Chapter 6.7

Provisions for the design, construction, inspection and testing of portable tanks *

Note The provisions of this chapter also apply to road tank vehicles to the extent indicated in chapter 6.8.

6.7.1 Application and general provisions

6.7.1.1 The provisions of this chapter apply to portable tanks intended for the transport of dangerous goods of classes 2 to 9, by all modes of transport. In addition to the provisions of this chapter, unless otherwise specified, the applicable provisions of the International Convention for Safe Containers (CSC) 1972, as amended, should be fulfilled by any multimodal portable tank which meets the definition of a "container" within the terms of that Convention. Additional provisions may apply to offshore portable tanks that are handled in open seas.

6.7.1.1.1 The International Convention for Safe Containers does not apply to offshore tank-containers that are handled in open seas. The design and testing of offshore tank-containers should take into account the dynamic lifting and impact forces that may occur when a tank is handled in open seas in adverse weather and sea conditions. The provisions for such tanks should be determined by the approving competent authority (see also MSC/Circ. 860 "Guidelines for the approval of offshore containers handled in open seas").

6.7.1.2 In recognition of scientific and technological advances, the technical provisions of this chapter may be varied by alternative arrangements. These alternative arrangements should offer a level of safety not less than that given by the provisions of this chapter with respect to the compatibility with substances transported and the ability of the portable tank to withstand impact, loading and fire conditions. For international transport, alternative arrangement portable tanks should be approved by the applicable competent authorities.

6.7.1.3 When a substance is not assigned a portable tank instruction (T1 to T75) in the Dangerous Goods List in chapter 3.2, interim approval for transport may be issued by the competent authority of the country of origin. The approval should be included in the documentation of the consignment and contain, as a minimum, the information normally provided in the portable tank instructions and the conditions under which the substance should be transported. Appropriate measures should be initiated by the competent authority to include the assignment in the Dangerous Goods List.

6.7.2 Provisions for the design, construction, inspection and testing of portable tanks intended for the transport of substances of classes 3 to 9

6.7.2.1 Definitions

For the purposes of this section:

Portable tank means a multimodal tank having a capacity of more than 450 ℓ used for the transport of substances of classes 3 to 9. The portable tank includes a shell fitted with service equipment and structural equipment necessary for the transport of dangerous substances. The portable tank should be capable of being filled and discharged without the removal of its structural equipment. It should possess stabilizing members external to the shell, and should be capable of being lifted when full. It should be designed primarily to be lifted onto a transport vehicle or ship and should be equipped with skids, mountings or accessories to facilitate mechanical handling. Road tank-vehicles, rail tank-wagons, non-metallic tanks and intermediate bulk containers (IBCs) are not considered to fall within the definition for portable tanks;

Shell means the part of the portable tank which retains the substance intended for transport (tank proper), including openings and their closures, but does not include service equipment or external structural equipment;

* Provisions for road tank vehicles are covered in chapter 6.8.

Service equipment means measuring instruments and filling, discharge, venting, safety, heating, cooling and insulating devices;

Structural equipment means the reinforcing, fastening, protective and stabilizing members external to the shell;

Maximum allowable working pressure (MAWP) means a pressure that should be not less than the highest of the following pressures measured at the top of the shell while in operating position:

.1 the maximum effective gauge pressure allowed in the shell during filling or discharge; or

.2 the maximum effective gauge pressure to which the shell is designed, which should be not less than the sum of:

  .1 the absolute vapour pressure (in bar) of the substance at 65°C (at the highest temperature during filling, discharge or transport for elevated-temperature substances transported over 65°C), minus 1 bar; and

  .2 the partial pressure (in bar) of air or other gases in the ullage space, being determined by a maximum ullage temperature of 65°C and a liquid expansion due to an increase in mean bulk temperature of $t_r - t_f$ (t_f = filling temperature, usually 15°C; t_r = 50°C, maximum mean bulk temperature).

Design pressure means the pressure to be used in calculations required by a recognized pressure-vessel code. The design pressure should be not less than the highest of the following pressures:

.1 the maximum effective gauge pressure allowed in the shell during filling or discharge; or

.2 the sum of:

  .1 the absolute vapour pressure (in bar) of the substance at 65°C, minus 1 bar;

  .2 the partial pressure (in bar) of air or other gases in the ullage space, being determined by a maximum ullage temperature of 65°C and a liquid expansion due to an increase in mean bulk temperature of $t_r - t_f$ (t_f = filling temperature, usually 15°C; t_r = 50°C, maximum mean bulk temperature); and

  .3 a head pressure determined on the basis of the dynamic forces specified in 6.7.2.2.12, but not less than 0.35 bar.

