BRITISH STANDARD

PD CEN/TR
14549:2004

Guide to the use of ISO 15649 and ANSI/ASME B31.3 for piping in Europe in compliance with the Pressure Equipment Directive

The European Standard CEN/TR 14549:2004 has the status of a British Standard

ICS 75.200

National foreword

This British Standard is the official English language version of CEN/TR 14549:2003.

The UK participation in its preparation was entrusted by Technical Committee PSE/17, Materials and Equipment for Petroleum, Petrochemical and Natural Gas Industries, to Subcommittee PSE/17/-/6, Processing Equipment and Systems, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the CEN/TR title page, pages 2 to 54, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 4 April 2004

ISBN 0 580 43580 6

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 14549

March 2004

ICS 75.200

English version

Guide to the use of ISO 15649 and ANSI/ASME B31.3 for piping in Europe in compliance with the Pressure Equipment Directive

Guide pour l'utilisation de l'ISO 15649 et l'ANSI/ASME B31.3 pour les tuyauteries en Europe en respectant la Directive Equipements sous Pression

Erdöl- und Erdgasindustrien - Alternative für metallische industrielle Rohrleitungen

This Technical Report was approved by CEN on 21 December 2003. It has been drawn up by the Technical Committee CEN/TC 12.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. CEN/TR 14549:2004: E

Contents

Foreword

This document CEN/TR 14549:2004 has been prepared by Technical Committee CEN/TC 12 “Materials, equipment and offshore structures for petroleum and natural gas”, the secretariat of which is held by AFNOR.

Annexes A, B, C, D and E are informative.

The European Pressure Equipment Directive (PED), Directive 97/23/EC, entered into force on 29th November 1999 and has been mandatory throughout all Member States of the EU and the rest of the European Economic Area (EEA) on 30th May 2002. The prime purpose of the PED is to eliminate barriers to trade without detriment to safety. In May 1985, European Community Ministers agreed on a *New Approach to Technical Harmonisation and Standards* in order to fulfil the objective of an open market in Europe with free movement of goods. *New Approach* Directives such as the PED set out essential safety requirements which must be met.

This document has been developed in order to facilitate PED compliance with respect to the current industry practice for piping that is based on ANSI/ASME B31.3.

This document is technically identical to the EEMUA publication 202 and its Amendment 1 published in May 2002.

This CEN Technical Report cannot provide a presumption of conformity with the PED, therefore the essential safety requirements of the PED should be followed and seen to be followed in full.

PED Issues and their solutions are continuing to develop, therefore users [1)] * of this CEN Technical Report are advised to make use of the references provided in this guide, in order to keep up to date via information published on the Internet World Wide Web.

[1)] In the text that follows, the term "user" often refers to the end user of pressure equipment, rather than to the user of this Guide. The precise meaning should be clear from the context in which the tern is used.

Introduction

This Guide explains how to use ISO 15649 and ANSI/ASME B31.3 while also complying with the European Pressure Equipment Directive (PED), for piping in Europe Union and other EEA countries. This Guide is intended to facilitate discussions between owner/purchaser, manufacturer/designer and notified body leading to conformity with the PED in a consistent manner.

In general, the PED acts as a jurisdictional regulation with emphasis on general requirements, while for the details of design and construction, reference needs to be made to appropriate engineering standards. ANSI/ASME B31.3 Code is a standard addressing design, fabrication, examination and testing of piping systems. Its use is subject to contractual agreements between the owner and the manufacturer/ assembler of a piping system. The PED does not prohibit the use of ANSI/ASME B31.3 (or indeed of any code), however the requirements specified in the PED should be fulfilled.

Review of ANSI/ASME B31.3 against the Articles and the essential safety requirements (ESRs) of the PED has shown that:

¾ some Articles and ESRs are satisfied by ANSI/ASME B31.3;

¾ some Articles and ESRs are not addressed by ANSI/ASME B31.3;

¾ some aspects of ANSI/ASME B31.3 differ from the Articles and ESRs.

The PED is transposed and translated by each Member State into its national legislation. Users are advised to review the translation implemented in the relevant Member State in order to ensure full regulatory compliance. (The relevant document in the UK is *The Pressure Equipment Regulations 1999*, SI 1999 No 2001.) National legislation can also include requirements outside the scope of the PED, for example for in-service inspection.

The full text of the PED can be found at the European Commission's PED website. The European Commission also publishes Guidelines approved by the Commission's Working Group Pressure (WGP) that, while not legally binding, are intended to provide more detail on how to apply the PED. References in the present document to "Guideline x/x" pertain to the WGP Guidelines. See also annex E.

