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Edition 2

SOUTH AFRICAN NATIONAL STANDARD

Categorization and conformity assessment criteria for all pressure equipment

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Table of changes

Change No.	Date	Scope

Foreword

This South African standard was approved by National Committee SABS TC 58, *Vessels under pressure*, in accordance with procedures of the SABS Standards Division, in compliance with annex 3 of the WTO/TBT agreement.

This document was published in March 2012.

This document supersedes SANS 347:2010 (edition 1.1).

This document was written in order to support a specific South African Regulation and, of necessity, includes references to South African legislation. It therefore might not be suitable for direct application in other jurisdictions where conflicting legislation exists.

Reference is made in 1.2, 3.1.4, 3.1.10, 3.1.13, 4.1.2, 5.1.4, 5.2.5, 5.2.5.1 (two references), 5.2.5.2, 5.2.5.3, 5.6.5, 5.6.5(d), 5.6.7(c), 5.6.8, 5.6.12, 5.15.1(b) and clause 8 to "relevant national legislation". In South Africa this means the Pressure Equipment Regulations (PER) in the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in clause 3 to "relevant national legislation". In South Africa this means the Pressure Equipment Regulations and Major Hazard Installation Regulations in the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in the note to 3.1.13 to "relevant national legislation". In South Africa this means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) or the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (or both), as applicable.

Reference is made in C.2.1 (b), C.2.2 (two references) and in the NOTE to C.2.2 (two references) to "relevant national legislation". In South Africa this means Regulation 7.4 of the Pressure Equipment Regulations in the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in C.3.1(c) to "relevant national legislation". In South Africa this means Regulation 7.3(b) of the Pressure Equipment Regulations in the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

Reference is made in C.4.2 to "relevant national legislation". In South Africa this means the Pressure Equipment Regulation (PER).

Annexes A, B and C form an integral part of this document.

Introduction

The risk of injury arising from defects in the construction of pressure equipment and non-pressure equipment is related to the consequences should failure occur during use. These consequences are primarily dependent on the hazard level. An increased hazard level requires an increased degree of independent conformity assessment or verification. Should a certified management system be controlled by the manufacturer, the involvement of the approved inspection authority (AIA) will be decreased.

Although this document is based on the European Directive, changes have been made to accommodate specific requirements in the vessels under pressure regulations, renamed as the Pressure Equipment Regulations in the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993). Every effort has been made to ensure that the manufacture of pressure equipment is carried out in a safe manner so as to prevent injury to the user as well as to the public.

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Categorization and conformity assessment criteria for all pressure equipment

1 Scope

1.1 This standard specifies the criteria to be used for the categorization and conformity assessment, as well as the selection of health and safety standards (see annex A) of pressure equipment (metallic and non-metallic) for use by but not limited to the manufacturer, users, certification bodies and approved inspection authorities.

1.2 This standard is also applicable to the certification, re-certification, modification or repair of pressure equipment (metallic and non-metallic) manufactured under the relevant national legislation (see foreword), as defined by the relevant statutory regulations for pressure equipment.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

2.1 Standards

API 600, *Steel gate valves – Flanged and butt-welding ends, bolted bonnets.*

ASME Section VIII – Division 1, *Rules for construction of pressure vessels.*

ASME B16.34, *Valves flanged, threaded and welding end.*

ASME B31, *Code for pressure piping.*

SANS 3834/ISO 3834, *Quality requirements for fusion welding of metallic materials (all parts).*

SANS 9001/ISO 9001, *Quality management systems – Requirements*

SANS 10019, *Transportable containers for compressed, dissolved and liquefied gases – Basic design, manufacture, use and maintenance.*

SANS 10227, *Criteria for the operation of inspection authorities performing inspection in terms of the Pressure Equipment Regulations.*

SANS 10228, *The identification and classification of dangerous goods for transport.*

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SANS 17020/ISO/IEC 17020, *General criteria for the operation of various types of bodies performing inspection.*

SANS 17021/ISO/IEC 17021, *Conformity assessment – Requirements for bodies providing audit and certification of management systems.*

2.2 Other publications

Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.

3 Definitions and abbreviations

For the purposes of this document, the definitions and abbreviations in the relevant statutory regulations for pressure equipment (e.g. the relevant national legislation (see foreword) and the following apply.

3.1 Definitions

3.1.1

approved certification body

body for management system certification in accordance with SANS 17021 and approved by the regulatory authority and accredited by a government-endorsed national accreditation body (e.g. SANAS)

3.1.2

approved inspection authority

AIA

South African organization that is approved by the regulatory authority in terms of SANS 10227

3.1.3

assembly

group of components put together by a manufacturer to form an integral and functional whole

NOTE The assembly of pressure equipment on the site and under the responsibility of the user, as in the case of industrial installations is not considered to be an assembly.

3.1.4

certificate of conformity

certificate of manufacture

written declaration of conformance to the relevant health and safety standard(s) and to the relevant national legislation (see foreword)

3.1.5

certified quality system

quality system for production, final inspection and testing, that is certified by an approved certification body

3.1.6

conformity assessment

process undertaken by the manufacturer and when applicable by the AIA in order to demonstrate that the statutory requirements are satisfied

3.1.7

conformity assessment modules

modular approach to conformity assessment, thereby subdividing it into a number of independent activities

3.1.8

defect

imperfections by nature or accumulated effect that render a part or product unable to comply with minimum applicable acceptance standards or specifications

NOTE Defects are pertinent to design, materials, fabrication, inspection, testing, qualification and certification.

3.1.9

hazard category

classification of pressure equipment according to risk

3.1.10

health and safety standard

code of construction

standard that is approved in terms of the relevant national legislation (see foreword) by the relevant regulatory authority, and that contains requirements for the design, manufacture, repair, modification, inspection and testing of pressure equipment (see annex A)

3.1.11

inspection

examination or measurement to verify whether an item or activity complies with specified requirements

3.1.12

pressure accessory

device with an operational function and having an identifiable pressure-bearing housing

NOTE The device has a function additional to that of containing pressure.

3.1.13

pressure equipment regulations

PER

pressure equipment regulations in the relevant national legislation (see foreword) for use in South Africa and enforced by the regulatory authority

3.1.14

pressure vessel

housing designed and manufactured to contain a fluid under a design pressure equal to or greater than 50 kPa

NOTE A pressure vessel may be composed of more than one chamber.

3.1.15

regulatory authority

authority which is legally charged with the enforcement of the requirements of the legislation that relates to pressure equipments in South Africa

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3.1.16

safety accessory

device designed to protect pressure equipment against the allowable limit being exceeded, which includes the following:

- a) device for direct pressure limitation, such as safety valves, bursting disc safety device, buckling rods, controlled safety pressure relief systems (CSPRS); and
- b) limiting devices, which either activate the means for correction or provide for shutdown or shutdown and lockout, such as pressure switches or temperature switches or fluid level switches and safety-related measurement and regulation (SRMCR) devices

3.1.17

surveillance

act of monitoring or observing to verify whether an item or activity complies with specified requirements

3.1.18

third party

organization performing inspection and test activities independently of the parties involved

3.1.19

transportable pressure equipment

equipment constructed to be transported under pressure with a maximum water capacity of 3 000 L e.g. transportable gas container

3.1.20

type approval

once-off approval of the design, inspection and testing of pressure equipment

3.1.21

unstable gas

gas or a vapour liable to transform itself, spontaneously and suddenly, producing a pressure variation, when this transformation happens in a confined volume under the only effect of a low variation of an operating parameter e.g. acetylene, methyl acetylene, vinyl fluoride

3.1.22

verification

act of reviewing, inspecting, testing, checking, auditing or otherwise determining and documenting whether items, processes, services or documents comply with specified requirements

3.2 Abbreviations

AIA	approved inspection authority
CB	approved certification body
CE	European certificate
IPE	inspector of pressurized equipment
PER	pressure equipment regulations
PS	design pressure
SEP	sound engineering practice
TP	test pressure

4 Criteria for determining hazard categories

4.1 Hazard categories

4.1.1 In order to determine how the statutory regulations will apply to specific items of pressure equipment, a manufacturer shall classify the equipment into one of the following five hazard categories:

- a) sound engineering practice (SEP),
- b) category I;
- c) category II;
- d) category III; or
- e) category IV.

4.1.2 Sound engineering practice (SEP) applies to equipment that is not subjected to conformity assessment but that shall be designed and manufactured in accordance with sound engineering practice (best practice) in order to ensure safe use. Such equipment shall ensure that design and manufacture take into account all the relevant factors that influence safety during its intended lifetime (see clause 6). The equipment shall have instructions for use and shall bear the identification of the manufacturer. SEP equipment is not required to meet any other of the essential statutory requirements listed in the relevant national legislation (see foreword).

4.1.3 For equipment categorized as category I equipment, the manufacturer shall ensure that such equipment complies with the requirements of the applicable health and safety standard(s). The manufacturer shall issue a certificate of conformity confirming that the equipment is manufactured in accordance with the applicable code of construction. The design requirements of such equipment shall be in accordance with the applicable health and safety standard(s).

4.1.4 The design of pressure equipment for category II and above needs to be approved by an appropriately registered professional person (i.e. registered Pr. Eng. Pr. Technologist or Pr. Cert. Eng.) (competent in this field) to a health and safety standard and verified by the AIA or certification body as applicable. Design requirements for piping shall be as given in annex B.

In the case of countries which do not fall within the recognition agreements (e.g. Washington accord etc), the design engineers with equivalent qualifications and relevant experience may be accepted through an agreement by verification engineer of an AIA for designs done outside of South Africa.

4.1.5 Imported pressure equipment in accordance with 5.2.5.1, 5.2.5.2 or 5.2.5.3 does not have to meet the requirements of 4.1.4.

4.2 Criteria for categorization

In order to determine which category an item of equipment falls into, the manufacturer shall identify the following:

- a) the type of pressure equipment, for example,
 - 1) pressure vessels,
 - 2) steam generators,
 - 3) piping,

- 4) pressure accessories,
 - 5) safety accessories; or
 - 6) transportable pressure equipment;
- b) the state of the intended fluid contents – gas or liquid; and
- c) the fluid group of the intended contents – group 1 or group 2 (see table 1).

Table 1 — Product classifications and relevant figures

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Equipment type	Pressure vessels				Steam generator	Piping				Transportable pressure equipment			
State of contents	Gas		Liquid^b			Gas		Liquid^b		Gas		Liquid^b	
Fluid group^c	1	2	1	2		1	2	1	2	1	2	1	2
Refer to figure	1	2	3	4	5	6	7	8	9	10	2 ^a	10	4 ^a
NOTE For two-phase flow, the equipment should be categorized to the higher risk.													
^a For categorization of transportable pressure equipment figures 2 or 7 and 4 or 9 may be used as appropriate. Pressure accessories for equipment associated with figure 10 shall also be assessed with figure 10. Valves having an internal volume less than 0,1 L shall be deemed to be equal to 0,1 L for the purpose of defining the hazard category in relation to figure 10. ^b No pockets of gas may form above the liquid in the equipment, including steam. ^c Fluid group 1 = dangerous; fluid group 2 = not dangerous (see 4.3.1).													

4.3 Categorization

4.3.1 Fluid groups

4.3.1.1 Fluid group 1

This group comprises fluids classified as dangerous substances (in accordance with SANS 10228 for transportable pressure equipment or Council Directive 67/548/EEC for the rest of the pressure equipment), fluids that are:

- a) explosive,
- b) extremely flammable,
- c) highly flammable,
- d) flammable (where the maximum allowable temperature is above flashpoint),
- e) corrosive,
- f) toxic,
- g) oxidizing, and
- h) saturated or superheated steam.

In certain installation(s) the user may classify the fluid. This shall be part of the final documentation.

4.3.1.2 Fluid group 2

This group comprises fluids other than those in fluid group 1.

4.3.2 Pressure accessories

Figures 1 to 4 for vessels or figures 6 to 9 for piping are applicable depending on whether the volume (V) or the nominal size (DN) is appropriate for classification of the pressure accessory. Where both the volume and the nominal size are appropriate, the pressure accessory shall be classified in the higher category.

Piping components need not be defined as pressure accessories when purchased and certified in accordance with a referenced standard listed in the applicable health and safety standard(s). The manufacturer of the equipment that uses the piping components shall remain liable for their integrity. Examples would include standard valves that comply with ASME B16.34 or API 600 when used in piping in accordance with ASME B31.3.

4.3.3 Safety accessories

These are generally classified as category IV. Safety accessories manufactured for specific equipment shall at least be classified as the same category as the equipment that they protect.

4.3.4 Assemblies

4.3.4.1 Assemblies shall be subjected to a global conformity assessment procedure comprising:

- a) assessment of each item of pressure equipment making up the assembly which has not been previously subjected to a conformity assessment procedure and to a separate marking; the assessment procedure shall be determined by the category of each item of equipment;
- b) the assessment of the integration of the various components of the assembly which shall be determined by the highest category applicable to the equipment concerned other than that applicable to any safety accessories; and
- c) the assessment of the protection of an assembly against exceeding the permissible operating limits shall be conducted in the light of the highest category applicable to the items of equipment to be protected.

4.3.4.2 Fitting a valve to transportable pressure equipment for dangerous fluids is exempt from compliance with this clause (see also SANS 10019).

4.4 Categorization graphs

4.4.1 General

Depending on the requirements of 4.2, the relevant of figures 1 to 9 shall be used to determine the applicable hazard category (SEP, I, II, III or IV) for pressure vessels, steam generators, piping and transportable pressure equipment for non-dangerous fluids.