.3 two thirds of the minimum test pressure specified in the applicable portable tank instruction in 4.2.4.2.6;

Test pressure means the maximum gauge pressure at the top of the shell during the hydraulic pressure test, equal to not less than 1.5 times the design pressure. The minimum test pressure for portable tanks intended for specific substances is specified in the applicable portable tank instruction in 4.2.4.2.6;

Leakproofness test means a test using gas, subjecting the shell and its service equipment to an effective internal pressure of not less than 25% of the MAWP;

Maximum permissible gross mass (MPGM) means the sum of the tare mass of the portable tank and the heaviest load authorized for transport;

Reference steel means a steel with a tensile strength of 370 N/mm^2 and an elongation at fracture of 27%;

Mild steel means a steel with a guaranteed minimum tensile strength of 360 N/mm^2 to 440 N/mm^2 and a guaranteed minimum elongation at fracture conforming to 6.7.2.3.3.3;

Design temperature range for the shell should be −40°C to 50°C for substances transported under conditions. For substances handled under elevated-temperature conditions, the design temperatur be not less than the maximum temperature of the substance during filling, discharge or transport. Mo design temperatures should be considered for portable tanks subjected to severe climatic conditions.

6.7.2.2 **General design and construction provisions**

6.7.2.2.1 Shells should be designed and constructed in accordance with the provisions of a pressure-vessel code recognized by the competent authority. Shells should be made of metallic materials suitable for forming. The materials should, in principle, conform to national or international material standards. For welded shells, only a material whose weldability has been fully demonstrated should be used. Welds should be skillfully made and afford complete safety. When the manufacturing process or the materials make it necessary, the shells should be suitably heat-treated to guarantee adequate toughness in the weld and in the heat-affected zones. In choosing the material, the design temperature range should be taken into account with respect to risk of brittle fracture, to stress corrosion cracking and to resistance to impact. When fine grain-steel is used, the guaranteed value of the yield strength should be not more than 460 N/mm^2 and the guaranteed value of the upper limit of the tensile strength should be not more than 725 N/mm^2 according to the material specification. Aluminium may only be used as a construction material when indicated in a portable tank special provision assigned to a specific substance in the Dangerous Goods List or when approved by the competent authority. When aluminium is authorized, it should be insulated to prevent significant loss of physical properties when subjected to a heat load of 110 kW/m^2 for a period of not less than 30 minutes. The insulation should remain effective at all temperatures less than 649°C and should be jacketed with a material with a melting point of not less than 700°C. Portable tank materials should be suitable for the external environment in which they may be transported.

*.2.2.2 Portable tank shells, fittings, and pipework should be constructed from materials which are:

.1 substantially immune to attack by the substance(s) intended to be transported; or

.2 properly passivated or neutralized by chemical reaction; or

.3 lined with corrosion-resistant material directly bonded to the shell or attached by equivalent means.

6.7.2.2.3 Gaskets should be made of materials not subject to attack by the substances intended to be transported.

6.7.2.2.4 When shells are lined the lining should be substantially immune to attack by the substance(s) intended to be transported, homogeneous, non-porous, free from perforations, sufficiently elastic and compatible with the thermal expansion characteristics of the shell. The lining of every shell, shell fittings and piping should be continuous, and should extend around the face of any flange. Where external fittings are welded to the tank, the lining should be continuous through the fitting and around the face of external flanges.

6.7.2.2.5 Joints and seams in the lining should be made by fusing the material together or by other equally effective means.

6.7.2.2.6 Contact between dissimilar metals which could result in damage by galvanic action should be avoided.

6.7.2.2.7 The materials of the portable tank, including any devices, gaskets, linings and accessories, should not adversely affect the substances intended to be transported in the portable tank.

6.7.2.2.8 Portable tanks should be designed and constructed with supports to provide a secure base during transport and with suitable lifting and tie-down attachments.

6.7.2.2.9 Portable tanks should be designed to withstand, without loss of contents, at least the internal pressure due to the contents and the static, dynamic and thermal loads during normal conditions of handling and transport. The design should demonstrate that the effects of fatigue, caused by repeated application of these loads through the expected life of the portable tank, have been taken into account.

6.7.2.2.9.1 For portable tanks that are intended for use as offshore tank-containers, the dynamic stresses imposed by handling in open seas should be taken into account.

