.5.1 Total change in angle of the interior mirror glass is maximum 0.45 degrees, when a force is applied 90 ± 1 degrees perpendicular to the outermost edge at the mirror housing producing a torque of ± 0.8 N·m around the ball.

3.2.1.7.5.2 The applied force shall act geometrical in the same position, on both sides of the mirror housing. When a force of +2 N and -2 N is applied on the outermost edge of the glass, a total maximum change in angle, of 0.04 degrees is allowed when mirror case is fixed.

3.2.1.7.6 Shipping Durability. The ISRV must meet the requirements of International Safe Transit Association (ISTA) Test Procedure 1A, Sequence Number 1 (Vibration).

3.2.1.7.7 Shock Load. First run the High Temperature Degradation test of 3.2.1.13.1, then on the same samples, perform the following procedure.

Apply an acceleration of magnitude 800 m/s² with nominal shock duration of 5 m/s. This acceleration shall be applied in both X directions and in both Y directions. All functions of the ISRV shall perform as designed during and after the test, and the ISRV shall be without any damage.

3.2.1.8 Attachment Strength to Windshield.

3.2.1.8.1 Relative Movement. No relative movement is allowed between the ISRV's channel mount and the windshield button, when a 4.5 N·m torque is applied to the channel mount.

3.2.1.8.2 Set Screw. The mirror support assembly (channel mount) shall withstand a set-screw torque of 2.5 N·m. Test to the point of destruction so that the maximum force is measured definitively.

3.2.1.9 Mirror Glass Minimum Reflectance. Must meet all applicable regulatory requirements as highlighted in 3.2.1.1 and in GMW16157.

The following requirements are dependent upon both the glare reduction technology and the reflective coating type utilized.

Any of the following procedures are permissible to measure mirror glass reflectance:

- ISO 5740, and/or SAE J964a.

3.2.1.9.1 ISRVs with No Glare Reduction. This requirement applies to ISRVs with only one level of reflectance.

3.2.1.9.1.1 Multi-Layered Silver-Based Coatings. The mirror glass reflectance shall be at least 70%.

3.2.1.9.1.2 Transflective Coating. This requirement applies to ISRVs with "Display on Demand" through-glass projected images. The mirror glass reflectance shall be at least 50%.

3.2.1.9.2 ISRVs with Prism Glare Reduction. This requirement applies to ISRVs with two levels of fixed reflectance.

3.2.1.9.2.1 Multi-Layered Silver-Based Coatings.

3.2.1.9.2.1.1 Day Setting. The mirror glass reflectance shall be at least 70%.

3.2.1.9.2.1.2 Night Setting. The mirror glass reflectance shall be at least 4%.

3.2.1.9.2.2 Transflective Coating. This requirement applies to ISRVs with "Display on Demand" through-glass projected images.

3.2.1.9.2.2.1 Day Setting. The mirror glass reflectance shall be at least 50%.

3.2.1.9.2.2.2 Night Setting. The mirror glass reflectance shall be at least 4%.

3.2.1.9.3 ISRVs with Auto-Dimming Glare Reduction. This requirement applies to ISRVs with variable reflectance, and is addressed in GMW16159.

3.2.1.10 Smell and Odor Resistance. The ISRV must perform to a minimum of Rating 6, when tested to the requirements of GMW3205, for Volume Code 5, and Dry Condition Code B.

3.2.1.11 Flammability. The ISRV must meet the requirements of GMW3232.

3.2.1.12 Material Related Part Performance.

3.2.1.12.1 All Interior Parts. The ISRV shall meet the requirements of GMW14444. Use installation position: 2, which assumes: "Position within vehicle is exposed to direct sunlight, this means below glass line. These parts are exposed to temperatures up to +95°C in the car." Also use customer usage codes: A (all parts in contact with customer hands), D (all parts in visible area), and E (all parts, which are in contact with refreshable air in the occupant compartment and the trunk).