Figure 10 applies specifically to transportable pressure equipment for dangerous gas as defined in the relevant statutory regulations for pressure equipment.

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In the graphs in figures 1 to 10, the design pressure (PS) or test pressure (TP) as relevant is plotted against the volume (V) or nominal size (DN). These graphs have up to five bands that relate to the different hazard categories (SEP, I, II, III or IV).

The manufacturer shall calculate and plot on the relevant graph, the design pressure and volume or nominal size for the equipment that is manufactured in order to identify which category such equipment falls into. In general, the lower the design pressure and volume, the lower the category for the equipment.

Each category shown in the graphs starts above the lower line and ends on the upper line.

The 50 kPa line belongs to the category above it.

4.4.2 Vessels

4.4.2.1 Dangerous gas

Vessels that fall within categories I or II and that are intended to contain an unstable gas, shall be classified as category III (see figure 1).

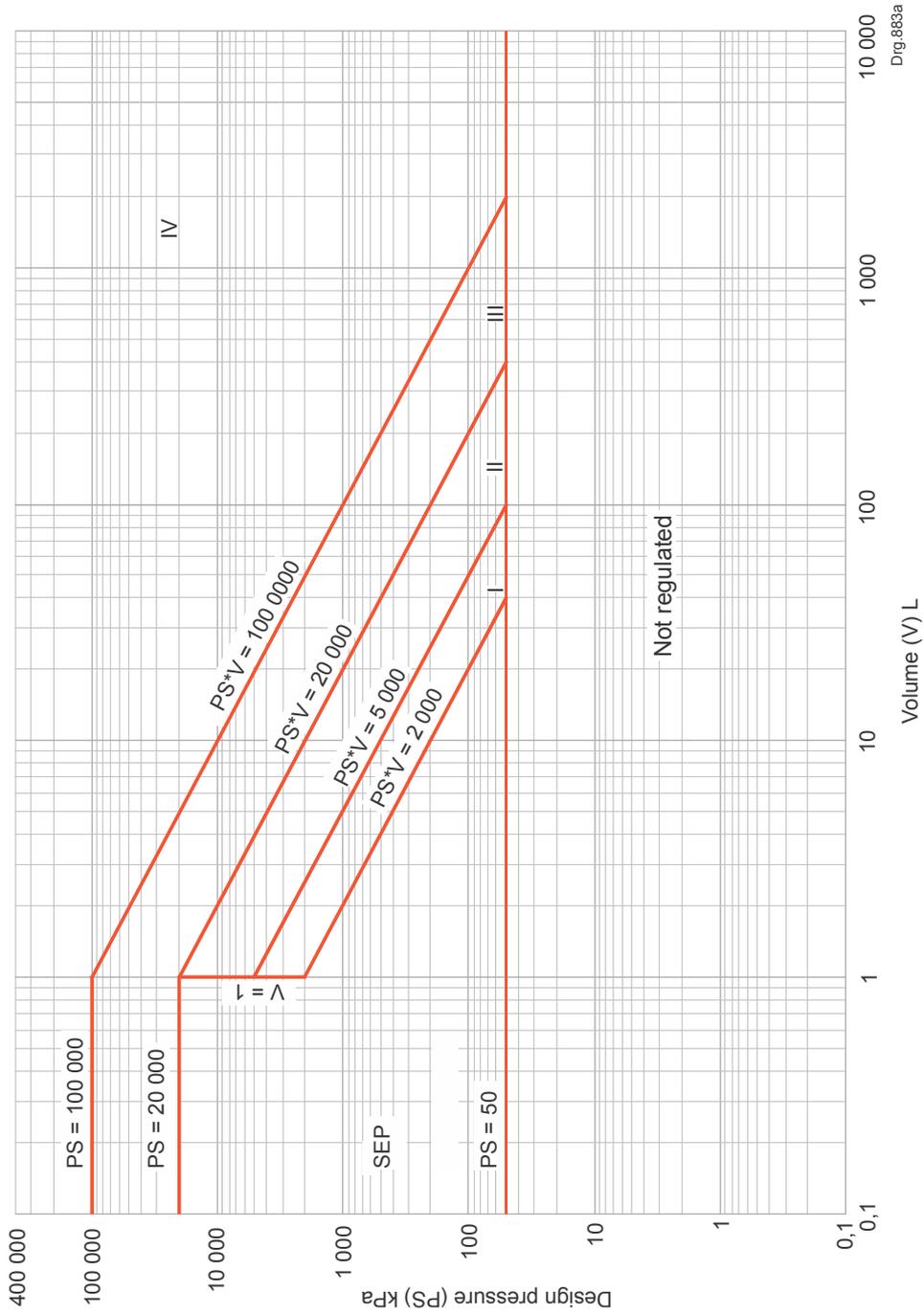


Figure 1 — Graph for vessels — Dangerous gas

4.4.2.2 Non-dangerous gas

Portable fire extinguishers up to 3 000 kPa shall be classified as at least category III (see figure 2).

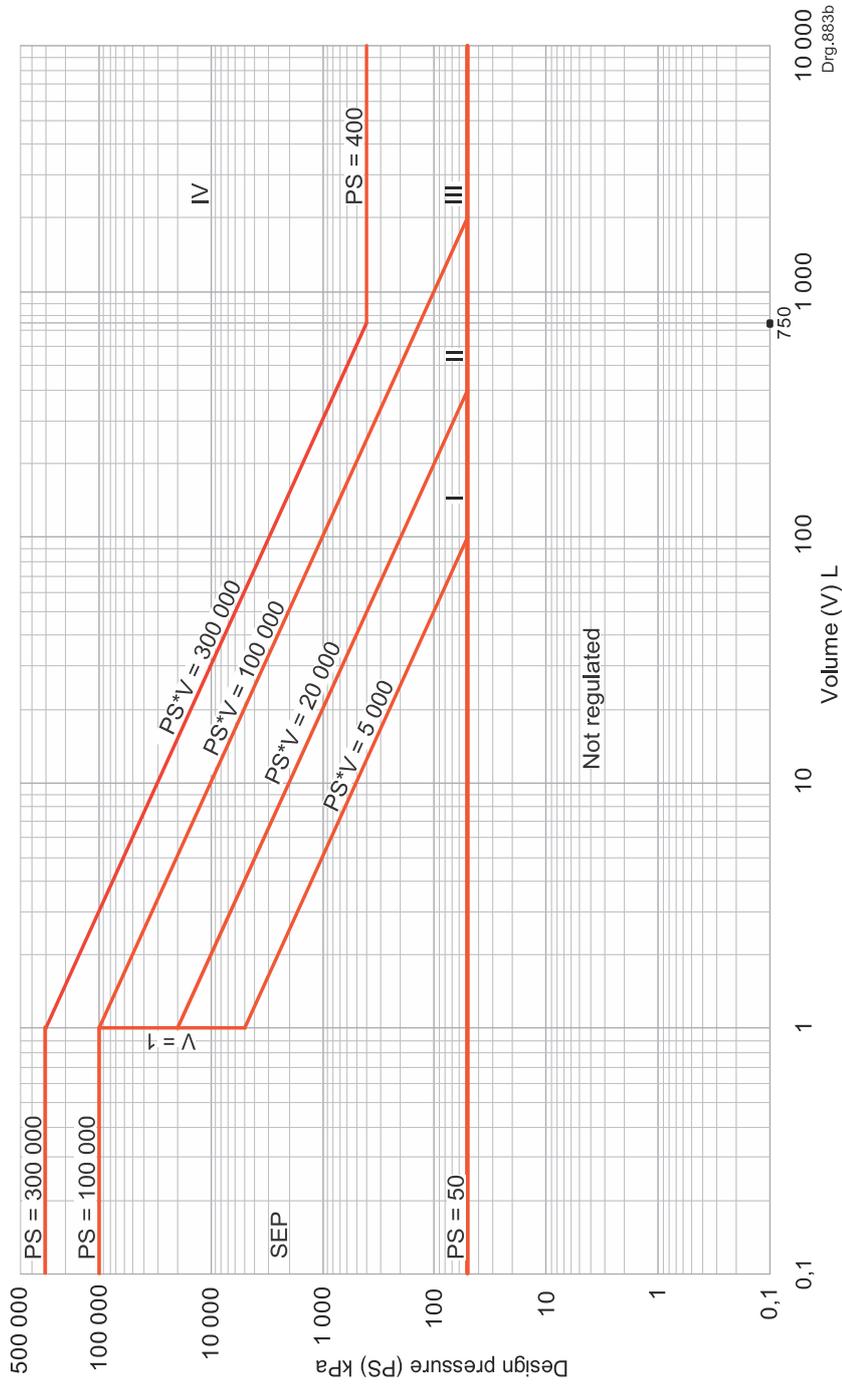


Figure 2 — Graph for vessels — Non-dangerous gas

4.4.2.3 Dangerous liquids

Figure 3 shows the various categories for dangerous liquids contained in vessels.

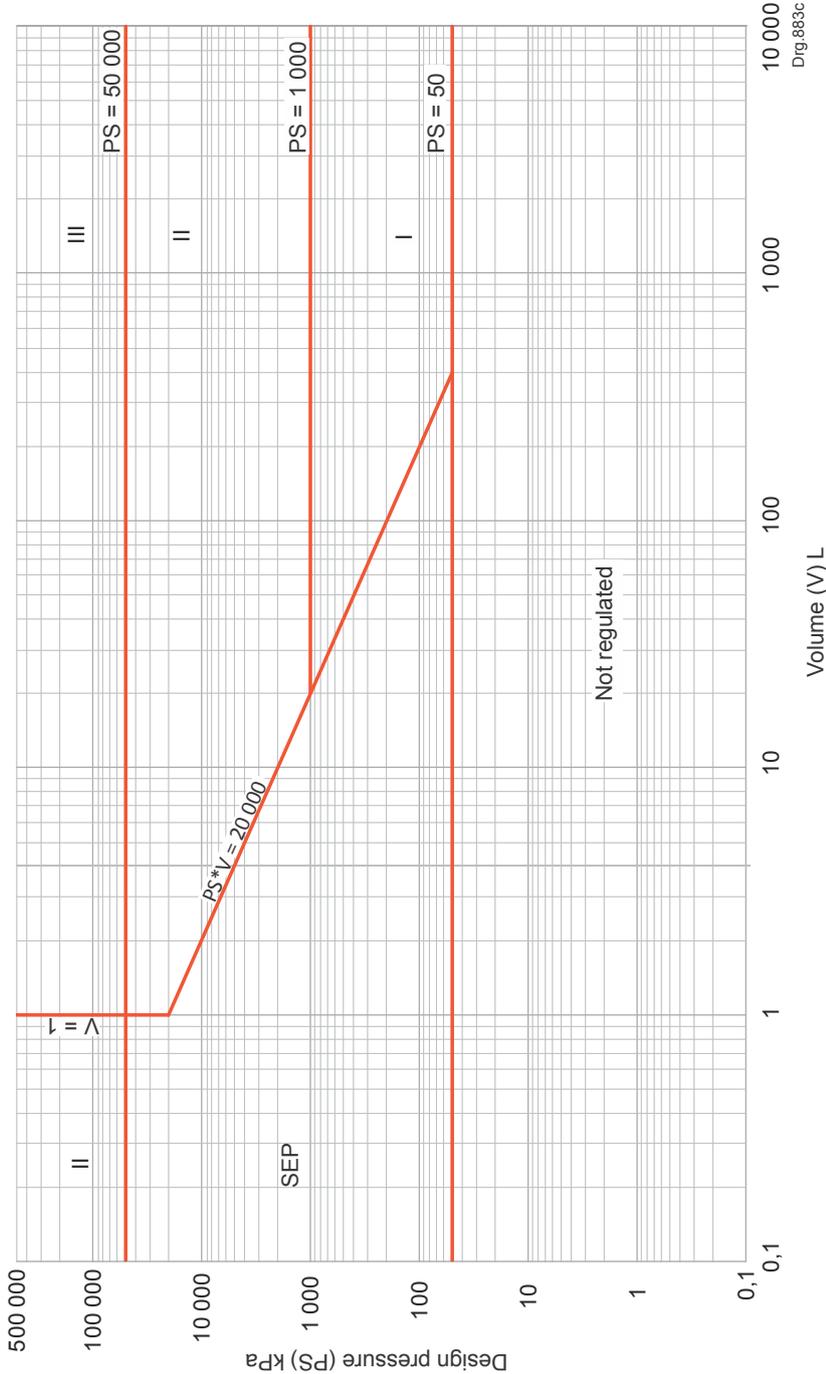


Figure 3 — Graph for vessels — Dangerous liquids

4.4.2.4 Non-dangerous liquids

Assemblies intended for generating warm water shall be subjected to a type approval.