Europia has published a guide for the oil industry on the use of the PED with particular emphasis on refinery operations, whilst EEMUA has published a guide for purchasers of valves under the PED (EEMUA Publication 196).

NOTE ON UNIT OF PRESSURE Throughout the text of this Guide, "bar" signifies gauge pressure (above atmospheric).

1 Scope

This Guide is intended for use in the petroleum, petrochemical and chemical industries. It identifies and defines a set of common additional and modified requirements to ISO 15649 and ANSI/ASME B31.3 necessitated by the PED. Additional guidance is provided by a suite of annexes (A to E) which are intended to be read independently, but in the context of the main text. These include an actions checklist, tables identifying key requirements of the PED and the corresponding clauses of the ISO/ANSI–ASME standards, and supplementary information.

ISO 15649 incorporates ANSI/ASME B31.3 by normative reference and also contains additional common international practice. The relationships are illustrated in Figure 1.

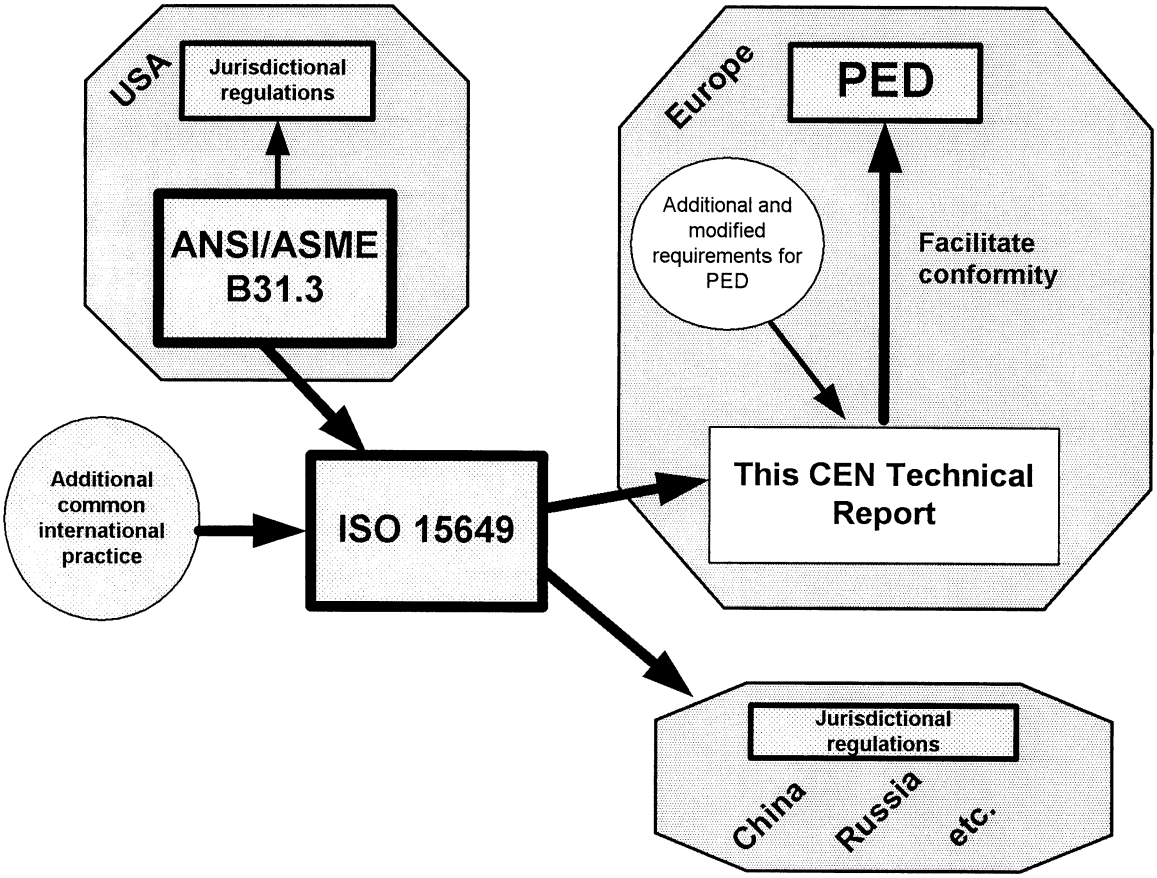


Figure 1 - Sketch of relationship

NOTE The scope of the PED itself is defined therein, in particular in the Preamble and in Article 1.

