



Shipping Validation

1 Scope

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. To ensure damage free vehicle delivery worldwide by subjecting passenger cars, light duty trucks, vans, sport utility vehicles (SUV), and crossover vehicles to haulaway truck (car carrier), railcar, and Roll-on Roll-off (Ro-Ro) ship environments. This includes consideration of the static and dynamic shipping environments, restraint system compatibility and clearance, as well as conveyance equipment compatibility and clearance.

1.2 Foreword. All vehicles are shipped from the final assembly plant to a retail dealership by haulaway truck or a combination of railcar and haulaway truck. Export and import vehicles are also transported by Ro-Ro ships.

A vehicle's service life may be affected by exposure to the shipping environment. For global shipping validation, damage free haulaway truck, railcar, and Ro-Ro ship transportation must be verified. The global homerooms must recognize the shipping methods and limitations in all regions where the vehicle will be shipped. This will require working with the affected regional logistic groups.

Shipping validation methods include field testing using representative equipment, laboratory simulation testing, and simulation using Computer Aided Engineering (CAE) or Unigraphics (UG) models.

Observed shipping issues that can be tested using UG include, but are not limited to: restraint system clearance, underbody clearance to conveyance decking, body clearance to conveyance (including mirrors, antenna, etc.), powertrain and exhaust clearance. Both static and dynamic clearances are evaluated on a pass-fail basis for various restraint systems and conveyance equipment. Worst case restraint system application and worst case vehicle configuration (see 4.1.1) are considered.

Observed shipping issues that can be tested using CAE include, but are not limited to: ocean body bracket strength, suspension loads and displacements, powertrain loads and displacements.

UG and CAE methods do not effectively analyze the following shipping issues: fluid spills, fastener torque, cosmetic damage, shock leaking, body panel fit/operation, etc.

Laboratory and field testing should also be considered to offset any limitations of the CAE and UG methods. The physical testing may also be required when analysis results show only marginal conformance to damage free shipment.

1.3 Applicability. This procedure is applicable to passenger cars, light duty trucks, vans, SUV, and crossover vehicles worldwide.

2 References

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

2.1 External Standards/Specifications.

None

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2.2 GM Standards/Specifications.

GMW14048 (ID)

GMW14289

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2.3 Additional References.

- CAE Procedure No. 60-02-063.
- GMNA Design Guidelines Best Practices (located in E2KS system, Shipping and Serviceability Community of Practice (CoP)).
- GMNA Shipping Manual (located in GM SupplyPower document library under outbound vehicle logistics).
- Vehicle Technical Specification (VTS) 3.2.1.7.6.2 Vehicle Shipping Structural Durability.

3 Resources

3.1 Facilities. The GMNA shipping simulators are the only full vehicle simulators available in General Motors. Testing on these simulators is available, if required, to all regions.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment. None required on the test vehicle.

Representative conveyances and restraint systems are provided by carriers for field testing.

3.3 Test Vehicle/Test Piece. Test vehicle equipped as specified.

3.4 Test Time. See Appendices A through C.

3.5 Test Required Information. Refer to the list of references in 2.3.

Note: The supplier shall work with the GM Design Responsible Engineer to comprehend these requirements.

3.6 Personnel/Skills. This validation is intended to be performed by personnel specifically trained to do the field testing, laboratory simulation testing, and/or analysis.

See Section 6 Safety for more information.

4 Procedure

4.1 Preparation.

4.1.1 Test Request. All new vehicles must be validated for the modes of shipping that a retail customer's vehicle would be expected to experience. Vehicles receiving mid-cycle enhancements or updated trim packages should also be reviewed and evaluated.

For restraint system and conveyance compatibility validation, the most restrictive vehicle model should be chosen. Items to consider include, but are not limited to:

- Approach, departure, and break over angle.
- Overall vehicle dimensions or profile.
- Fascias, rockers, air dams, and ground effects.
- Outside mirrors.
- Non-removable antenna.
- Luggage racks (if plant installed).
- Trailer hitches (if plant installed).
- Suspension system, including shock type.
- Vehicle and powertrain mass.
- Tires, wheels, and wheel well liners.

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- Exhaust systems.
- Underbody structures and hardware.
- Tie down points (if applicable), including clearance.

4.1.2 Vehicle Preparation. For validation procedures that require a vehicle, ensure it is test ready. This includes, but is not limited to:

- Pre-test inspection and documentation of the vehicle.
- Trim heights are at the low end of the specification for underbody clearance testing, or at the high end of the specification for roof clearance testing.
- Vehicle is the most restrictive model.
- Verification that all body and underbody components are design/build intent and are correctly installed.
- Vehicle tie down attachment points (if applicable) are representative and in “new” condition.
- Vehicle is at shipping weight.
- All fluids are at the level specified by the final assembly plant.
- Fuel level does not exceed $\frac{1}{4}$ tank. (Note that the “as-shipped” fuel level is ideal.)
- All fasteners are torqued to the correct values and a paint dot has been applied to all critical fasteners.
- Vehicle has been washed and the underbody is free of dirt and debris.
- Tire pressure is representative of assembly plant value.
- Vehicle is fully operational including the parking brake mechanism, mirrors, and driver side window.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

All testing shall comply with local shipping practices. This includes the parking brake being fully applied and the automatic transmission being placed in Park (1st gear for manual transmissions).

4.3 Instructions. There are three types of conveyances to validate for: haulaway truck (car carrier), railcar, and Roll-on Roll-off (Ro-Ro) ship. See Tables A1 through C1 in Appendices A through C respectively for validation options for each conveyance.

4.3.1 Haulaway Truck (Car Carrier). Vehicles must be able to sustain the haulaway truck dynamic environment. Vehicle ride is influenced by the type of haulaway truck, the vehicle location on the haulaway truck, the load factor, the road input, and the type of restraint system.

4.3.1.1 The global direction is to restrain vehicles by soft tie (strap over tire) for vehicle restraint. Currently, Western Europe and China use a wheel chock in addition to the soft tie strap which must be considered as it may reduce body clearances. Consideration of regional restraint systems and their limitations will ensure vehicle compatibility and damage-free delivery. Contact regional logistics groups for information regarding current restraint capabilities.

4.3.1.2 Each GM region uses unique haulaway trucks providing unique vehicle underbody and body clearances. Vehicle shipping validation requires consideration of all types of conveyances.

4.3.1.3 Vehicles may be driven onto or backed onto haulaway trucks. Vehicles may be inclined, front up or front down, up to 17 degrees during transport.

4.3.2 Railcar. During railcar shipment, vehicles must be able to sustain the North American dynamic environment which is known to be the most severe globally due to aged tracks, railcar-to-railcar coupling impacts (humps), and the slack action present in the couplers during railcar acceleration and braking. Because of the cost advantage over haulaway truck shipment, North America relies heavily on railcar transport, shipping about 70% of their vehicles by this method. In contrast, other regions ship 30% or less by railcar.

4.3.2.1 The railcar restraint systems differ from those used on haulaway trucks. All regions use unique chock type designs that must be evaluated for vehicle clearance. Several types of restraints may also be used in each region. For example, in North America unique restraint systems were developed for tri level railcars and

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