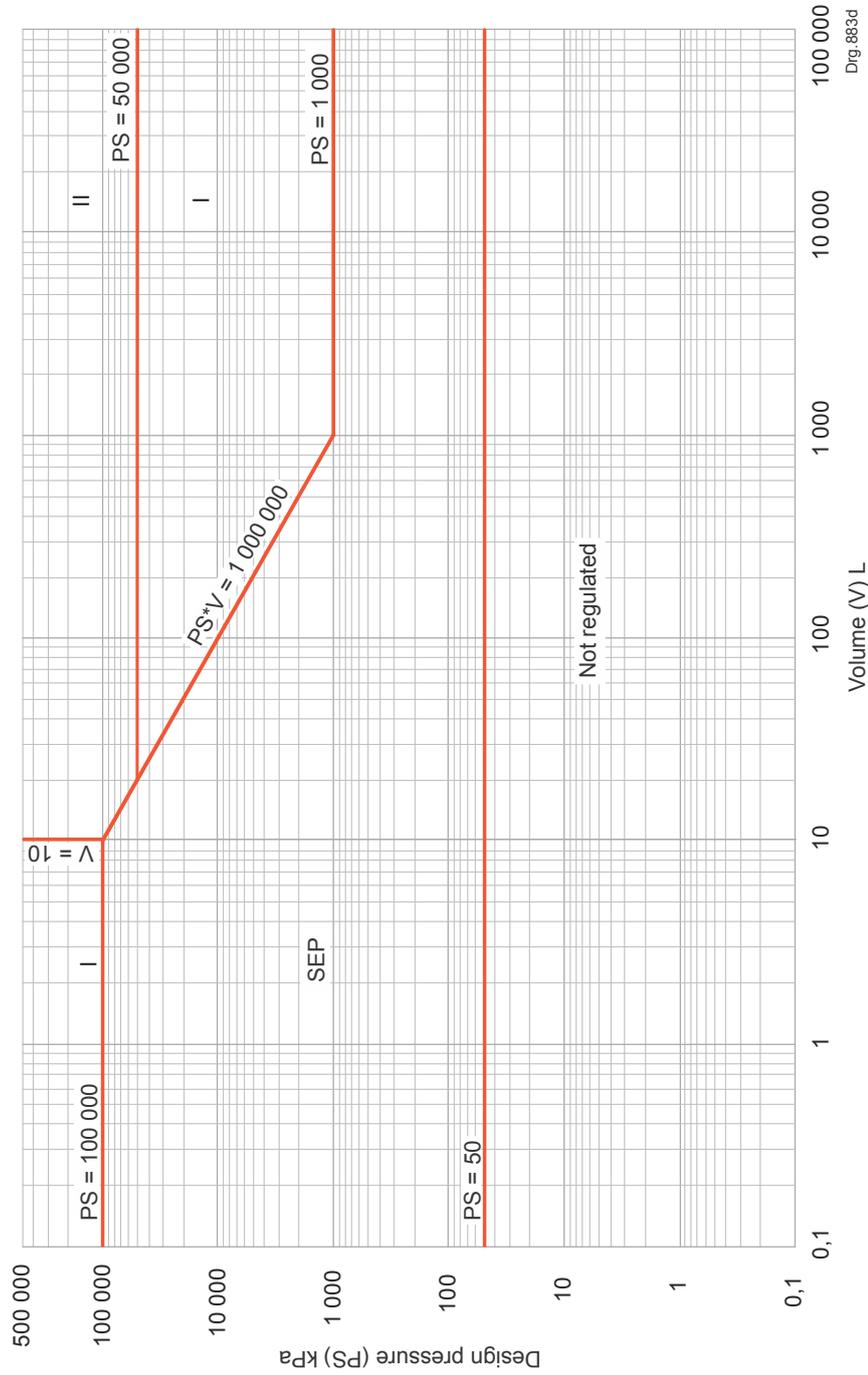


Figure 4 — Graph for vessels — Non-dangerous liquids

4.4.3 Steam generators

The design of jacketed pressure cookers shall be subjected to a conformity assessment procedure equivalent to at least one of the category III modules.

NOTE For more information on conformity assessment procedures for stationary pressure equipment, see annex C.

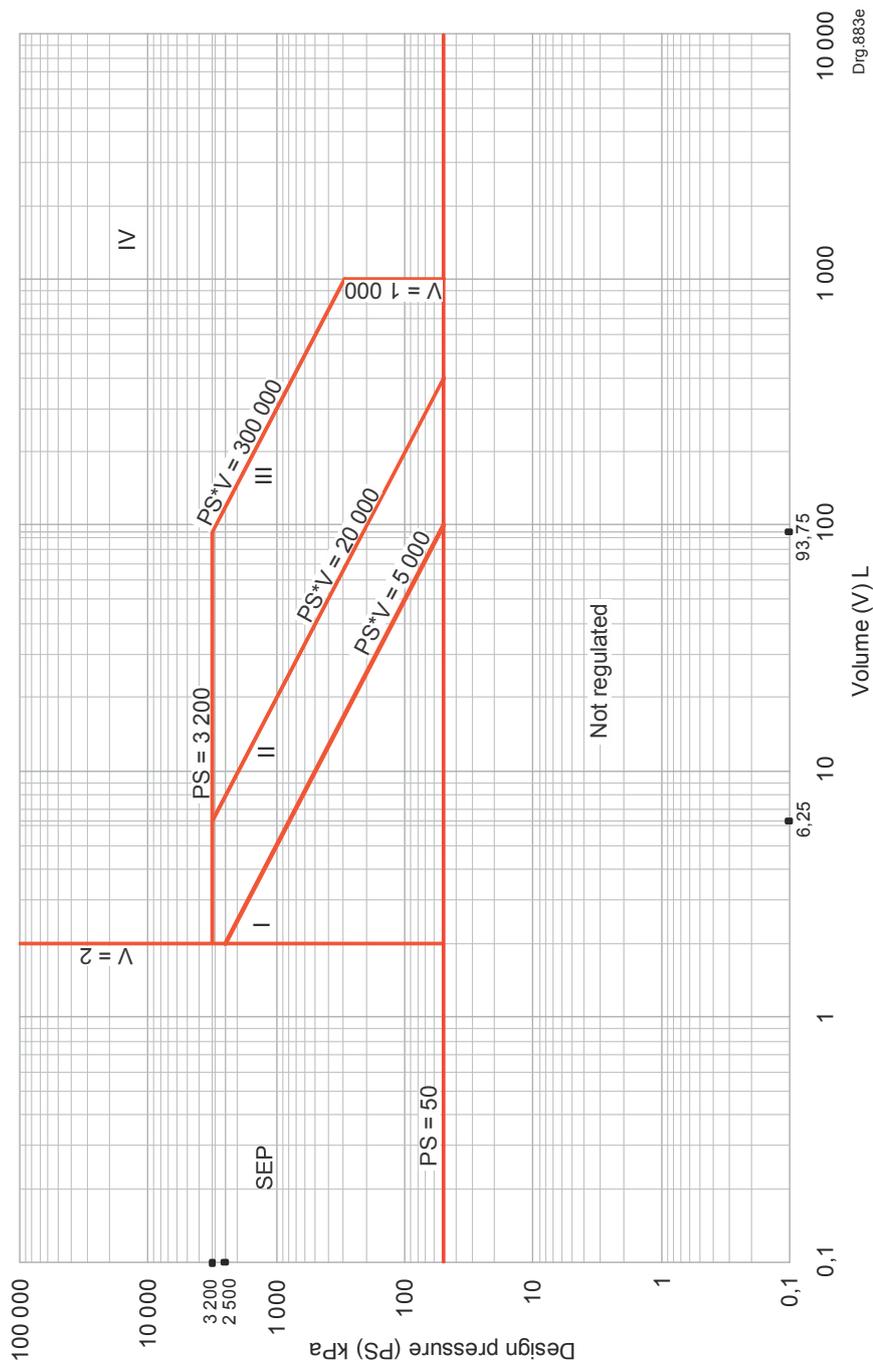


Figure 5 — Graph for steam generators

4.4.4 Piping

4.4.4.1 Dangerous gas

Piping that is intended for unstable gases that fall within categories I or II shall be classified as category III.

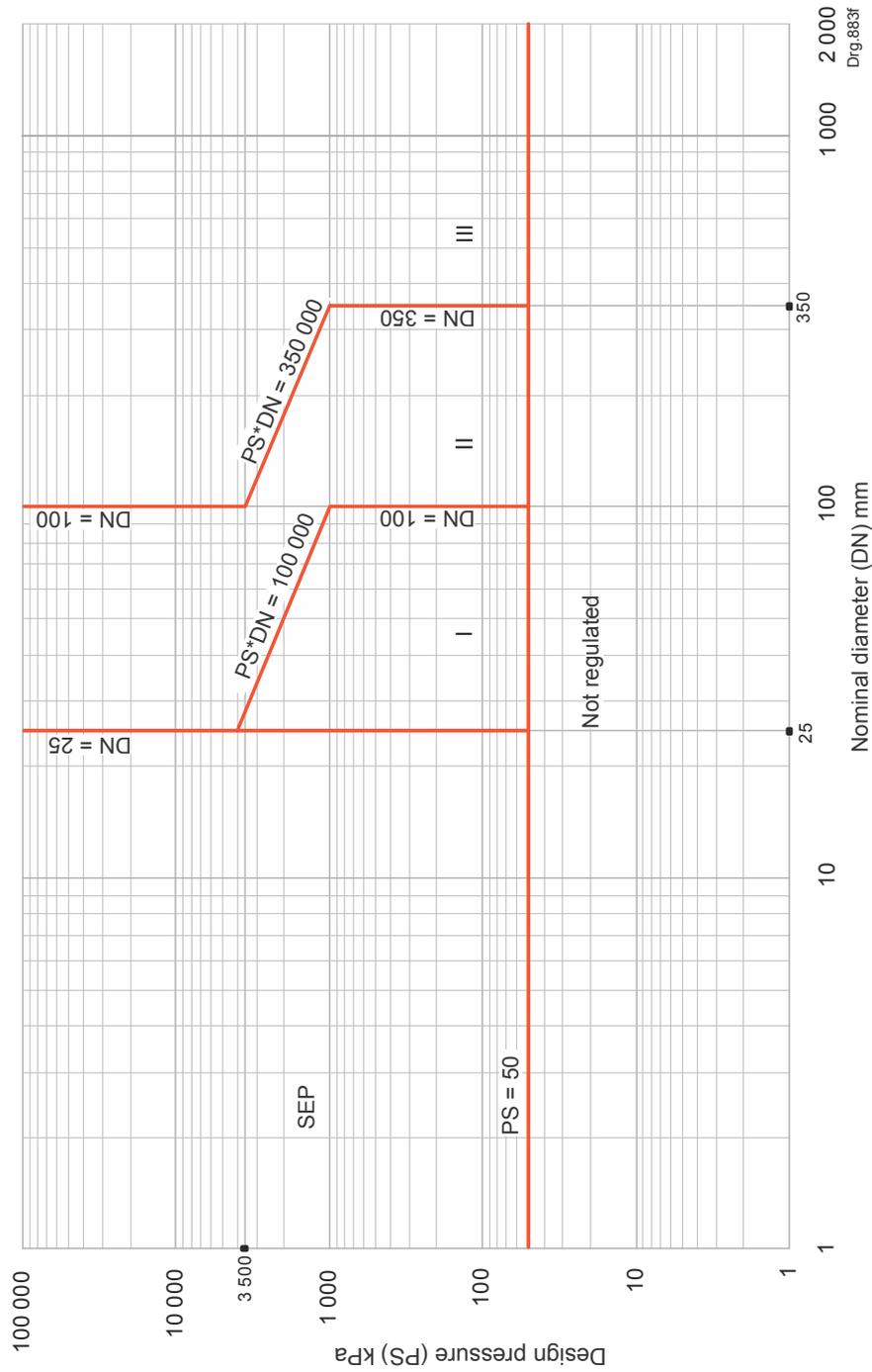


Figure 6 — Graph for piping — Dangerous gas

4.4.4.2 Non-dangerous gas

All piping that contains fluids at a temperature greater than 350 °C (not applicable to non-metallic piping) and that falls into category II shall be classified as category III.

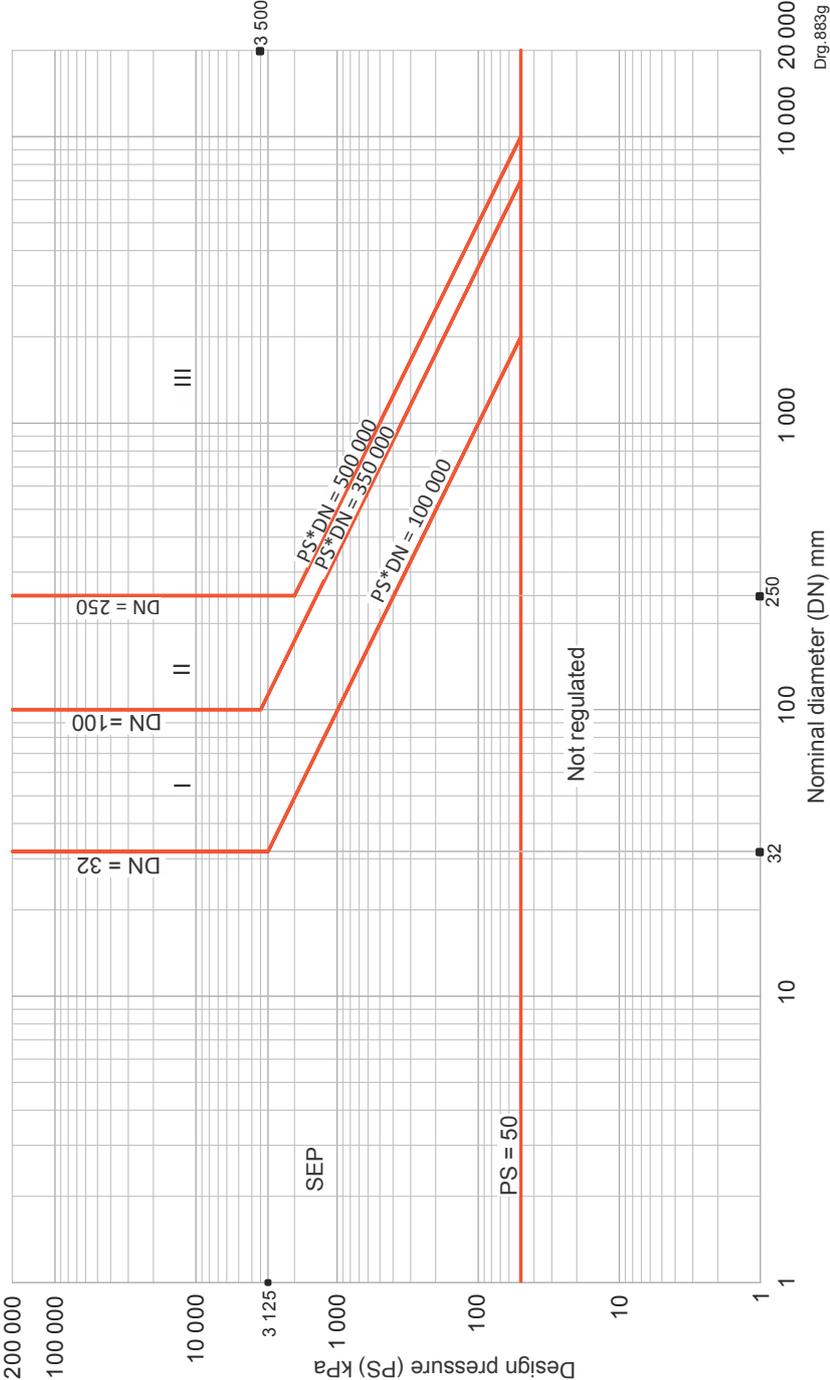


Figure 7 — Graph for piping — Non-dangerous gas

4.4.4.3 Dangerous liquids

Figure 8 shows the various categories for dangerous liquids contained in piping.