2 Normative References

This Technical Report incorporates by dated or undated reference, provisions from other publications. These references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Technical Report only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 764-4, *Pressure equipment – Part 4: Establishment of technical delivery conditions for metallic materials.*

EN 10204, *Metallic products - Types of inspection documents.*

ISO 15649:2001, *Petroleum and natural gas industries – Piping.*

Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment (published in the Official Journal of the European Communities No L 181, 9.7.97). (Note: the full text of the PED is online, see Ref. 4 below).

PED – Information Resource Centre – The European Commission DG-Enterprise website for the PED: http://ped.eurodyn.com/.

Guidelines related to the application of the Pressure Equipment Directive 97/23/EC, web page: http://ped.eurodyn.com/Guidelines/Guid-Intro.html.

European Pressure Equipment Directive – A guide for the oil industry [Europia]. http://europia.standardsline.net/ and connect to “Pressure Equipment Directive”.

ANSI/ASME B31.3:1999, Process Piping (including ANSI/ASME B31.3a – 2000 Addenda).

ASME QAI-1:1998, Qualifications for Authorized Inspection.

EEMUA Publication 196, Valves Purchasers' Guide to the PED.

3 Terms and definitions

For the purposes of this Technical Report, the terms and definitions given in ISO 15649:2001, ANSI/ASME B31.3:1999 and the PED apply. Piping is defined in Article 1, sub-clause 2.1.2 of the PED applied.

4 General

4.1 Scope of the PED

The PED applies to the design, manufacture and conformity assessment of pressure equipment and assemblies with a maximum allowable pressure greater than 0,5 bar. "Pressure equipment" means vessels, piping, safety accessories (devices to prevent overpressure, e.g. safety valves) and pressure accessories (operational devices with pressure-bearing housings, e.g. valves). "Assemblies" means several pieces of pressure equipment assembled to constitute an integrated and functional whole (see Guidelines 3/8 and 3/9). This scope differs from the scope of ANSI/ASME B31.3, for example piping systems for less than 1 bar pressure and for non-flammable, non-toxic etc. service are excluded from ANSI/ASME B31.3.

The PED applies to new equipment. For further details see the PED Preamble and Article 1. Repairs to piping are not covered by the PED, but may be covered by national regulations (Guideline 1/3). A modification where the content, main purpose and safety systems remain essentially the same, may be regarded as non-important and outside the scope of the PED (Guideline 1/4).

For further guidance on assemblies, see also other Guidelines prefaced "3/"

4.2 Responsibilities

ISO 15649 and ANSI/ASME B31.3 specify responsibilities for owner, designer, manufacturer and fabricator/assembler. ANSI/ASME B31.3 does not address the issue of third party involvement, this would be a requirement of jurisdictional regulations.

However, under the PED the "manufacturer" is responsible for design including certain design conditions, for manufacture and for conformance with the PED. The manufacturer's responsibilities as defined in the PED could fall to a designer, an importer, an owner, or an engineering contractor. The assigning of the manufacturer's responsibilities would be agreed by the parties to a contract, and may need to be defined for each component and assembly. (For further information on the responsibilities of the manufacturer, the reader is referred to the European Commission's *Guide to the Implementation of Directives based on the New Approach and the Global Approach*.)

4.3 Fluid groups

The manufacturer is responsible for classifying the fluid as Group 1 or 2, as required by PED Article 9, in accordance with Table 1 below.

Table 1 – Fluid groups

Fluid group (Gas or Liquid)	Fluids defined as
Group 1	– explosive – extremely flammable – highly flammable – flammable (where the maximum allowable temperature is above the flash point) – very toxic – toxic – oxidizing
Group 2	All other fluids not in Group 1

Two-phase fluids should be treated as gases.

The fluid service categories (normal fluid service, category D, category M) as defined in annex M of ANSI/ASME B31.3:1999 are not directly related to the fluid groups in PED. Note that Category M applies to toxic fluids, Category D to non-toxic, non-flammable, non-dangerous, low-pressure and moderate temperature fluids.