6.7.2.2.10 A shell which is to be equipped with a vacuum-relief device should be designed to withstand, without permanent deformation, an external pressure of not less than 0.21 bar above the internal pressure. The vacuum-relief device should be set to relieve at a vacuum setting not greater than -0.21 bar unless the shell is designed for a higher external overpressure, in which case the vacuum-relief pressure of the device to be fitted should be not greater than the tank design vacuum pressure. A shell used for the transport of solid substances of packing groups II or III only which do not liquefy during transport may be designed for a lower external pressure, subject to competent authority's approval. In this case, the vacuum-relief device should be set to relieve at this lower pressure. A shell that is not to be fitted with a vacuum-relief device should be designed to withstand, without permanent deformation, an external pressure of not less than 0.4 bar above the internal pressure.

6.7.2.2.11 Vacuum-relief devices used on portable tanks intended for the transport of substances meeting the flashpoint criteria of class 3, including elevated-temperature substances transported at or above their flashpoint, should prevent the immediate passage of flame into the shell, or the portable tank should have a shell capable of withstanding, without leakage, an internal explosion resulting from the passage of flame into the shell.

6.7.2.2.12 Portable tanks and their fastenings should, under the maximum permissible load, be capable of absorbing the following separately applied static forces:

.1 in the direction of travel: twice the MPGM multiplied by the acceleration due to gravity (*g*)*;

.2 horizontally at right angles to the direction of travel: the MPGM (when the direction of travel is not clearly determined, the forces should be equal to twice the MPGM) multiplied by the acceleration due to gravity (*g*)*;

.3 vertically upwards: the MPGM multiplied by the acceleration due to gravity (*g*)*; and

.4 vertically downwards: twice the MPGM (total loading including the effect of gravity) multiplied by the acceleration due to gravity (*g*)*.

6.7.2.2.13 Under each of the forces in 6.7.2.2.12, the safety factor to be observed should be as follows:

* For calculations purposes, $g = 9.81 m/s^2$.

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.1 for metals having a clearly defined yield point, a safety factor of 1.5 in relation to the guaranteed yield strength; or

.2 for metals with no clearly defined yield point, a safety factor of 1.5 in relation to the guaranteed 0.2% proof strength and, for austenitic steels, the 1% proof strength.

6.7.2.2.14 The value of yield strength or proof strength should be the value according to national or international material standards. When austenitic steels are used, the specified minimum values of yield strength or proof strength according to the material standards may be increased by up to 15% when these greater values are attested in the material inspection certificate. When no material standard exists for the metal in question, the value of yield strength or proof strength used should be approved by the competent authority.

6.7.2.2.15 Portable tanks should be capable of being electrically earthed when intended for the transport of substances meeting the flashpoint criteria of class 3, including elevated-temperature substances transported above their flashpoint. Measures should be taken to prevent dangerous electrostatic discharge.

6.7.2.2.16 When required for certain substances by the applicable portable tank instruction in 4.2.4.2.6 or by a portable tank special provision indicated in the Dangerous Goods List, portable tanks should be provided with additional protection, which may take the form of additional shell thickness or a higher test pressure, the additional shell thickness or higher test pressure being determined in the light of the inherent risks associated with the transport of the substances concerned.

6.7.2.2.17 Thermal insulation directly in contact with the shell intended for substances transported at elevated temperature should have an ignition temperature at least 50°C higher than the maximum designed temperature of the tank.

6.7.2.3 Design criteria

6.7.2.3.1 Shells should be of a design capable of being stress-analysed mathematically or experimentally by resistance strain gauges, or by other methods approved by the competent authority.

6.7.2.3.2 Shells should be designed and constructed to withstand a hydraulic test pressure not less than 1.5 times the design pressure. Specific provisions are laid down for certain substances in the applicable portable tank instruction indicated in the Dangerous Goods List and described in 4.2.4 or by a portable tank special provision indicated in column 13 of the Dangerous Goods List. The minimum shell thickness should not be less than that specified for these tanks in 6.7.2.4.1 to 6.7.2.4.10.

6.7.2.3.3 For metals exhibiting a clearly defined yield point or characterized by a guaranteed proof strength (0.2% proof strength, generally, or 1% proof strength for austenitic steels), the primary membrane stress σ (sigma) in the shell should not exceed $0.75R_e$ or $0.50R_m$, whichever is lower, at the test pressure, where:

R_e = yield strength in N/mm^2, or 0.2% proof strength or, for austenitic steels, 1% proof strength;

R_m = minimum tensile strength in N/mm^2.