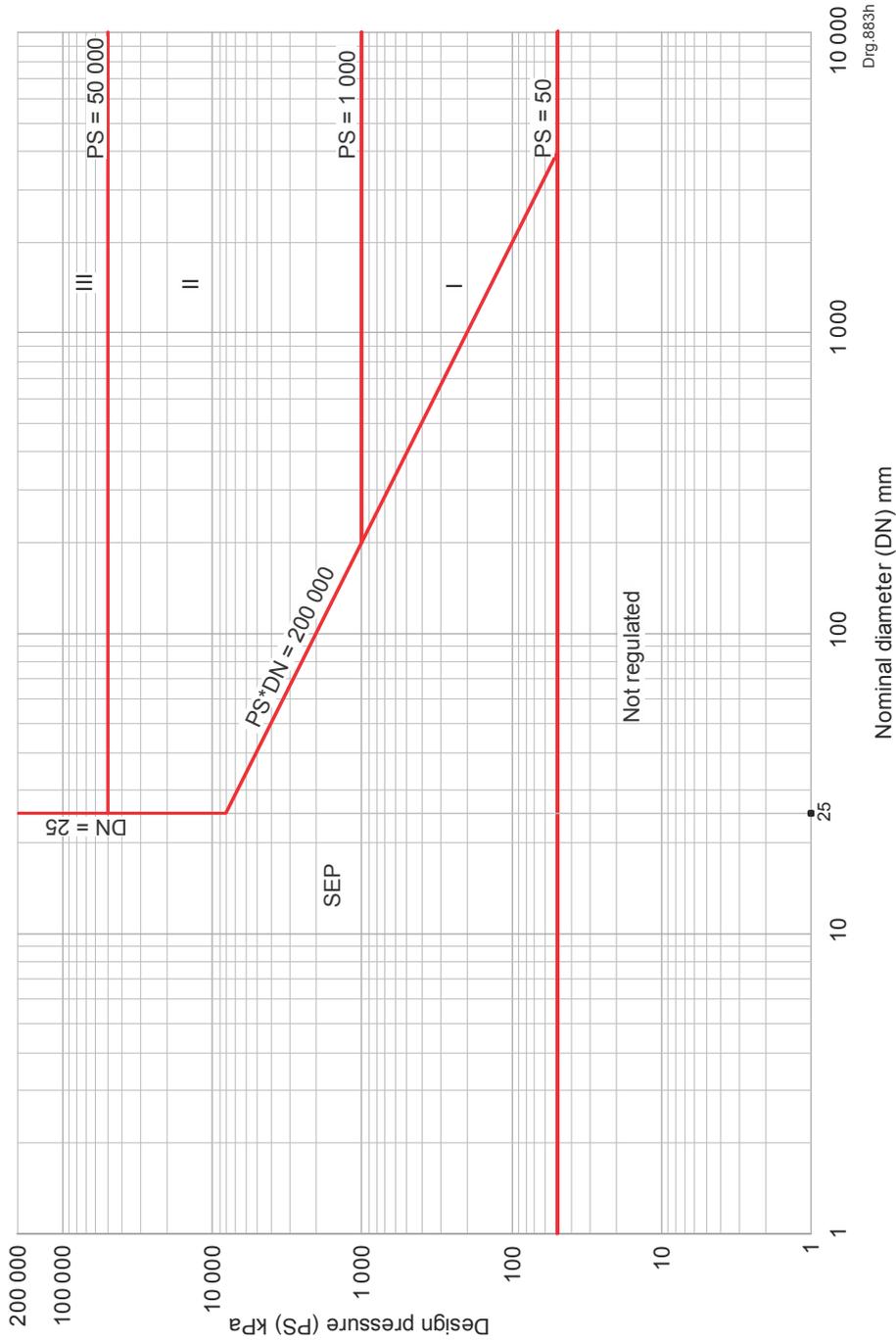


Figure 8 — Graph for piping — Dangerous liquids

4.4.4.4 Non-dangerous liquids

Figure 9 shows the various categories for non-dangerous liquids contained in piping.

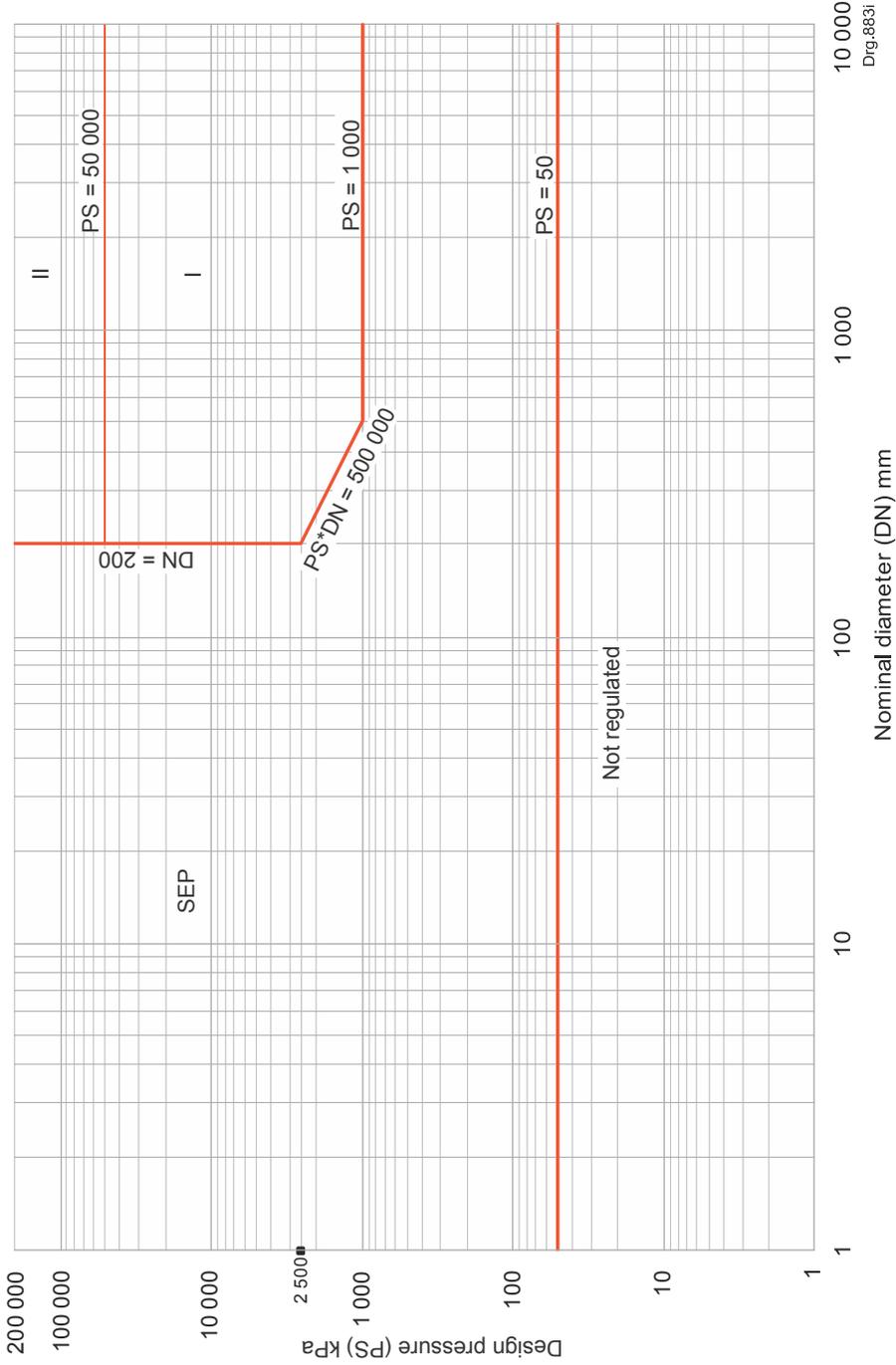


Figure 9 — Graph for piping — Non-dangerous liquids

4.4.5 Transportable pressure equipment for dangerous fluids

Figure 10 shows the various categories and for dangerous gas contained in transportable pressure equipment.

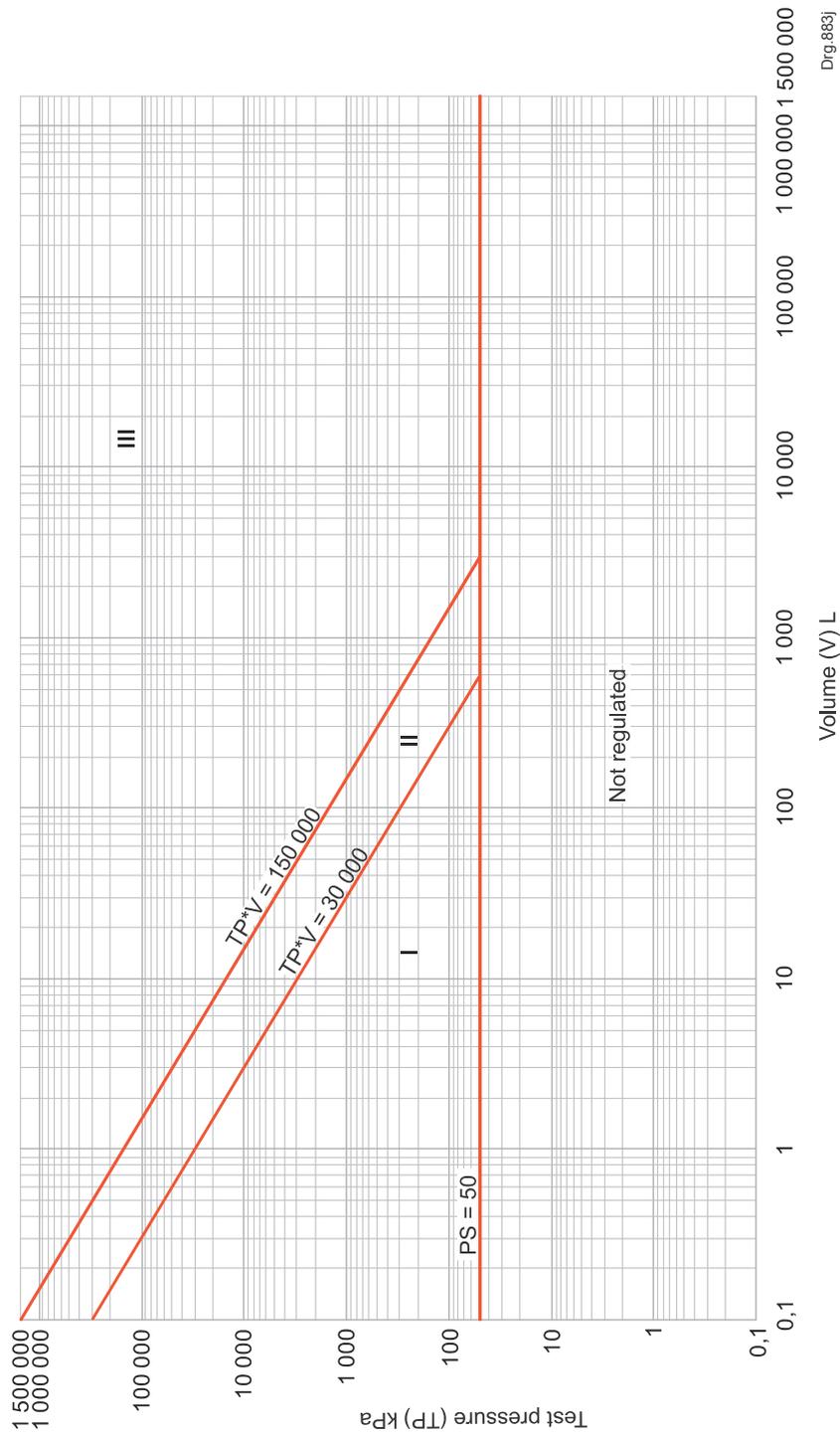


Figure 10 — Graph for transportable container and vessels for dangerous gas

5 Conformity assessment criteria

5.1 General

5.1.1 Before putting pressure equipment classified as either hazard category I, II, III or IV on the market, such equipment shall be subjected to the procedures in the appropriate conformity assessment modules (see modules A to H1) in 5.3 to 5.15 (inclusive).