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3.2.1.12.2 Interior Plastic Parts. The ISRVM shall meet the requirements of GMW14651. Use installation position: 2, which assumes: "Position within vehicle is exposed to direct sunlight, this means below glass line. These parts are exposed to temperatures up to +95°C in the car".

3.2.1.13 Environmental Exposure. The majority of these tests follow the "Climatic" and "Enclosure" requirements sections of GMW3172. Perform the tests, and meet the performance criteria, per GMW3172.

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.

3.2.1.13.1 High Temperature Degradation. Perform the High Temperature Degradation test and meet the performance criteria per GMW3172. This test shall be the "preconditioning" prior to running the Shock Load test of 3.2.1.7.7.

3.2.1.13.2 Thermal Shock Air-to-Air (TS). This is the first of two tests that must be run back-to-back. It is to be followed immediately by the Power Temperature Cycle (PTC) test of 3.2.1.13.3.

Perform the thermal shock (TS) test and meet the performance criteria per GMW3172, with the following procedure deviations:

- No. Cycles = 10
- Cycle Time = 60 minutes
- Sample Size = 6

Post-test, the ISRVM's Functional Status Classification shall be A.

3.2.1.13.3 Power Temperature Cycle (PTC). This test is to immediately follow the TS test of 3.2.1.13.2 (same samples are first tested per 3.2.1.13.2 then per 3.2.1.13.3). This test must follow the TS Test because this test will detect problems that may have been generated during the TS Test. Do not separate PTC from TS or run them in reverse order.

Perform the PTC test and meet the performance criteria per GMW3172, with the following procedure deviations:

- No. Cycles = 10
- Cycle Time = 60 minutes
- Sample Size = 6

Post-test, the ISRVM's Functional Status Classification shall be A.

3.2.1.13.4 Thermal Shock/Water Splash. This test is not required of ISRVMs because of their low probability of being splashed by water when operating hot.

3.2.1.13.5 Humid Heat Cyclic (HHC). Perform the HHC test and meet the performance criteria per GMW3172.

3.2.1.13.6 Humid Heat Constant (HHCO). Perform the HHCO test and meet the performance criteria per GMW3172.

3.2.1.13.7 Salt Mist. Perform the salt mist test and meet the performance criteria per GMW3172. The following material degradation test condition option shall be applied: "Operating Type 2.1, 6 cycles. Each cycle equals 8 h salt, 16 h humidity." Total test time is 144 h.

3.2.1.13.8 Salt Spray. This test is not required of ISRVMs because it is instead intended for all non-interior components located on the vehicle.

3.2.1.13.9 Dust. Perform the dust test and meet the performance criteria per GMW3172. Apply the parameters of the International Protection (IP) dust code: 5K. (The IP dust code is part of the ISRVM's GMW3172 code letter sequence: "C C C E A IP5K2", as referenced in 3.2.1.13.)

3.2.1.13.10 Water. Perform the water test and meet the performance criteria per GMW3172. Apply the parameters of the International Protection (IP) water code: 2. (The IP water code is part of the ISRVM's GMW3172 code letter sequence: "C C C E A IP5K2", as referenced in 3.2.1.13.)

3.2.1.13.11 Seal. This test is not required of ISRVMs because it is instead intended for sealed electrical devices to evaluate the effectiveness of their seals.

3.2.1.13.12 Water Freeze. This test is not required of ISRVMs because it is instead intended for all components that may allow water pooling on housings or mechanical linkages, with the exclusion of components located in the passenger compartment.

3.2.1.13.13 Sugar Water Function Impairment (SWFI). The SWFI test is intended to identify the component's immunity to spilled beverages containing dissolved sugar, where there are moving knobs or sliders such that the drying of the sugar solution may result in sticking or poor feel.

The SWFI requirement in this standard only applies to the twist knob Day-Night actuation mechanism of Prism ISRVMs (if present).

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While it is theoretically possible for a beverage container to discharge its contents and splash the pivot ball joints of the ISRVM, it is not felt that this will degrade adjustment or deflection performance of the ISRVM to any level of customer noticeability. ISRVMs with push buttons will have this SWFI requirement addressed in another standard.

