GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW14853

Non-Metallic Fuel Tank, Minus 40 °C, Six (6) Meter Drop Test or 4000 Joule Energy Impact

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 evaluate the drop test capabilities of non-metallic fuel tanks.

1.2 Foreword. This procedure is used by tank suppliers to develop tank designs and for quality control during production. It is included as part of the following specification listed on the part drawing (related to performance):

- GM Engineering Standard GMW3086, Plastic Fuel Tank

1.2.1 This procedure specifies two methods that may be used:

1.2.1.1 Long Method: This method takes a tank with a 60/40 glycol/water mixture inside (both at ambient temperature) and cools them together in a cold chamber to -40 °C ± 2 °C (-40 °F ± 4 °F). This method would be used if resources were not available to pre-cool the glycol/water mixture (i.e., larger chamber, separate chamber for pre-cooled glycol/water mixture and energy required to sustain pre-cooled glycol/water mixture).

1.2.1.2 Short Method: This method takes a tank (at ambient temperature) and cools it to -40 °C ± 2 °C (-40 °F ± 4 °F). Then a glycol/water mixture pre-cooled to -40 °C ± 2 °C (-40 °F ± 4 °F) is added. The time it takes to cool the tank is much less than that required to cool the glycol/water mixture, thus saving time. This method, however, requires resources to pre-cool the glycol/water mixture (i.e., larger chamber, extra chamber to cool glycol/water mixture, dedicated test chamber and energy required to sustain pre-cooled glycol/water mixture). An advantage of the short method when used in quality control, is that if a test sample tank does not meet the requirement, then a fewer number of tanks will have been produced since the last test. This will result in less scrap.

1.3 Applicability. Non-metallic fuel tanks.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3086 GMW14508

3 Resources

3.1 Facilities. Non-metallic fuel tank supplier facilities with a smooth, hard impact surface such as cement or steel. Facilities must be approved by GM.

3.2 Equipment.

3.2.1 Fixture/clamp/strap to hold tank to drop equipment and capable of withstanding the applied internal hydrostatic pressure upon impact.

3.2.2 Cold chamber capable of stabilizing fuel tank and glycol/water to -40 °C ± 2 °C (-40 °F ± 4 °F) within the specified time.

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3.2.3 Equipment to hoist and release the lowest point of fuel tank to and from 6 m (20 ft) without disrupting the tank orientation or to a height that is equivalent to a 4000 J impact energy.

3.2.4 Container/drum capable of holding calculated volume of the cold chamber.

Note: All instrumentation is to be calibrated as required; record instrumentation details and date of calibration on Data Sheet A1 (Appendix A), unless the information is otherwise preserved in the testing laboratory records.

3.3 Test Vehicle/Test Piece. The fuel System under test shall include the fuel tank shell, encapsulated ring or rings and internal weldments. Inlet Check Valve (ICV) and fill spuds are not required.

3.4 Test Time.

Calendar time:	1 to 2 days
Test hours:	1 hour
Coordination hours:	4 hours

3.5 Test Required Information.

3.5.1 The GM release engineer shall provide the supplier with the Total Fuel Capacity of the tank (to be used to calculate the amount of glycol/water mixture to be added to test tank).

3.5.2 The GM release engineer shall determine if the tank shall be impacted at other locations other than the standard locations specified in this procedure. The standard locations are: all sides except top as a minimum.

3.5.3 Cool Down Time.

3.5.3.1 Long Method: The supplier may want to determine the time required to stabilize a tank with a 60/40 glycol/water mixture inside (both at ambient temperature) and cool them together in the actual cold chamber that will be used for test. The temperature is measured in the center of the glycol/water mixture in the fuel tank. This cool down time can then be used for future tests. Alternately, the supplier may measure temperature during each test.

3.5.3.2 Short Method: Initially, the supplier must determine the time required to cool a tank's pinch area to -40 °C ± 2 °C (-40 °F ± 4 °F). The pinch area shall be thermocoupled at the center of the thickest area of a tank (typically, this is at a pinch area) using the actual cold chamber to be used for tests. This cool down time shall then be used for future tests.

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation.

4.1.1 Apply adequate clamping/fixture/straps to the fuel tank.

4.1.2 Calculate the amount of 60/40 mixture of glycol and water needed to achieve equivalent weight for the Total Fuel Capacity of the tank, see 7.1 Glossary.

See calculation in 5.1 for specific gravity and equations. On a tank for gasoline only, use the specific gravity (SPG) for gasoline (0.71). On a tank of diesel only use the SPG for diesel (0.88).

4.1.3 Methods.

4.1.3.1 Long Method.

4.1.3.1.1 Fill tank with the calculated amount of the 60/40 glycol and water mixture.

4.1.3.1.2 Place filled tank inside cold chamber and stabilize tank and fluid to -40 °C ± 2 °C (-40 °F ± 4 °F). The temperature is measured in the glycol/water mixture at the center of the fluid in the fuel tank. Use predetermined time from Section 3.5 if available.

4.1.3.2 Short Method.

4.1.3.2.1 Place 60/40 glycol/water mixture in a container/drum in the cold chamber.

4.1.3.2.2 Stabilize the glycol/water mixture in the container/drum to -40 °C ± 2 °C (-40 °F ± 4 °F).

4.1.3.2.3 Place empty fuel tank in cold chamber for the time determined in Section 3.5 as that required to cool a tank's thickest area to -40 °C ± 2 °C (-40 °F ± 4 °F).

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