The modules for products in categories II, III and IV require the involvement of an independent body, (certification body, AIA or third-party organization) either in the approval and monitoring of the manufacturer's quality system, or in direct product inspection.

Third-party organizations, when approved by the regulatory authority, may also carry out the approval of welding procedures and personnel, including non-destructive testing personnel, as required for pressure equipment assemblies classified as category II, III and IV. For direct product inspection the manufacturer shall appoint the AIA if not appointed by the buyer or user of the equipment.

Modules differ according to the type of assessment (for example, documentary checks, type approval, design approval, quality assurance) and the organization carrying out the assessment (i.e. the manufacturer and AIA or a certification body).

See annex C for specific requirements pertaining to ASME pressure equipment.

5.1.2 According to the category of the equipment, manufacturers shall use the modules as given in this standard and table 2 to allow for proper choice according to application. The categories for transportable containers are given in table 3.

NOTE The modules attributed to a higher hazard category may also be used in the lower categories.

5.1.3 Assemblies shall be subjected to a global conformity assessment procedure comprising:

- a) assessment of each item of pressure equipment making up the assembly that has not been previously subjected to a conformity assessment procedure and to a separate marking; the assessment procedure shall be determined by the category of each item of equipment;
- b) the assessment of the integration of the various components of the assembly shall be determined by the highest category applicable to the equipment concerned other than that applicable to any safety accessories;
- c) the assessment of the protection of an assembly against exceeding the permissible operating limits shall be conducted in the light of the highest category applicable to the items of equipment to be protected; and
- d) whereas this global conformity assessment procedure relates to assemblies composed of several pieces of pressure equipment assembled to constitute an integrated and functional whole; whereas these assemblies may range from simple assemblies such as pressure cookers to complex assemblies such as water tube boilers; whereas, if the manufacturer of an assembly intends it to be placed on the market and put into service as an assembly - and not in the form of its constituent non-assembled elements - that assembly shall conform to this global conformity assessment procedure; whereas, on the other hand, this global conformity assessment procedure does not cover the assembly of pressure equipment on the site and under the responsibility of the user, as in the case of industrial installations.

5.1.4 Certificate or declaration of conformity and marking

Once conformity assessment has been completed, and if the equipment or assembly complies with the provisions of the relevant national legislation (see foreword), the manufacturer shall be required to affix the marking to each item of pressure equipment or assembly and draw up a declaration of conformity.

Table 2 — Conformity assessment modules for each category of pressure equipment excluding transportable pressure equipment for dangerous fluids

1	2	3	4	5
Hazard category	Conformity assessment modules ^a			
	Manufacturer without certified quality system		Manufacturer with certified quality system	
	Single product	Serial production	Single product	Serial production
I	A		A	
II	A1	A1	D1	E1
III	B1 + F	B + C1	H	B1+ D or B + E
IV	G	B + F	H1	B + D
<p>A = internal production control A1 = internal manufacturing checks with monitoring of the final assessment B = type verification B1 = design verification C1 = conformity to type (and verification of final assessment) D = production quality assurance for final inspection and testing D1 = production quality assurance for final inspection and testing E = product quality assurance for final inspection and testing E1 = product quality assurance for final inspection and testing F = product verification G = unit verification H = full quality assurance H1 = full quality assurance with design verification and special surveillance of the final assessment</p>				
<p>^a Conformity assessment modules selected for serial and single production are interchangeable.</p>				

Table 3 — Conformity modules for transportable containers and vessels for dangerous fluids

1	2	3	4	5
Hazard category	Conformity assessment modules ^a			
	Manufacturer without certified quality system		Manufacturer with certified quality system	
	Single product	Serial production	Single product	Serial production
I	A1	A1	D1	E1
II	B1 + F	B + C1	H	B1 + D or B + E
III	G	B + F	H1	B + D
A1 = Internal manufacturing checks with monitoring of the final assessment B = type verification B1 = design verification C1 = conformity to type (and verification of final assessment) D = production quality assurance for final inspection and testing D1 = production quality assurance for final inspection and testing E = product quality assurance for final inspection and testing E1 = product quality assurance for final inspection and testing F = product verification G = unit verification H = full quality assurance H1 = full quality assurance with design verification and special surveillance of the final assessment				
^a Conformity assessment modules selected for serial and single production are interchangeable.				

5.2 Final assessment

5.2.1 General

Pressure equipment shall be subjected to a final assessment by the manufacturer as described in 5.2.2 to 5.2.4 (inclusive). AIA shall also carry out final assessment as per conformity assessment modules C1 (monitoring), E1, F, G, H1.

5.2.2 Final inspection

Pressure equipment shall undergo a final inspection to assess visually and by examination of the accompanying documents compliance with the requirements of the applicable health and safety standard(s). Tests carried out during manufacture may be taken into account. In order to comply with the safety requirements, the final inspection shall be carried out internally and externally on every part of the equipment, where appropriate, in the course of manufacture (e.g. where examination during the final inspection is no longer possible).

5.2.3 Pressure test

Final assessment of pressure equipment shall include a test for the pressure containment aspect, which will normally take the form of a hydrostatic pressure test at a pressure at least equal, where appropriate, to the value specified in the applicable health and safety standard(s).

For category I series-produced pressure equipment, this test may be performed on a statistical basis.

Where the hydrostatic pressure test is harmful or impractical, other tests of a recognized value may be carried out. For tests other than the hydrostatic pressure test, additional measures, such as non-destructive tests or other methods of equivalent validity, shall be applied before those tests are carried out.

5.2.4 Assemblies

For assemblies, the final assessment shall also include a check of the safety accessories intended to check full compliance with the requirements specified in the applicable health and safety standard(s).

5.2.5 Imported pressure equipment

Pressure equipment imported into South Africa (with all the documentation and marking, as required by the statutory regulations), shall be subjected to a conformity assessment review by the importer to ensure compliance with the relevant national legislation (see foreword). All reviews of pressure vessels, steam generators and assemblies shall be verified by an AIA (appointed by the importer) except where manufactured under SEP and category 1 requirements, as applicable.

5.2.5.1 CE and Pi marked equipment

CE and Pi (π) marked equipment in accordance with the PED/TPED and manufactured to the applicable health and safety standard(s) referred to in the relevant national legislation (see foreword) and annex A shall be acceptable for importation into South Africa provided the equipment is verified for compliance with the relevant national legislation (see foreword) by the importer and the AIA for pressure equipment category 2 and above.

5.2.5.2 ASME stamped equipment

ASME stamped equipment complying to ASME shall be acceptable for importation into South Africa provided the equipment is verified for compliance with the relevant national legislation (see foreword) by the importer and the AIA for pressure equipment category 2 and above (see also annex C).

5.2.5.3 DoT stamped equipment

DoT stamped pressure equipment complying with DoT regulations and stamped with DoT manufacturer's Registration Number (Mxxxx) shall be acceptable for importation into South Africa provided the equipment is verified for compliance with the relevant national legislation (see foreword) by the importer and the AIA for pressure equipment category 2 and above.

5.3 Module A — Internal production control

5.3.1 This module describes the procedure whereby the manufacturer, or his authorized representative established in South Africa, shall comply with the requirements in 5.3.2 and shall declare that the pressure equipment complies with the requirements of the applicable statutory regulations for pressure equipment. The manufacturer, or his authorized representative established

in South Africa, shall affix to each item of pressure equipment the permanent marking or data plate, as relevant, required by the pressure equipment regulations, and draw up a certificate of conformity.

5.3.2 The manufacturer shall draw up the technical documentation described in 5.3.3 and, either the manufacturer or his authorized representative established in South Africa, shall make it available to the relevant regulatory authority for inspection purposes for a period of twelve years after the last of the pressure equipment has been manufactured.

Where neither the manufacturer nor his authorized representative is established in South Africa, the obligation to keep the technical documentation available is the responsibility of the person who places the pressure equipment on the local market.

5.3.3 The technical documentation shall enable an assessment to be made of the conformity of the pressure equipment with the requirements of the applicable statutory regulations for pressure equipment. It shall, as far as is relevant for such assessment, cover the design, manufacture and operation of the pressure equipment, and contain the following:

- a) a general description of the pressure equipment;
- b) conceptual design and manufacturing drawings and diagrams of components, subassemblies, circuits, etc.;
- c) descriptions and explanations necessary for an understanding of the said drawings and diagrams and the operation of the pressure equipment;
- d) the applicable health and safety standard(s);
- e) results of design calculations made, verifications carried out, etc.; and
- f) inspection results and test reports.

5.3.4 The manufacturer, or his authorized representative established in South Africa, shall keep a copy of the certificate of conformity with the technical documentation.

5.3.5 The manufacturer shall take all measures necessary to ensure that the manufactured pressure equipment complies with the technical documentation referred to in 5.3.3 and with the applicable statutory regulations for pressure equipment.

5.4 Module A1 — Internal manufacturing checks with monitoring of the final assessment

In addition to the requirements of module A (see 5.3), the following shall apply:

- a) Final assessment shall be performed by the manufacturer and it shall be monitored by means of unexpected visits by an AIA.
- b) During such visits, the AIA shall
 - 1) establish that the manufacturer has performed the final assessment in accordance with the requirements of the applicable code of construction; and
 - 2) take samples of pressure equipment at the manufacturing or storage premises in order to conduct checks. The AIA shall assess the number of items of equipment to be sampled and shall perform, or have performed, all or part of the final assessment of the pressure equipment samples.

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- c) Should one or more of the items of pressure equipment not conform, the AIA shall take appropriate measures.
- d) On the responsibility of the AIA, the manufacturer shall affix the AIA's identification number to each pressure equipment.

5.5 Module B — Type verification

5.5.1 This module describes the part of the procedure whereby an AIA ascertains and attests that a representative sample of the product concerned complies with the requirements of the applicable statutory regulations for pressure equipment.

5.5.2 The application for type verification shall be lodged by the manufacturer, or by his authorized representative established in South Africa, with a single AIA of his choice provided that the AIA's scope of accreditation allows it to do this type of work.

5.5.3 The application shall contain

- a) the name and address of the manufacturer and, if the application is lodged by the manufacturer's authorized representative established in South Africa, his name and address as well,
- b) a written declaration that a similar application has not been lodged with another AIA,
- c) the technical documentation described in 5.5.5.

5.5.4 The applicant shall make available to the AIA a representative sample of the product concerned, hereinafter called 'type'. The AIA may request further samples should the test programme so require. A type may cover several versions of pressure equipment provided that the differences between the versions do not affect the level of safety.

5.5.5 The technical documentation shall enable an assessment to be made of the conformity of the pressure equipment with the requirements of the applicable statutory regulations for pressure equipment. It shall, as far as is relevant for such assessment, cover the design, manufacture and operation of the pressure equipment, and contain the following:

- a) a general description of the type;
- b) conceptual design, manufacturing drawings and diagrams of components, subassemblies, circuits, etc.;
- c) descriptions and explanations necessary for an understanding of the said drawings and diagrams and the operation of the pressure equipment;
- d) the applicable health and safety standard(s);
- e) results of design calculations made, verifications carried out, etc.;
- f) test reports; and
- g) information concerning the tests carried out during manufacture.

5.5.6 The AIA shall

- a) examine the technical documentation, verify that the type has been manufactured in conformity therewith and identify the components designed in accordance with the relevant requirements of

the applicable health and safety standards, as well as those designed without complying with the requirements of those standards;

b) in particular, the AIA shall

- 1) examine the technical documentation with respect to the design and manufacturing procedures;
- 2) verify the materials used for compliance with the applicable health and safety standard(s);
- 3) approve the procedures for the permanent joining of pressure equipment parts; and
- 4) verify that the personnel undertaking the permanent joining of pressure equipment parts and the non-destructive tests are qualified or have been approved in accordance with the applicable statutory regulations for pressure equipment;

c) perform, or have performed, the appropriate verifications and necessary tests to establish whether the solutions adopted by the manufacturer comply with the requirements of the applicable statutory regulations for pressure equipment;

d) perform or have performed the appropriate verifications and necessary tests to establish whether, where the manufacturer has chosen to apply the applicable health and safety standard(s), these have actually been applied; and

e) agree with the applicant as to the location where the verifications and necessary tests shall be carried out.

5.5.7 Where the type complies with the applicable statutory regulations for pressure equipment, the AIA shall issue a type-verification certificate to the applicant. The certificate, which shall be valid for twelve years and be renewable, shall contain the name and address of the manufacturer, the results of the verification and the necessary data for identification of the approved type.

5.5.8 A list of the relevant parts of the technical documentation shall be annexed to the type-verification certificate and a copy shall be kept by the AIA. If the AIA refuses to issue a type-verification certificate to the manufacturer, or to his authorized representative established in South Africa, that body shall provide detailed reasons for such refusal. Appeals can be lodged with the relevant regulatory authority.