Perform the SWFI test and meet the performance criteria per GMW3172. In addition, any degradation in operational forces or torque shall still meet the requirements in 3.2.1.14.2.1.1, and in 3.2.1.14.2.2.1.

3.2.1.13.14 UV Light Exposure. Perform the test according to Method D of GMW14162 applying 601.6 kJ/m². Exposed samples must not show any surface deterioration, staining, objectionable color or gloss change, or any other undesirable effect.

If the sample geometry allows, after exposure the color change (delta E) reading shall be taken and must be no greater than 3. Measure the sample in the same area before and after exposure. Any visual color change which is considered objectionable by GM Engineering can override the delta E value, and require design changes to meet this requirement.

3.2.1.14 Additional Prism Mirror Requirements. Refer to GM Global Best Practice ISRVM-14 for supplemental background information and the theory behind using prism glass for glare reduction.

3.2.1.14.1 General Operation. The Prism ISRVM shall have two fixed settings: "Day" and "Night".

3.2.1.14.1.1 Glare Reduction Strategy. In addition to the two different reflectance values per 3.2.1.9.2, the Prism ISRVM shall reduce glare by reflecting the glare up into the vehicle's header/roof liner while in the "Night" mode.

3.2.1.14.1.2 Consistent Field of View (FOV). The ISRVM's FOV shall not require readjustment when toggled back and forth between the "Day" and the "Night" settings.

3.2.1.14.2 Day/Night Adjustment; Effort/Feel. For more details reference GM Global Best Practice ISRVM-52.

3.2.1.14.2.1 Objective. Measure the perpendicular force at the end of the rotating toggle or flip tab. Operating effort (N·m) is the highest force value (N) recorded during the test multiplied by the length (m) from the load's application point to the pivot axis of the toggle or if the flip tab mechanism.

3.2.1.14.2.1.1 Rotating Toggle Adjustment Effort. Effort shall be within 0.13 N·m and 0.35 N·m.

3.2.1.14.2.1.2 Flip Tab Adjustment Effort. Effort shall be within 5.0 N and 19.0 N.

3.2.1.14.2.1.3 Robustness to Unintended Activation. This requirement applies to both rotating toggle and flip tab designs. The prism mechanism must remain at rest in its day and/or night position, with minimal initial movement, when a force up to 25% of its adjustment effort, as measured by 3.2.1.14.2.1.1 or 3.2.1.14.2.1.2, is applied to its rotating toggle or flip tab, respectively.

3.2.1.14.2.2 Subjective.

3.2.1.14.2.2.1 Rotating Toggle. The day/night adjustment effort/feel shall be evaluated by activating the rotating toggle (typically a flat blade "twist knob", but may also be round/barrel style) with the thumb and index (first) finger.

The toggle should distinctly travel between the day night positions and should not require force to be applied during the entire adjustment travel path (i.e., should not want to stop at any point midway between "day" and "night" positions).

Toggle activation should not feel "mushy", but instead should be "crisp", yet not a hard "snap".

The force required to initiate movement should feel moderate; if too light then the customer may experience unintended activation; if too heavy then the customer may feel that they have to "work too hard" to activate and that toggling the prism is perceived to be "unpleasant".

3.2.1.14.2.2.2 Flip Tab. The day-to-night adjustment effort/feel shall be evaluated by flipping the tab towards the driver by the index finger.

Note: It is not necessary to rest the thumb on the bottom of the bezel/housing, but if the thumb is engaged, be careful not to accidentally activate a telematics button (if present) in the "chin" area.

The night-to-day adjustment effort/feel shall be evaluated by flipping the tab away from the driver with the thumb. (Typically, night-to-day adjustment does not have any additional hand contact to the ISRVM.)

The flip tab should distinctly travel between the day night positions and should not require force to be applied during the entire adjustment travel path (i.e., should not want to stop at any point midway between "day" and "night" positions).

