



ISO/TC 197  
Hydrogen technologies

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**Preliminary DRAFT TR 16113 - MH applications not covered by ISO 16111**

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Background: Here is a preliminary draft for TR 16113 prepared by WG 25.

This document is being circulated for information and consideration. This document will be discussed under agenda item 7.4 at the TC 197 plenary meeting in December, in order to know what countries are interested in the preparation of this draft. The comment form will be circulated as document N 897, especially for those who will not be attending the plenary, who would like to submit comments.

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**Preliminary Draft  
WG 25  
2017-11-09**

**Technical Report**

**DESIGN AND TEST OF MH ASSEMBLIES  
NOT COVERED BY ISO 16111\***

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## **1. Introduction/Scope**

ISO 16111\* is devoted to transportable metal hydride tanks with a limited volume and for limited types of applications. However, the use of Metal Hydride (MH) assemblies are more and more considered for applications not covered by the scope of ISO 16111\*.

Nevertheless the design and testing method of MH assembly for applications not covered by this scope appear consistent to those proposed by ISO 16111\*, but require some complementary rules or adaptations of the design and testing methods. This technical report is a guideline for this adaptation, for three main applications related to the ISO 16111\*:

- shells having an internal volume greater than 150 l,
- fixed fuel-storage onboard hydrogen fueled vehicles, and
- stationary applications.

## 2. References

ISO 16111\*, *Transportable gas storage devices –hydrogen absorbed in reversible metal hydride*

ISO 11120, *Gas cylinders Refillable seamless steel tubes of water capacity between 150 l and 3000 l --Design, construction and testing*

## 3. Shells having an internal volume greater than 150 l

In the absence of an ISO Standard dedicated to hydride systems with internal volumes higher than 150 l and lower than 3000 l having MDP (maximum development pressure) lower than 250 bars, the ISO 16111\* can be used as a guideline.

In such cases, requirements of ISO 16111\* may need to be modified to account for the size, geometry and/or application of larger systems.

Due to their relatively large mass and size, MH assembly having volume greater than 150 l are generally considered to be transportable only by fixing them to a moveable structure such as a trailer or hand truck. As such, when using ISO 16111\* for guidance, users should take into account the means of transport and the environment the storage system will be subjected to.

In addition to those listed in clause 5.3 of ISO 16111\*, the MH assembly shell may also be designed and tested in accordance with ISO 11120.

MH Assemblies having volume greater than 150 l can be designed for different operating regimes than those envisioned in the scope of ISO 16111\*. Therefore, in agreement with authorities having jurisdiction of the country of use, the manufacturer may use engineering judgment and calculations to modify the testing regime as required to demonstrate that a design meets the intent of ISO 16111\*. In cases where physical testing proposed in ISO 16111\* is not feasible due to size, geometry or safety considerations, modeling may be used as an alternative means of demonstrating the ability to meet a given requirement.

#### **4. Fixed fuel-storage onboard hydrogen fueled vehicles**

In the absence of an ISO Standard dedicated to MH assemblies intended to be used for fixed fuel-storage onboard hydrogen fueled vehicles having MDP lower than 250 bars, ISO 16111\* can be used as a guideline.

In such cases, requirements of ISO 16111\* may need to be modified to account for the conditions of use

Due to their use, MH assemblies onboard hydrogen fueled vehicles are generally considered to be transportable only by fixing them to the vehicle structures such as for a car, truck, train, boat, etc. As such, when using ISO 16111\* for guidance, users should take into account the means of transport and the environment the storage system will be subjected to.

The normal operating temperature should be included in the service condition temperature range. The service temperature range should be at the least -40 °C to +85 °C.

In addition to the testing method of ISO 16111\*, the manufacturer may also test the shell in accordance to the national regulation of the country of use related to onboard hydrogen fueled vehicles.

MH Assemblies used for fixed fuel-storage onboard hydrogen fueled vehicles may be designed for different operating regimes than those envisioned in the scope of ISO 16111\*. Therefore, in agreement with authorities having jurisdiction of the country of use, the manufacturer may use engineering judgment and calculations to modify the testing regime as required to demonstrate that a design meets the intent of ISO 16111\*. In cases where physical testing is not feasible due to size, geometry or safety considerations, modeling may be used as an alternative means of demonstrating the ability to meet a given requirement.

\*Revision of ISO 16111:2008 is under development with publication planned for 2018

## 5. Stationary application

In the absence of an ISO Standard dedicated to hydride systems for stationary application (i.e. hydride systems that are not used to transport hydrogen itself, that means hydrogen systems that are used to store and release hydrogen once installed and integrated in a stationary hydrogen chain, without being moved during or in-between these operations), the ISO 16111\* can be used as a guideline.

In such cases, requirements of the ISO 16111\* may need to be modified to account for the size, geometry and/or application of larger systems.

In addition to clause 5.3.1 of ISO 16111\*, when volume is higher of 150 l the MH assembly shell may also be designed and tested in accordance with ISO 11120.

Some of the requirements of ISO 16111\* are not mandatory for stationary applications:

- Concerning the drop test (clause 6.2.4.3 of ISO 16111\*), there is no need to perform this kind of test. If the MH assembly is dropped during handling or transportation, it should not be used and should be returned to the manufacturer for requalification/recertification.
- It is not necessary for the MH assembly to be tested (clause 6.2.6 of ISO 16111\*) in configurations/orientations other than the position it will occupy during its stationary use.
- It is not necessary to perform the shut-off valve impact test (clause 6.2.7 of ISO 16111\*), as long as the shut-off valve is well protected against external impact, during transportation and operation of the MH assembly.

During transportation before installation, the free hydrogen gas should be removed from the MH assembly and replaced with an inert gas such as argon.

MH assemblies for stationary applications may be designed for different operating regimes than those envisioned in the scope of ISO 16111\*. Therefore, in agreement with authorities having jurisdiction of the country of use, the manufacturer may use engineering judgment and calculations to modify the testing regime as required to demonstrate that design meets the intent of ISO 16111\*. In cases where physical testing is not feasible due to size, geometry or safety considerations, modeling may be used as an alternative means of demonstrating ability to meet a given requirement

\*Revision of ISO 16111:2008 is under development with publication planned for 2018