5.5.9 The applicant shall inform the AIA that holds the technical documentation concerning the type-verification certificate, of all modifications to the approved pressure equipment; these modifications are subjected to additional approval where they might affect compliance with the essential requirements or the prescribed conditions for use of the pressure equipment. This additional approval shall be given in the form of an annex to the original type-verification certificate.

5.5.10 Each AIA shall communicate to the relevant regulatory authority the relevant information concerning type-verification certificates which it has withdrawn, and, on request, those it has issued. Each AIA shall also communicate to other AIAs the relevant information concerning the type-verification certificates it has withdrawn or refused.

5.5.11 The other AIAs may receive copies of the type-verification certificates or their annexes (or both). The annexes to the type-verification certificates shall also be made available to them.

5.5.12 The manufacturer, or his authorized representative established in South Africa, shall keep together with the technical documentation, copies of type-verification certificates and their annexes for a period of twelve years after the last of the pressure equipment has been manufactured.

5.5.13 Where neither the manufacturer nor his authorized representative is established in South Africa, the obligation to keep the technical documentation available is the responsibility of the person who places the product on the local market.

5.6 Module B1 – Design verification

5.6.1 This module describes the procedure whereby an AIA ascertains and attests that the design meets the provisions of the health and safety standard(s) which applies to it.

5.6.2 The manufacturer, or his authorized representative established within South Africa, shall lodge an application for design verification with a single AIA.

5.6.3 The application shall include:

- a) the name and address of the manufacturer and, if the application is lodged by the authorized representative, his name and address as well,
- b) a written declaration that the same application has not been lodged with any other AIA,
- c) the technical documentation described in 5.6.5.

5.6.4 The application may cover several versions of the pressure equipment provided that the differences between the versions do not affect the level of safety.

5.6.5 The technical documentation shall enable an assessment to be made of the conformity of the pressure equipment with the requirements of the relevant national legislation (see foreword) which apply to it. It shall, as far as is relevant for such assessment, cover the design, manufacture and operation of the pressure equipment and contain:

- a) a general description of the pressure equipment,
- b) conceptual design and manufacturing drawings and diagrams of components, subassemblies, circuits, etc.,
- c) descriptions and explanations necessary for an understanding of the said drawings and diagrams and the operation of the pressure equipment,
- d) a list of the standards referred to in annex A, applied in full, and descriptions of solutions adopted to meet the essential requirements of the relevant national legislation (see foreword) where the standards referred to in annex A have not been applied,
- e) the necessary supporting evidence for the adequacy of the design solution. This supporting evidence shall include the results of tests carried out by the appropriate laboratory of the manufacturer or on his behalf,
- f) results of design calculations made, examinations carried out, etc.; and
- g) information regarding the qualifications or approvals required for manufacturing.

5.6.6 The AIA shall examine the technical documentation and identify the components which have been designed in accordance with the relevant provisions of the standards referred to in annex A.

5.6.7 In particular, the AIA shall:

- a) approve the procedures for manufacturing of pressure equipment parts, or check that they have been previously approved;
- b) verify that the personnel undertaking the permanent joining of pressure equipment parts and the non-destructive tests are qualified or approved in accordance with manufacturing requirements;
- c) perform the necessary examinations to establish whether the solutions adopted by the manufacturer meet the essential requirements of the relevant national legislation (see foreword),
- d) perform the necessary examinations to establish whether, the relevant standards, have been applied;
- e) verify materials compliance; and
- f) verify procedures for permanent jointing.

5.6.8 Where the design meets the provisions of the relevant national legislation (see foreword) which apply to it, the AIA shall issue a design verification report to the applicant. The report shall contain the name and address of the applicant, the conclusions of the verification, conditions for its validity and the necessary data for identification of the approved design.

5.6.9 A list of the relevant parts of the technical documentation shall be annexed to the report and a copy kept by the AIA.

5.6.10 If the AIA refuses to issue a design verification report to the manufacturer or to his authorized representative established within South Africa, that AIA shall provide detailed reasons for such refusal.

5.6.11 Provision shall be made for an appeals procedure.

5.6.12 The applicant shall inform the AIA that holds the technical documentation concerning the design verification report of all modifications to the approved design; these are subject to additional approval where such changes may affect the conformity of the pressure equipment with the essential requirements of the relevant national legislation (see foreword) or the prescribed conditions for use of the equipment. This additional approval shall be given in the form of an addition to the original design verification report.

5.6.13 Each AIA shall communicate to the other AIAs the relevant information concerning the design verification reports it has withdrawn or refused.

The other AIA's may on request obtain the relevant information concerning:

- a) the design verification reports and additions granted; and
- b) the design verification reports and additions withdrawn.

5.6.14 The manufacturer, or his authorized representative established within South Africa, shall keep with the technical documentation referred to in 5.6.5 copies of the design-verification report and their additions for a period of twelve years (12) after the last of the pressure equipment has been manufactured.

5.6.15 Where neither the manufacturer nor his authorized representative is established within South Africa, the obligation to keep the technical documentation available is the responsibility of the person who places the product on the market (the importer).

5.7 Module C1 — Conformity to type

5.7.1 This module describes the procedure whereby the manufacturer, or his authorized representative established in South Africa, shall ensure and declare that the pressure equipment concerned complies with the type as described in the type-verification certificate and complies with the requirements of the applicable statutory regulations for pressure equipment. The manufacturer, or his authorized representative established in South Africa, shall affix his own manufacturing mark to each item of pressure equipment and draw up a certificate of conformity.

5.7.2 The manufacturer shall take all measures necessary to ensure that pressure equipment complies with the type described in the type-verification certificate and with the requirements of the applicable statutory regulations for pressure equipment.

5.7.3 The manufacturer, or his authorized representative established in South Africa, shall keep a copy of the certificate of conformity for a period of twelve years after the last of the pressure equipment has been manufactured.

5.7.4 Where neither the manufacturer nor his authorized representative is established in South Africa, the obligation to keep the technical documentation available is the responsibility of the person who places the pressure equipment on the local market.

5.7.5 Final assessment shall be subjected to monitoring in the form of unexpected visits by an AIA chosen by the manufacturer.

5.7.6 During such visits, the AIA shall

- a) establish that the manufacturer has performed the final assessment in accordance with the applicable code of construction; and
- b) take samples of the pressure equipment at the manufacturing or storage premises in order to conduct checks. The AIA shall assess the number of items of equipment to be sampled and shall decide whether it is necessary to perform, or have performed, all or part of the final assessment on the pressure equipment samples.

5.7.7 Should one or more of the items of pressure equipment not conform to the module, the AIA shall take appropriate measures.

5.7.8 On the responsibility of the AIA, the manufacturer shall affix the AIA's identification number to each item of pressure equipment.

5.8 Module D — Production quality assurance

5.8.1 General

This module describes the procedure whereby the manufacturer, who complies with the requirements of 5.8.2.1, shall ensure and declare that the pressure equipment concerned complies with the type described in the type-verification certificate or design-verification certificate and complies with the requirements of the applicable statutory regulations for pressure equipment. The manufacturer, or his authorized representative established in South Africa, shall affix the manufacturer's mark to each item of pressure equipment and draw up a certificate of conformity. The manufacturer's mark shall be accompanied by the identification number of the AIA responsible for surveillance, as specified in 5.8.3.

5.8.2 Certified quality system

5.8.2.1 The manufacturer shall operate a certified quality system for production, final inspection and testing as specified in 7.1 and be subject to surveillance as specified in 7.2.

5.8.2.2 The quality system shall ensure compliance of the pressure equipment with the type described in the type-verification certificate or design-verification certificate and with the requirements of the applicable statutory regulations for pressure equipment.

5.8.3 Type verification or Design verification

The manufacturer shall lodge an application for an AIA to perform the type verification or design verification and issue an applicable certificate before the manufacturer applies for certification of the quality system.

5.9 Module D1 — Production quality assurance

5.9.1 This module describes the procedure whereby the manufacturer, who complies with the requirements of 5.9.3 below, ensures and declares that the items of pressure equipment concerned satisfy the requirements of the applicable statutory regulations for pressure equipment. The manufacturer, or his authorized representative established in South Africa, shall affix the manufacturer's mark to each item of pressure equipment and draw up a written certificate of conformity. The manufacturer's marking shall be accompanied by the identification number of the certification body responsible for surveillance as specified in 5.9.3.

5.9.2 The manufacturer shall draw up the technical documentation described below. The technical documentation shall enable an assessment to be made of the conformity of the pressure equipment with the requirements of the applicable statutory regulations for pressure equipment. It shall, as far as is relevant for such assessment, cover the design, manufacture and operation of the pressure equipment and contain:

- a) a general description of the pressure equipment;
- b) conceptual design and manufacturing drawings and diagrams of components, subassemblies, circuits, etc.;
- c) descriptions and explanations necessary for an understanding of the said drawings and diagrams and the operation of the pressure equipment;
- d) a list of the standards referred to in annex A and descriptions of the solutions adopted to meet the essential requirements of the applicable statutory regulations for pressure equipment;
- e) results of design calculations made, examinations carried out, etc.; and
- f) test reports.

5.9.3 The manufacturer shall operate a certified quality system for production, final inspection and testing as specified in 7.1 and be subject to surveillance as specified in 7.2.

5.9.4 The quality system shall ensure compliance of the pressure equipment with the requirements of the applicable statutory regulations for pressure equipment.

5.10 Module E — Product quality assurance

5.10.1 The manufacturer shall operate a certified quality system for the final pressure equipment inspection and testing, as specified in clause 7 and be subjected to surveillance as specified in 7.2.

5.10.2 Under the quality system, each item of the pressure equipment shall be verified and appropriate tests, as set out in the applicable health and safety standard(s), or equivalent tests, particularly for final assessment as referred to in the applicable code of construction, shall be carried out in order to ensure its compliance with the requirements of the applicable statutory regulations for pressure equipment.

5.11 Module E1 — Product quality assurance

5.11.1 This module describes the procedure whereby the manufacturer, who complies with the requirements of 5.11.3, shall ensure and declare that the pressure equipment concerned complies with the requirements of the applicable statutory regulations for pressure equipment. The manufacturer, or his authorized representative established in South Africa, shall affix the manufacturer's mark to each item of pressure equipment and draw up a certificate of conformity. The mark shall be accompanied by the identification number of the approved certification body responsible for surveillance.

5.11.2 The manufacturer shall draw up the technical documentation. The technical documentation shall enable an assessment to be made of the conformity of the pressure equipment with the requirements of the applicable statutory regulations for pressure equipment. It shall, as far as is applicable for such assessment, cover the design, manufacture and operation of the pressure equipment and contain the following:

- a) a general description of the pressure equipment;
- b) conceptual design and manufacturing drawings and diagrams of components, subassemblies, circuits, etc.;
- c) descriptions and explanations necessary for an understanding of the said drawings and diagrams and the operation of the pressure equipment;
- d) a list of the health and safety standards, applied in full or in part, and descriptions of the solutions adopted to meet the essential requirements of the applicable statutory regulations for pressure equipment where the standards referred to in annex A have not been applied;
- e) results of design calculations made, verifications carried out, etc.; and
- f) test reports.

5.11.3 The manufacturer shall operate a certified quality system in accordance with 7.1 and for the final pressure equipment inspection and testing by an AIA and be subjected to surveillance by an approved certification body in accordance with 7.2.

5.12 Module F — Product verification

5.12.1 This module describes the procedure whereby the manufacturer, or his authorized representative established in South Africa, shall ensure and declare that the pressure equipment subjected to the requirements in 5.12.3 complies with the type as described in the type-verification certificate, or in the design-verification certificate, and that it complies with the requirements of the applicable statutory regulations for pressure equipment.

5.12.2 The manufacturer, or his authorized representative established in South Africa, shall affix the manufacturer's mark to all the pressure equipment concerned and draw up a certificate of conformity. The manufacturer, or his authorized representative established in South Africa, shall

keep a copy of the certificate of conformity for a period of twelve years after the last of the pressure equipment has been manufactured.

5.12.3 The AIA shall perform the appropriate verifications and tests in order to check the conformity of the pressure equipment with the applicable requirements of the statutory regulations for pressure equipment by examining and testing every product in accordance with 5.12.4 to 5.12.7 (inclusive).

5.12.4 Each item of pressure equipment shall be individually examined and shall undergo appropriate verifications and tests as set out in the applicable health and safety standards, or equivalent verifications and tests in order to verify that it conforms to the type and the requirements of the applicable statutory regulations for pressure equipment.

5.12.5 In particular, the AIA shall

- a) verify that the personnel undertaking the permanent joining of parts and the non-destructive tests are qualified or have been approved in accordance with the applicable code of construction;
- b) verify the certificate issued by the materials manufacturer in accordance with the applicable code of construction; and
- c) carry out or have carried out the final inspection and proof test referred to in the applicable code of construction and examine the safety devices, if applicable.

5.12.6 The AIA shall affix its identification number or have it affixed to each item of pressure equipment and countersign the certificate of conformity that relates to the tests carried out.

5.12.7 The manufacturer, or his authorized representative established in South Africa, shall ensure that the certificates of conformity countersigned by the AIA can be made available on request.

5.13 Module G — Unit verification

5.13.1 This module describes the procedure whereby the manufacturer shall ensure and declare that the pressure equipment, which has been issued with the certificate referred to in 5.13.4(f), complies with the requirements of the applicable statutory regulations for pressure equipment. The manufacturer shall affix the manufacturer's mark to the pressure equipment and draw up a certificate of conformity.

5.13.2 The manufacturer shall apply to an AIA of his choice for pressure equipment verification if the AIA was not appointed by the buyer/user.