6.7.2.3.3.1 The values of R_e and R_m to be used should be the specified minimum values according to national or international material standards. When austenitic steels are used, the specified minimum values for R_e and R_m according to the material standards may be increased by up to 15% when greater values are attested in the material inspection certificate. When no material standard exists for the metal in question, the values of R_e and R_m used should be approved by the competent authority or its authorized body.

6.7.2.3.3.2 Steels which have a R_e/R_m ratio of more than 0.85 are not allowed for the construction of welded shells. The values of R_e and R_m to be used in determining this ratio should be the values specified in the material inspection certificate.

6.7.2.3.3.3 Steels used in the construction of shells should have an elongation at fracture, in %, of not less than $10{,}000/R_m$ with an absolute minimum of 16% for fine-grain steels and 20% for other steels. Aluminium and aluminium alloys used in the construction of shells should have an elongation at fracture, in %, of not less than $10{,}000/6R_m$ with an absolute minimum of 12%.

6.7.2.3.3.4 For the purpose of determining actual values for materials, it should be noted that for sheet metal, the axis of the tensile test specimen should be at right angles (transversely) to the direction of rolling. The permanent elongation at fracture should be measured on test specimens of rectangular cross-section in accordance with ISO 6892:1984 using a 50 mm gauge length.

6.7.2.4 Minimum shell thickness

6.7.2.4.1 The minimum shell thickness should be the greater thickness based on:

.1 the minimum thickness determined in accordance with the provisions of 6.7.2.4.2 to 6.7.2.4.10;

.2 the minimum thickness determined in accordance with the recognized pressure-vessel code, including the provisions in 6.7.2.3; and

.3 the minimum thickness specified in the applicable portable tank instruction in 4.2.4.2.6 or by a portable tank special provision indicated in the Dangerous Goods List.

6.7.2.4.2 The cylindrical portions, ends (heads) and manhole covers of shells not more than 1.80 m in diameter should be not less than 5 mm thick in the reference steel or of equivalent thickness in the metal to be used. Shells more than 1.80 m in diameter should be not less than 6 mm thick in the reference steel or of equivalent thickness in the metal to be used, except that for powdered or granular solid substances of packing group II or III the minimum thickness requirement may be reduced to not less than 5 mm thick in the reference steel or of equivalent thickness in the metal to be used.

6.7.2.4.3 When additional protection against shell damage is provided, portable tanks with test pressures less than 2.65 bar may have the minimum shell thickness reduced, in proportion to the protection provided, as approved by the competent authority. However, shells not more than 1.80 m in diameter should be not less than 3 mm thick in the reference steel or of equivalent thickness in the metal to be used. Shells more than 1.80 m in diameter should be not less than 4 mm thick in the reference steel or of equivalent thickness in the metal to be used.

6.7.2.4.4 The cylindrical portions, ends (heads) and manhole covers of all shells should be not less than 3 mm thick regardless of the material of construction.

6.7.2.4.5 The additional protection referred to in 6.7.2.4.3 may be provided by overall external structural protection, such as suitable "sandwich" construction with the outer sheathing (jacket) secured to the shell, double-wall construction or by enclosing the shell in a complete framework with longitudinal and transverse structural members.

6.7.2.4.6 The equivalent thickness of a metal other than the thickness prescribed for the reference steel in 6.7.2.4.3 should be determined using the following equation:

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{R_{m1} \times A_1}}$$

where:

e_1 = required equivalent thickness (in mm) of the metal to be used;

e_0 = minimum thickness (in mm) of the reference steel specified in the applicable portable tank instruction identified in the Dangerous Goods List and described in 4.2.4.2.6 or by a portable tank special provision indicated in the Dangerous Goods List;

R_{m1} = guaranteed minimum tensile strength (in N/mm^2) of the metal to be used (see 6.7.2.3.3);

A_1 = guaranteed minimum elongation at fracture (in %) of the metal to be used according to national or international standards.

