TECHNICAL BULLETIN

Prepared by WG-2 TB 16/20 – February 2020

"-40°C" Mark on Cylinders/Valves

In some countries in the Nordic region there is a legal requirement to mark pressure receptacles with "- 40°C" to show they are not brittle at low temperatures. This includes receptacles according to RID/ADR. The requirement existed before the TPED was introduced. There are detail differences in the Finnish and the Swedish regulations.

The requirements today:

Cylinders:

In Finland all cylinders shall be marked with "-40°C".

In Sweden all seamless steel cylinders shall be marked with "-40°C".

Valves: There is no requirement to mark valves and other accessories with "-40°C" even if the regulations say that they shall resist temperatures down to -40°C.

In the Finnish regulation it states: (Section 25 (250/2005)) Tanks belonging to transportable pressure equipment

(2) With the exception of the transport of dangerous goods referred to in section 1(2), the material of a tank and its accessories belonging to transportable pressure equipment used in the transport shall be resistant to brittle fracture down to "-40°C".

(3) With regard to the durability of the material referred to in subsection 2, the tank shall bear the mark of "-40°C" after the conformity mark referred to in section 6(1) of the Government Decree on the Indication of Conformity of Packaging's and Tanks Used in the Transport of Dangerous Goods, and the identification number of the inspection body or another mark approved by the Safety Technology Authority.

In the Swedish regulation it states: (MSBFS 2012:6 / ADR-S 2013)

6.2.1.2 Materials

6.2.1.2.2 Pressure receptacles and their closures shall be manufactured from materials that are listed in the technical standards for construction and manufacturing. The materials shall also be listed in the applicable packing instruction as suitable for the substances that are intended to be transported. Materials shall not be indicated as sensitive to embrittlement or stress corrosion in the technical standards for construction and manufacturing.

6.2.1.3 Service equipment

6.2.1.3.1 Valves, piping and other devices subjected to pressure, with the exception of pressure relief devices, shall be constructed and manufactured so that the burst pressure corresponds to at least 1,5 times the test pressure of the pressure receptacle.

MSBFS 2012:6 (ADR-S 2013) 19.2:

19.2 Construction

Seamless steel cylinders, that are to be assessed or reassessed according the governments regulation SRVFS 2005:3, transportable pressure equipment, or its successor, shall be constructed in appropriate materials that are not sensitive to brittle fracture at temperatures between -40 °C and +50 °C.

***EUROPEAN INDUSTRIAL GASES ASSOCIATION** AISBL*
AVENUE DES ARTS 3 – 5 ♦ B-1210 BRUSSELS
PHONE +32 2 217 70 98 ♦ FAX + 32 2 219 85 14 ♦ E-mail : info@eiga.eu - www.eiga.eu

Swedish TPED:

Marking with “-40 °C”

11 § A seamless steel cylinder according to 1 kap. 2 a § or 2 c § that will be used for national transportation of dangerous goods in Sweden and at time of assessment or reassessment has been verified to have been manufactured from a steel that is not inclined to brittle fracture between -40 °C and +50 °C according to chapter 19.2 i ADR-S and RID-S, shall be marked”-40 °C”.

12 § A seamless steel cylinder according to 1 kap. 2 b § that has conformed to directive 84/525/EEG and will be used for national transportation of dangerous goods in Sweden, and that at the time of the first re-test according to ADR-S and RID-S has been verified to have been manufactured from a steel that is not inclined to brittle fracture between -40 °C and +50 °C according to chapter 19.2 i ADR-S and RID-S, shall be marked”-40 °C”. MSBFS 2011:3

13 § A seamless steel cylinder that has been verified before the 1 July 2005 to fulfil the material demand in chapter 19.2 in ADR-S and RID-S, but that has not yet been marked with ”-40 °C”, shall, at the latest at the next re-test that is made according to this constitution, be marked ”-40 °C”.

Characteristics of steels used for cylinders

Charpy V tests have been used for many years to check that steel cylinders are not brittle at low temperatures. The latest designs of gas cylinders to ISO9809-1 and -2, use the enhanced material properties of modern steels to allow a reduction in mass and higher working pressures. These modern steels have a high level of fracture toughness and this brings with it an inherently high Charpy V impact value.

However all heat treated seamless steel cylinders of whatever age are resistant to operational loads and stresses. The steels used in older cylinders, especially normalized steel, sometimes have Charpy V values at 0°C which do not meet the requirements of current EN/ISO standards. They can however safely be used at temperatures well below the “transition temperature” of the steel from which they are made. They have been used for many years in climates such as those encountered in Alaska, Canada, Sweden, Finland and Russia. No incidents involving failure of these cylinders due to the cold environment are known to the industry.

Recommendations

- Aluminium alloy cylinders are not sensitive to low temperatures (cold embrittlement) and should not have to bear the”-40 °C” mark.
- EN/ISO standards for seamless steel cylinders require good Charpy V values at -50 °C and the cylinders shall be stamped with the manufacturing standard. Therefore they should not require the “-40 °C” mark.
- Older seamless steel cylinders manufactured according to national standards that do not pass the Charpy test at “-50 °C” requirement have been proven safe through long term use. Mechanical impact tests carried out on cylinders show that such cylinders, with low Charpy values, are not sensitive to failure due to cold embrittlement. Therefore it should not actually be necessary to mark these cylinders with “-40 °C”. Cylinders already marked with “-40 °C” would, of course, retain the mark.

Consequently the recommendation of EIGA is that the “-40°C” mark is not necessary.

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