NOTE It is the duty of the manufacturer to ensure that timely participation of the AIA on all pressure equipment verification irrespective of who appointed the AIA.

5.13.3 The technical documentation shall enable an assessment to be made of the conformity of the pressure equipment with the requirements of the applicable statutory regulations for pressure equipment. It shall cover the design, manufacture and operation of the pressure equipment.

The technical documentation shall contain the following:

- a) a general description of the pressure equipment;
- b) conceptual design and manufacturing drawings and diagrams of components, subassemblies, circuits, etc.;
- c) descriptions and explanations necessary for an understanding of the said drawings and diagrams and the operation of the pressure equipment;

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- d) a list of the health and safety standards, applied in full or in part, and descriptions of the solutions adopted to meet the essential requirements of the applicable statutory regulations for pressure equipment where the standards referred to in annex A have not been applied;
- e) results of design calculations made, verifications carried out, etc.;
- f) test reports; and
- g) appropriate details relating to the approval of the manufacturing and test procedures and of the qualifications or approval of the personnel concerned (see SANS 10227 and SANS 17020) in accordance with the applicable code of construction.

5.13.4 The AIA shall examine the design and construction of each item of pressure equipment and during manufacture and perform appropriate tests as set out in the applicable health and safety standards, or equivalent verifications and tests, to ensure its compliance with the requirements of the applicable code of construction.

In particular the AIA shall

- a) examine the technical documentation with respect to the design and manufacturing procedures;
- b) assess the materials used where these are not in conformity with the applicable health and safety standards, and check the certificate issued by the material manufacturer in accordance with the applicable code of construction;
- c) approve the procedures for the permanent joining of parts or check that they have been previously approved in accordance with the applicable code of construction;
- d) verify the qualifications or approval of the personnel (see SANS 10227 and SANS 17020), required under the applicable code of construction;
- e) carry out the final inspection referred to in the applicable code of construction, perform or have performed the tests referred to in the applicable code of construction, and examine the safety devices, if applicable; and
- f) affix its identification number or have it affixed to the pressure equipment and countersign the certificate of conformity for the tests carried out. This certificate shall be kept for a period of five years.

5.13.5 The manufacturer, or his authorized representative established in South Africa, shall ensure that this certificate of conformity can be made available on request.

5.14 Module H — Full quality assurance

5.14.1 General

This module describes the procedure whereby the manufacturer who complies with the requirements in 5.14.2 shall ensure and declare that the pressure equipment concerned complies with the requirements of the applicable statutory regulations for pressure equipment. The manufacturer, or his authorized representative established in South Africa, shall affix the manufacturer's mark to each item of pressure equipment and draw up a certificate of conformity.

The manufacturer's mark shall be accompanied by the identification number of the approved certification body (CB) responsible for surveillance, as specified in 7.2.

5.14.2 Quality system

The manufacturer shall operate a certified quality system for design, manufacture, final inspection and testing, and be subjected to surveillance as specified in clause 7.

5.15 Module H1 — Full quality assurance with design verification and special surveillance of the final assessment

5.15.1 In addition to the requirements of module H, the following shall apply:

- a) The manufacturer shall lodge an application for each unit of the pressure equipment for verification of the design with the AIA.
- b) The application shall enable the design, manufacture and operation of the pressure equipment to be understood, and enable conformity with the relevant requirements of the relevant national legislation (see foreword) to be assessed.

The application shall include

- 1) the technical design specifications, including standards, which have been applied, and
 - 2) the necessary supporting evidence for their adequacy, in line with the particular health and safety standard(s). This supporting evidence shall include the results of tests carried out by the appropriate laboratory of the manufacturer or by the AIA as required by the particular health and safety standard(s).
- c) The AIA shall examine the application and, where the design complies with the requirements of the applicable statutory regulations for pressure equipment, shall issue a design-verification certificate to the applicant. The certificate shall contain the results of the verification, the conditions for its validity, the necessary data for identification of the approved design and, if relevant, a description of the functioning of the pressure equipment or accessories.
 - d) The applicant shall inform the AIA that has issued the design-verification certificate of all the modifications to the approved design. Where the modifications to the approved design might affect compliance with the essential requirements of the applicable statutory regulations for pressure equipment or the prescribed conditions for use of the pressure equipment, these modifications shall receive additional verification from the AIA that issued the design-verification certificate. This additional verification shall be given in the form of an annex to the original design-verification certificate.
 - e) Each AIA shall also communicate to other inspection authorities the relevant information concerning the design-verification certificates it has withdrawn or refused.

5.15.2 Final assessment shall be subjected to increased surveillance in the form of unexpected visits by the AIA. In the course of such visits, the AIA shall conduct verifications on the pressure equipment.

6 Essential requirements for construction

6.1 Pressure equipment shall be designed, manufactured and checked, and if applicable equipped and installed, in such a way as to ensure its safety when put into service in accordance with the manufacturer's instructions, or in reasonably foreseeable conditions. The design of category II, III and IV pressure equipment shall be approved by a professionally registered person in this field, and prior to submission for verification by the AIA when applicable. (See also 4.1.4.)

6.2 The pressure equipment shall be properly designed taking all relevant factors into account in order to ensure that the equipment will be safe throughout its intended life. The pressure equipment shall be designed for loadings appropriate to its intended use and other reasonably foreseeable operating conditions.

6.3 Design stability aspects

Where the calculated thickness does not allow for adequate structural stability, the necessary measures shall be taken to remedy the situation taking into account the risks from transport and handling.

6.4 Assemblies

Assemblies shall be so designed that:

- a) the components to be assembled together are suitable and reliable for their duty; and
- b) all the components are properly integrated and assembled in an appropriate manner.

6.5 Means of examination

6.5.1 Pressure equipment shall be designed and constructed so that all necessary examinations to ensure safety can be carried out.

6.5.2 Means of determining the internal condition of the equipment shall be available, where it is necessary to ensure the continued safety of the equipment, such as access openings allowing physical access to the inside of the pressure equipment so that appropriate examinations can be carried out safely and ergonomically.

6.5.3 Other means of ensuring the safe condition of the pressure equipment may be applied:

- a) where it is too small for physical internal access, or
- b) where opening the pressure equipment would adversely affect the inside, or
- c) where the substance contained has been shown not to be harmful to the material from which the pressure equipment is made and no other internal degradation mechanisms are reasonably foreseeable.

6.6 Safety accessories

6.6.1 Safety accessories shall:

- a) be so designed and constructed as to be reliable and suitable for their intended duty and take into account the maintenance and testing requirements of the devices, where applicable;
- b) be independent of other functions, unless their safety function cannot be affected by such other functions; and
- c) comply with appropriate design principles in order to obtain suitable and reliable protection.

6.6.2 These principles include, in particular, fail-safe modes, redundancy, diversity and self-diagnosis.

6.7 Manufacturing

6.7.1 Manufacturing procedures

The manufacturer shall ensure the competent execution of the provisions set out at the design stage by applying the appropriate techniques and relevant procedures, especially with a view to the aspects set out below.

6.7.1.1 Preparation of the component parts

Preparation of the component parts (e.g. forming and chamfering) shall not give rise to defects or cracks or changes in the mechanical characteristics likely to be detrimental to the safety of the pressure equipment.

6.7.1.2 Permanent joining

6.7.1.2.1 Permanent joints and adjacent zones shall be free of any surface or internal defects detrimental to the safety of the equipment.

6.7.1.2.2 The properties of permanent joints shall meet the minimum properties specified for the materials to be joined unless other relevant property values are specifically taken into account in the design calculations.

6.7.1.2.3 For pressure equipment, permanent joining of components which contribute to the pressure resistance of equipment and components which are directly attached to them shall be carried out by suitably qualified personnel according to suitable joining procedures.

6.7.1.2.4 For pressure equipment in categories II, III and IV, joining procedures and personnel shall be approved by a competent third party which, at the manufacturer's discretion, may be:

- a) an approved inspection authority; or
- b) a third-party organization recognized by the regulatory authority.

6.7.1.2.5 To carry out these approvals the third party shall perform examinations and tests as set out in the appropriate health and safety standard(s).

6.7.1.3 Heat treatment

Where there is a risk that the manufacturing process will change the material properties to an extent which would impair the safety of the pressure equipment, suitable heat treatment shall be applied at the appropriate stage of manufacture.

6.7.1.4 Traceability

Suitable procedures shall be established and maintained for identifying the material making up the components of the equipment which contribute to pressure resistance by suitable means from receipt, through production, up to the final test of the manufactured pressure equipment.

6.7.1.5 Control of manufacturing process

The manufacturer may use finished products, ready-made parts or components, or may subcontract these tasks. However, he shall always retain the overall control and have the necessary competence to take the responsibility for the product. The manufacturer constructs the pressure equipment with a view of placing it on the South African market on his own behalf or to sell it to a buyer for installation in industrial sites.

6.8 Operating instructions

6.8.1 When pressure equipment is placed on the market, it shall be accompanied, as far as relevant, with instructions for the user, containing all the necessary safety information relating to:

- a) mounting including assembling of different pieces of pressure equipment;
- b) putting into service; and
- c) use maintenance including checks by the user.

6.8.2 Instructions shall cover information affixed to the pressure equipment and shall be accompanied, where appropriate, by the technical documents, drawings and diagrams necessary for a full understanding of these instructions.

6.8.3 If appropriate, these instructions shall also refer to hazards arising from misuse and particular features of the design.

7 Quality system requirements

7.1 Quality system

The manufacturer shall operate a quality system for the manufacture, repair, modification and installation of pressure equipment to ensure compliance with the applicable health and safety standard(s). For certain conformity assessment modules the manufacturer's quality system shall be approved by a certification body.

7.1.1 When required by the applicable conformity assessment module the manufacturer shall lodge an application for assessment of his quality system with a certification body of his choice.

7.1.2 The application shall include

- a) all the relevant information on the pressure equipment concerned; and
- b) the documentation concerning the quality system.
- c) the technical documentation for the approved type and a copy of the type-verification certificate or design verification certificate, where and as applicable.

7.1.3 The quality system shall ensure compliance of the pressure equipment with the requirements of the applicable statutory regulations for pressure equipment in general, the applicable health and safety standard(s) in particular, the selected conformity assessment module and this standard. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic and orderly manner in the form of written policies, procedures and instructions. This quality system documentation shall permit a consistent interpretation of the procedures and quality measures such as programmes, plans, manuals and records.

7.1.4 The quality system documentation shall contain, in particular, a description of

- a) the quality objectives and the organizational structure, responsibilities and powers of management with regard to the quality of the design and to product quality;
- b) the technical design specifications, including standards, that will be applied and, means that will be used to ensure that the requirements of the applicable statutory regulations for pressure equipment will be complied with;

- c) the design control and design verification techniques, processes and systematic measures that will be used when designing the pressure equipment, particularly with regard to materials, in accordance with the applicable code of construction;
- d) the corresponding manufacturing, quality control and quality assurance techniques, processes and systematic measures that will be used, particularly the procedures for the permanent joining of parts as approved in accordance with the applicable code of construction;
- e) the verifications and tests that will be carried out before, during, and after manufacture, and the frequency with which they will be carried out;
- f) the quality records, such as inspection reports and test data, calibration data, reports on the qualifications or approval of the personnel concerned (see SANS 10227 and SANS 17020), particularly those of the personnel undertaking the permanent joining of parts and the non-destructive tests in accordance with the applicable code of construction; and
- g) the means of monitoring the achievement of the required pressure equipment design and quality and the effective operation of the quality system.

7.1.5 The certification body shall assess the quality system to determine whether it complies with the requirements in the applicable health and safety standard(s).

7.1.6 The auditing team shall have at least one member that is experienced in the assessment of the pressure equipment technology concerned, for example, an inspector of pressurized equipment (IPE). The assessment procedure shall include an inspection visit to the manufacturer's premises. The decision to visit shall be notified to the manufacturer. The notification shall contain the results of the verification and the previous assessment visit. Provision shall be made for an appeals procedure.

7.1.7 The manufacturer shall undertake to fulfil the obligations that arise from the certified quality system and to ensure that the system remains satisfactory and efficient.

7.1.8 The manufacturer shall inform the certification body that has approved the quality system of any intended modifications to the quality system. The certification body shall assess the proposed changes and decide whether the amended quality system will still comply with the requirements in the applicable health and safety standard(s) or whether a reassessment is required. The certification body shall notify its decision to the manufacturer. The notification shall contain the results of the verification and the assessment decision.

7.1.9 Acceptable quality systems are:

- a) SANS 3834 and ASME VIII-Division 1,
- b) European certificate certified systems (For example manufacturing to PED Modules D; E; H; H1); and
- c) SANS 9001 series adapted to address all the requirements of the applicable health and safety standard(s).

7.2 Surveillance

7.2.1 The purpose of surveillance is to ensure that the manufacturer duly fulfils the obligations that arise from the approved quality system.

7.2.2 The manufacturer shall allow the certification body access, for inspection purposes, to the locations of manufacture, inspection, testing and storage, and provide it with all the necessary information, in particular,

- a) the quality system documentation,
- b) the technical documentation, and
- c) the quality records, such as inspection reports and test data, calibration data, and reports on the qualifications of the personnel concerned.

7.2.3 The certification body shall carry out periodic audits to ensure that the manufacturer maintains and applies the quality system and shall provide the manufacturer with an audit report. The frequency of periodic audits shall be such that a full reassessment is carried out every three years.