6.7.2.4.7 When, in the applicable portable tank instruction in 4.2.4.2.6, a minimum thickness of 8 mm, 10 mm or 12 mm is specified, it should be noted that these thicknesses are based on the properties of the reference steel and a shell diameter of 1.80 m. When a metal other than mild steel (see 6.7.2.1) is used or the shell has a diameter of more than 1.80 m, the thickness should be determined using the following equation:

$$e_1 = \frac{21.4 \times e_0 d_1}{1.8\sqrt[3]{R_{m1} \times A_1}}$$

where:

e_1 = required equivalent thickness (in mm) of the metal to be used;

e_0 = minimum thickness (in mm) of the reference steel specified in the applicable portable tank instruction identified in the Dangerous Goods List and described in 4.2.4.2.6 or by a portable tank special provision indicated in the Dangerous Goods List;

d_1 = diameter of the shell (in m), but not less than 1.80 m;

R_{m1} = guaranteed minimum tensile strength (in N/mm^2) of the metal to be used (see 6.7.2.3.3);

A_1 = guaranteed minimum elongation at fracture (in %) of the metal to be used according to national or international standards.

6.7.2.4.8 In no case should the wall thickness be less than that prescribed in 6.7.2.4.2, 6.7.2.4.3 and 6.7.2.4.4. All parts of the shell should have a minimum thickness as determined by 6.7.2.4.2 to 6.7.2.4.4. This thickness should be exclusive of any corrosion allowance.

6.7.2.4.9 When mild steel is used (see 6.7.2.1), calculation using the equation in 6.7.2.4.6 is not required.

6.7.2.4.10 There should be no sudden change of plate thickness at the attachment of the ends (heads) to the cylindrical portion of the shell.

6.7.2.5 Service equipment

6.7.2.5.1 Service equipment should be so arranged as to be protected against the risk of being wrenched off or damaged during handling and transport. When the connection between the frame and the shell allows relative movement between the sub-assemblies, the equipment should be so fastened as to permit such movement without risk of damage to working parts. The external discharge fittings (pipe sockets, shut-off devices), the internal stop-valve and its seating should be protected against the danger of being wrenched off by external forces (for example, by using shear sections). The filling and discharge devices (including flanges or threaded plugs) and any protective caps should be capable of being secured against unintended opening.

6.7.2.5.1.1 For offshore tank-containers, where positioning of service equipment and the design and strength of protection for such equipment is concerned, the increased danger of impact damage when handling such tanks in open seas should be taken into account.

6.7.2.5.2 All openings in the shell, intended for filling or discharging the portable tank, should be fitted with a manually operated stop-valve located as close to the shell as reasonably practicable. Other openings, except for openings leading to venting or pressure-relief devices, should be equipped with either a stop-valve or another suitable means of closure located as close to the shell as reasonably practicable.

6.7.2.5.3 All portable tanks should be fitted with a manhole or other inspection openings of a suitable size to allow for internal inspection and adequate access for maintenance and repair of the interior. Compartmented portable tanks should have a manhole or other inspection openings for each compartment.

6.7.2.5.4 As far as reasonably practicable, external fittings should be grouped together. For insulated portable tanks, top fittings should be surrounded by a spill-collection reservoir with suitable drains.

6.7.2.5.5 Each connection to a portable tank should be clearly marked to indicate its function.

6.7.2.5.6 Each stop-valve or other means of closure should be designed and constructed to a rated pressure not less than the MAWP of the shell, taking into account the temperatures expected during transport. All stop-valves with screwed spindles should close by a clockwise motion of the handwheel. For other stop-valves, the position (open and closed) and direction of closure should be clearly indicated. All stop-valves should be designed to prevent unintentional opening.

6.7.2.5.7 No moving parts, such as covers, components of closures, etc., should be made of unprotected corrodible steel when they are liable to come into frictional or percussive contact with aluminium portable tanks intended for the transport of substances meeting the flashpoint criteria of class 3, including elevated-temperature substances transported above their flashpoint.

6.7.2.5.8 Piping should be designed, constructed and installed so as to avoid the risk of damage due to thermal expansion and contraction, mechanical shock and vibration. All piping should be of a suitable metallic material. Welded pipe joints should be used wherever possible.

6.7.2.5.9 Joints in copper tubing should be brazed or have an equally strong metal union. The melting point of brazing materials should be no lower than 525°C. The joints should not decrease the strength of the tubing, as may happen when cutting threads.

6.7.2.5.10 The burst pressure of all piping and pipe fittings should be not less than the highest of four times the MAWP of the shell or four times the pressure to which it may be subjected in service by the action of a pump or other device (except pressure-relief devices).

6.7.2.5.11 Ductile metals should be used in the construction of valves and accessories.

6.7.2.5.12 The heating system should be designed or controlled so that a substance cannot reach a temperature at which the pressure in the tank exceeds its MAWP or causes other hazards (such as dangerous thermal decomposition).