Flip tab activation should not feel "mushy", but instead should be "crisp", yet not a hard "snap".

The force required to initiate movement should feel moderate; if too light then the customer may experience unintended activation; if too heavy then

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March 2011

Page 11 of 38



Documents

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the customer may feel that they have to “work too hard” to activate and that toggling the prism is perceived to be “unpleasant”.

3.2.1.14.3 Operating Sound.

3.2.1.14.3.1 Subjective.

3.2.1.14.3.1.1 Rotating Toggle. The day/night operating sound shall be evaluated by activating the rotating toggle (typically a flat blade “twist knob”, but may also be round/barrel style) with the thumb and index (first) finger.

While ISRVMs are not listed as a specific test, the guidelines, setup and procedure for manually operated components in GMW14233 shall be followed.

The sound during prism “day” to “night” activation shall have a low frequency, be sophisticated and distinct when operating. Squeaking, spring noises, and/or scratching are not allowed during activation. Overall, the noise shall be minimal.

3.2.1.14.3.1.2 Flip Tab. The day-to-night operating sound shall be evaluated by flipping the tab towards the driver by the index finger. Note that it is not necessary to rest the thumb on the bottom of the bezel/housing, but if the thumb is engaged, be careful not to accidentally activate a telematics button (if present) in the “chin” area.

While ISRVMs are not listed as a specific test, the guidelines, setup and procedure for manually operated components in GMW14233 shall be followed.

The sound during prism “day” to “night” activation shall have a low frequency, be sophisticated and distinct when operating. Squeaking, spring noises, and/or scratching are not allowed during activation. Overall, the noise shall be minimal, and while day-night activation should be “crisp”, there should not be any loud “snap”.

3.2.1.14.4 Prism Actuation Durability. Perform the test per 3.2.1.14.3.1. During and after the test, the ISRVMs shall not make any objectionable noise while moving between day-night settings or show any sudden jerking and functional problems. Within 1 h after the test, the hand-set adjust effort and toggle/flip tab effort requirements shall be met.

3.2.1.14.4.1 Procedure.

3.2.1.14.4.1.1 Definition of One (1) Cycle. One cycle shall consist of moving the rotating toggle/flip tab from the day position to the night position and return to the day position.

3.2.1.14.4.1.2 Perform 5 000 full cycles at room temperature, at a rate of 5 to 10 cycles per minute.

3.2.1.14.5 Prism Angles.

3.2.1.14.5.1 Standard Angle. The prism wedge angle shall be between 3 degrees 10 minutes and 3 degrees 20 minutes. The wedge angle of the prism glass subassembly can be verified by either of the following methods.

3.2.1.14.5.1.1 Prism Glass Subcomponent. The prism wedge angle can be verified by physically measuring the angle between its first and second surfaces (planes).

Note: It is recommended that this measurement method is applied to the prism glass subcomponent prior to applying the anti-shatter coating to the backside (second surface) so that the thickness and variation of this anti-shatter coating does not affect the wedge angle measurement's accuracy.

3.2.1.14.5.1.2 ISRVM Assembly. Using either a projector or a laser beam, project a beam into the glass so that it reflects against a screen. The angle formed by the upper and lower beams is twice the wedge angle (i.e., the wedge angle is the measurement between the central plane and either the upper beam or the lower beam).

3.2.1.14.5.2 “Truck” High Angle. This option is no longer part of our strategy. For more details reference GM Global Best Practice ISRVM-14.

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 Sample Selection. The sample selection procedure is to conform to GMW15760.

3.2.4 Serviceability. The ISRVM shall meet the serviceability requirements of GMW16157.

3.2.5 User System/Subsystem/Component/Part Interface.

3.2.5.1 Human Vehicle Integration. The ISRVM shall be designed to meet all Human Vehicle Integration (HVI) requirements and criteria.

3.2.5.1.1 Double Pivot Assembly. ISRVM shall have a “double-pivot” mounting system per GM Human Factors Design Objectives: Inside Rear

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March 2011

Page 12 of 38



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