7.2.4 In addition, the certification body may pay unexpected visits to the manufacturer. The need for such additional visits, and the frequency thereof, shall be determined by a visit-control system operated by the certification body. The following factors, in particular, shall be considered in the visit-control system:

- a) the category of the equipment;
- b) the results of previous surveillance visits;
- c) the need to follow up on corrective action;
- d) special conditions linked to the approval of the system, where applicable; and
- e) significant changes in manufacturing organization, policy or techniques.

7.2.5 During such visits the certification body may, if necessary, carry out or have carried out tests to verify that the quality system is being applied correctly. The certification body shall provide the manufacturer with a visit report and, if a test has taken place, with a test report.

7.2.6 The manufacturer shall, for a period of twelve years after the last of the pressure equipment has been manufactured, make available to the national authorities:

- a) the documentation referred to in 7.1.2.b);
- b) the modifications referred to in 7.1.8; and
- c) the decisions and reports from the certification body referred to in 7.1.5, 7.1.6, 7.1.8, 7.2.3 and 7.2.5.

7.2.7 Each certification body shall communicate to the other certification bodies the relevant information concerning the quality system approvals that it has withdrawn or refused.

NOTE The manufacturer only needs to put a quality management system in place as required by the relevant module, for example,

- a) in module D, the manufacturer only needs a quality system that complies with 5.8.2 for production, final inspection and testing;
- b) in module E, the manufacturer only needs a quality system that complies with 5.9.2 for final inspection and testing;
- c) in module H, the manufacturer only needs a quality system that complies with 5.12.2 for design, production, final inspection and testing.

8 Marking

Where the pressure equipment is too small, e.g. accessories, the information referred to in the relevant national legislation (see foreword) may be given on a label attached to that pressure equipment provided a unique number is used to provide traceability to the label and any certificate.

Annex A
(normative)

**Schedule of health and safety standards as
approved by the Department of Labour**

1	2
American standards	
ASME Section I	Rules for construction of power boilers
ASME Section III	Rules for construction of nuclear facility components (divisions 1, 2 and 3)
ASME Section IV	Rules for construction of heating boilers
ASME Section VI	Recommended rules for the care and operation of heating boilers
ASME Section VII	Recommended guidelines for the care of power boilers
ASME Section VIII	Rules for construction of pressure vessels (divisions 1, 2 and 3)
ASME Section X	Fiber-reinforced plastic pressure vessels
ASME Section XI	Rules for inservice inspection of nuclear power plant components
ASME B31	ASME Code for pressure piping: B31.1 – Power piping B31.2 – Fuel gas piping B31.3 – Process piping B31.4 – Pipeline transportation systems for liquid hydrocarbons and other liquids B31.5 – Refrigeration piping and heat transfer components B31.8 – Gas transmission and distribution piping systems B31.8S – Managing system integrity of gas pipelines B31.9 – Building services piping B31.11 – Slurry transportation piping systems
ASME RTP-1	Reinforced thermoset plastic corrosion resistant equipment
ASME PCC-2	Repair of pressure equipment and piping
ASME PCC-3	Inspection planning using risk-based methods
ASME PVHO-1	Safety standard for pressure vessels for human occupancy
ASTM D 2774	Standard practice for underground installation of thermoplastic pressure piping
ASTM D 2996	Standard specification for filament-wound "fiberglass" pipe (glass-fibre-reinforced thermosetting resin)
ASTM D 3299	Standard specification for filament-wound glass-fiber-reinforced thermoset resin corrosion-resistant tanks
ASTM D 4097	Standard specification for contact-moulded glass-fiber-reinforced thermoset resin corrosion-resistant tanks
API	American Petroleum Institute. Standard specifications for pressure equipment (as applicable)
The Association of American Railroads Section C, Part III	Specifications for tank cars, M 1002
ANSI/ISA 84.00.01	Functional safety – Safety instrumented systems for the process industry sector
ANSI NB-23	National board inspection code
ANSI Z223.1	National fuel gas code

Annex A (continued)

1	2
American standards (concluded)	
AWWA	American water works association. as applicable
DOT 3T	Seamless steel cylinder with a minimum water capacity of 1000 pounds and a minimum service pressure of 1800 psig.
DOT 4L	Welded insulated cylinders.
TEMA rules	Tubular exchanger manufacturers association, Inc.
UL 1316	Standard for safety for glass-fiber-reinforced plastic underground storage tanks for petroleum products, alcohols and alcohol-gasoline mixtures
Australian standards	
AS 2634	Chemical plant equipment made from glass-fibre reinforced plastics (GRP) based on thermosetting resins
British standards	
BS 1113	Design and manufacture of water-tube steam generating plant (including super heaters, reheaters and steel tube economizers)
BS 4994	Specification of the design and construction of vessels and tanks in reinforced plastics
BS 5169	Fusion welded steel air receivers
BS 6464	Specification for reinforced plastics pipes, fittings and joints for process plants
BS 7159	Code of practice for design and construction of glass-reinforced plastics (GRP) piping systems for individual plants or sites
PD 5500	Specification for unfired fusion welded pressure vessels
European standards	
99/36/EC	Council Directive 1999/36/EC of 29 April 1999 on transportable pressure equipment
EN 286-1	Simple unfired pressure vessels designed to contain air or nitrogen – Part 1: Pressure vessels for general purposes
EN 303-1	Heating Boilers – Part 1: Heating boilers with forced draught burners – Terminology, general requirements, testing and marking
EN 303-2	Heating Boilers – Part 2: Heating boilers with forced draught burners – Special requirements for boilers with atomizing oil burners
EN 12493	LPG equipment and accessories – Welded steel tanks for liquefied petroleum gas (LPG) – Road tankers design and manufacture
EN 12952 (All parts)	Water-tube boilers and auxiliary installations
EN 12953 (All parts)	Shell boilers
EN 13121 (All parts)	GRP tanks and vessels for use above ground
EN 13923	Filament-wound FRP pressure vessels – Materials, design, manufacturing and testing
EN 13445	Unfired pressure vessels
EN 13458-1	Cryogenic vessels – Static vacuum insulated vessels – Part 1: Fundamental requirements
EN 13458-2	Cryogenic vessels – Static vacuum-insulated vessels – Part 2: Design, fabrication, inspection and testing
EN 13480 (All parts)	Piping

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Annex A (concluded)

European standards (concluded)	
EN 13530-1	Cryogenic vessels – Large transportable vacuum insulated vessels – Part 1: Fundamental requirements
EN 13530-2	Cryogenic vessels – Large transportable vacuum insulated vessels – Part 2: Design, fabrication, inspection and testing
EN 14398-2	Cryogenic vessels – Large transportable non-vacuum insulated vessels – Part 2: Design, fabrication, inspection and testing
EN 14025	Tanks for the transport of dangerous goods – Metallic pressure tanks – Design and construction
EN 14931	Pressure vessels for human occupancy (PVHO) – Multi-place pressure chambers for hyperbaric therapy – Performance, safety requirements and testing
EN 50052	Cast aluminium alloy enclosures for gas-filled high-voltage switchgear and control gear
CWA 15740	Risk-based inspection and maintenance procedures for industry (RIMAP)
IEC 61508	Functional Safety of electrical/electronic/programmable electronic safety-related systems – General requirements
IEC 61511 (All parts)	Functional safety – Safety instrumented systems for the process industry sector
French standards	
RCC-M	Design and construction rules for mechanical components of PWR nuclear standards
CODAP	Code for the construction of unfired pressure vessels
German standards	
Technical Rules	Technical rules for steam boilers (TRD), Dampfkrv and all sections
AD-2000	Technical rules for pressure vessels (TRB), Druckbehvo and all sections
DVS 2205	Design calculations for containers and apparatus made from thermoplastics
DVS 2210-1	Plastic piping for industrial applications
ISO Standards	
ISO 4126 (All parts)	Safety devices for protection against excessive pressure
ISO 14692 (All Parts)	Petroleum and natural gas industries – Glass-reinforced plastics (GRP) piping
ISO 23251	Petroleum, petrochemical and natural gas industries – Pressure-relieving and depressuring systems
South African standards	
SANS 1518	Transport of dangerous goods – Design, construction, testing, approval and maintenance of road vehicles and portable tanks
SANS 1668	Fibre-reinforced plastics (FRP) tanks for buried (underground) storage for petroleum products
SANS 1748 (All Parts)	Glass-fibre-reinforced thermosetting plastics (GRP) pipes
SANS 7396-1	Medical gas pipeline systems – Part 1: Pipeline systems for compressed medical gases and vacuum
SANS 10019	Transportable containers for compressed, dissolved and liquefied gases – Basic design, manufacture, use and maintenance
SANS 10252-1	Water supply and drainage to buildings – Part 1: Water supply installations for buildings
SANS 10260 (All parts)	Industrial gas pipelines
SANS 10147	Refrigerating systems including plants associated with air-conditioning systems
SANS 10377-1	Pressure vessels for human occupancy – Part 1: Hyperbaric chambers (therapeutic)

Annex B
(normative)

Design and construction requirements for piping

B.1 Piping designer

B.1.1 General

A piping designer is the person(s) in charge of the engineering design of piping and shall be experienced in the use of the health and safety standards.

B.1.2 Roles, accountability and qualifications of the piping designer

For category I, the piping designer shall meet the qualification and experience requirements of the applicable health and safety standards.

For category II and higher, the piping designer shall be an appropriately registered professional person (i.e. registered Pr. Eng. Pr. Technologist or Pr. Cert. Eng.) with at least four years of relevant experience in the design of related pressure piping in compliance with the applicable health and safety standard(s).

In the case of countries which do not fall within the recognition agreements (e.g. Washington accord etc), the design engineers with equivalent qualifications and relevant experience may be accepted through an agreement by verification engineer of an AIA for designs done outside of South Africa.

Piping design experience includes design calculations for pressure, sustained and occasional loads, and piping flexibility.

The piping designer need not do the drawings and calculations, but shall sign them indicating the correctness of the design in compliance with the health and safety standards. The piping designer shall review the need for a piping flexibility analysis and if required, sign-off the correctness of this analysis. In signing-off the design calculations and drawings the piping designer declares that the design is in accordance with the applicable health and safety standards.

B.2 The piping design package

The piping design package shall contain, as a minimum, the following information:

- a) the medium and hazard category in accordance with this standard;
- b) the health and safety standard(s) used for the design;
- c) the design and operating conditions;
- d) the fabrication, inspection and testing requirements;
- e) the pipe routing and support information; and
- f) a stress isometric, when stress analysis is required.

B.3 Roles and accountability of the user

The user shall keep the piping design and manufacture package for the life of the piping system.

Annex C
(normative)

**Conformity assessment procedures
for stationary pressure equipment**

C.1 Categorization of ASME or RSA/CI/OHSA pressure equipment

Equipment designed, manufactured, inspected, tested and certified in accordance with this annex shall meet the conformity assessment criteria for pressure equipment categories I through IV (equivalent to modules G + H).

C.2 ASME stamped equipment

C.2.1 ASME stamped equipment means any pressure equipment that fully complies with all the ASME boiler and pressure vessel code rules, including the use of:

- a) authorized organizations holding a code symbol or certificates of authorization (or both); and
- b) the inspection by an authorized inspector (AI). Refer to the relevant national legislation (see foreword).

C.2.2 The relevant national legislation (see foreword) states that imported pressure equipment stamped by an ASME authorized manufacturer in compliance with a full ASME code of construction shall be deemed to meet the requirements of the relevant national legislation (see foreword).

NOTE The intent was that such certification is deemed to be meeting the requirements of the health and safety standards, however any additional requirements of the relevant national legislation (see foreword) e.g. marking shall also be complied with. This may require the application of an additional nameplate meeting the relevant national legislation (see foreword) requirements e.g. units of measure and categorization.

C.3 RSA/CI/OHSA stamped equipment

C.3.1 Where equipment is in full accordance with the ASME code except for marking and certification requirements, it shall be marked with RSA/CI/OHSA. In this case one of the following options shall be used:

- a) The manufacturer is an ASME stamp holder and the AI role is taken over by an AIA that inspects, verifies and also certifies the equipment, or
- b) The manufacturer has an certified quality control system in line with ASME Code (Mandatory appendix 10 in ASME VIII Division 1, for example) and SANS 3834-2 and the authorized inspector role is taken over by an AIA that inspects, verifies and also certifies the equipment, or
- c) Same as a) or b) above but the authorized inspector role is taken over by a foreign inspection body approved by the regulatory authority in accordance with the relevant national legislation (see foreword).

C.3.2 In all cases the verification by the AIA shall meet also the minimum requirements of the applicable health and safety standard(s).

C.4 Marking and records

C.4.1 RSA/CI/OHSA – AA – BB

RSA/CI/OHSA = ASME

AA = Name/Section (VIII Division1 = 8.1, B31.1 = 31.1)

BB = Date of issue/addenda (2011 = 10)

C.4.2 Equipment designed, manufactured, inspected, tested and certified in accordance with this annex shall meet the applicable requirements for marking/nameplate and records of the relevant national legislation (see foreword), regardless of the pressure vessel category.

Bibliography

EN 473, *Non-destructive testing – Qualification and certification of NDT personnel – General principles.*

ISO/IEC Guide 62, *General requirements for bodies operating assessment and certification/registration of quality systems.*

SANS 9000/ISO 9000, *Quality management systems – Fundamentals and vocabulary.*

SANS 9712/ISO 9712, *Non-destructive testing – Qualification and certification of personnel.*

SANS 13485/ISO 13485, *Medical devices – Quality management systems – Requirements for regulatory purposes.*



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