6.7.2.5.13 The heating system should be designed or controlled so that power for internal heating elements is not available unless the heating elements are completely submerged. The temperature at the surface of the heating elements for internal heating equipment or the temperature at the shell for external heating equipment should, in no case, exceed 80% of the auto-ignition temperature (in °C) of the substances carried.

6.7.2.5.14 If an electrical heating system is installed inside the tank, it should be equipped with an earth leakage circuit breaker with a releasing current of less than 100 mA.

6.7.2.5.15 Electrical switch cabinets mounted to tanks should not have a direct connection to the tank interior and should provide protection of at least the equivalent of [IP 56] according to IEC 144 or IEC 529.

6.7.2.6 Bottom openings

6.7.2.6.1 Certain substances should not be transported in portable tanks with bottom openings. When the applicable portable tank instruction identified in the Dangerous Goods List and described in 4.2.4.2.6 indicates that bottom openings are prohibited, there should be no openings below the liquid level of the shell when it is filled to its maximum permissible filling limit. When an existing opening is closed, it should be accomplished by internally and externally welding one plate to the shell.

6.7.2.6.2 Bottom discharge outlets for portable tanks carrying certain solid, crystallizable or highly viscous substances should be equipped with not less than two serially fitted and mutually independent shut-off devices. The design of the equipment should be to the satisfaction of the competent authority or its authorized body and should include:

.1 an external stop-valve fitted as close to the shell as reasonably practicable; and

.2 a liquid-tight closure at the end of the discharge pipe, which may be a bolted blank flange or a screw cap.

6.7.2.6.3 Every bottom discharge outlet, except as provided in 6.7.2.6.2, should be equipped with three serially fitted and mutually independent shut-off devices. The design of the equipment should be to the satisfaction of the competent authority or its authorized body and include:

.1 a self-closing internal stop-valve, that is a stop-valve within the shell or within a welded flange or its companion flange, such that:

  .1 the control devices for the operation of the valve are designed so as to prevent any unintended opening through impact or other inadvertent act;

  .2 the valve may be operable from above or below;

  .3 if possible, the setting of the valve (open or closed) should be capable of being verified from the ground;

  .4 except for portable tanks having a capacity of not more than 1,000 ℓ, it should be possible to close the valve from an accessible position of the portable tank that is remote from the valve itself; and

  .5 the valve should continue to be effective in the event of damage to the external device for controlling the operation of the valve;

.2 an external stop-valve fitted as close to the shell as reasonably practicable; and

.3 a liquid-tight closure at the end of the discharge pipe, which may be a bolted blank flange or a screw cap.

6.7.2.6.4 For a lined shell, the internal stop-valve required by 6.7.2.6.3.1 may be replaced by an additional external stop-valve. The manufacturer should satisfy the provisions of the competent authority or its authorized body.

6.7.2.7 Safety relief devices

6.7.2.7.1 All portable tanks should be fitted with at least one pressure-relief device. All relief devices should be designed, constructed and marked to the satisfaction of the competent authority or its authorized body.

6.7.2.8 Pressure-relief devices

6.7.2.8.1 Every portable tank with a capacity not less than 1,900 ℓ and every independent compartment of a portable tank with a similar capacity should be provided with one or more pressure-relief devices of the spring-loaded type and may in addition have a frangible disc or fusible element in parallel with the spring-loaded devices except when prohibited by reference to 6.7.2.8.3 in the applicable portable tank instruction in 4.2.4.2.6. The pressure-relief devices should have sufficient capacity to prevent rupture of the shell due to over-pressurization or vacuum resulting from filling, from discharging, or from heating of the contents.

6.7.2.8.2 Pressure-relief devices should be designed to prevent the entry of foreign matter, the leakage of liquid and the development of any dangerous excess pressure.

6.7.2.8.3 When required for certain substances by the applicable portable tank instruction identified in the Dangerous Goods List and described in 4.2.4.2.6, portable tanks should have a pressure-relief device approved by the competent authority. Unless a portable tank in dedicated service is fitted with an approved relief device constructed of materials compatible with the load, the relief device should comprise a frangible disc preceding a spring-loaded pressure-relief device. When a frangible disc is inserted in series with the required pressure-relief device, the space between the frangible disc and the pressure-relief device should be provided with a pressure gauge or suitable tell-tale indicator for the detection of disc rupture, pinholing, or leakage which could cause a malfunction of the pressure-relief system. The frangible disc should rupture at a nominal pressure 10% above the start-to-discharge pressure of the relief device.