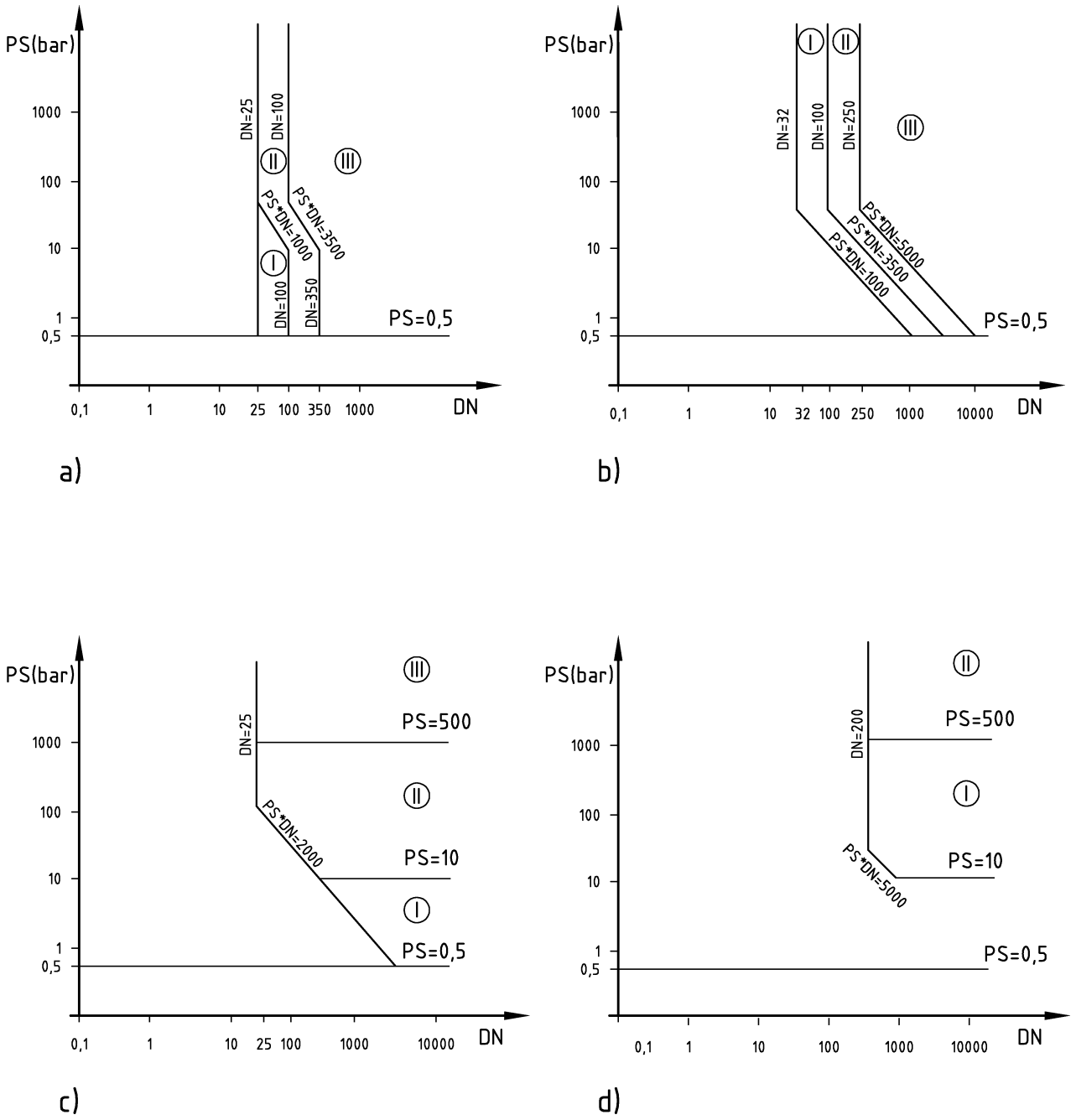
4.4 Conformity assessment categories

The manufacturer is responsible for classifying the piping into the appropriate conformity assessment category in accordance with the PED Annex II, Tables 6, 7, 8, 9, (see Figure 2 below) depending on the state (gas or liquid), fluid group, pressure and nominal diameter (DN). The purpose of the category is to aid selection of an appropriate conformance assessment module, where Category I is the lowest and Category III is the highest shown in the Tables for piping. Category IV (shown in tables for other equipment) may also be applied to piping (see 4.5 below).

The demarcation lines in the conformity assessment tables extracted from the PED (see Figure 2) indicate the upper limit for each category. (It should be noted that the figures are plotted on a log-log scale. For a linear-linear representation, see EEMUA Pub. 196.)

PED Article 3, clause 3 requires that piping below the Category I limits be in accordance with the Sound Engineering Practice (SEP) of a Member State.

The fluid service categories (D, M) in ANSI/ASME B31.3 are not related to the conformity assessment categories in the PED.



Key

a) PED Annex II Table 6
b) PED Annex II Table 7
c) PED Annex II Table 8
d) PED Annex II Table 9

Figure 2 – Conformity assessment tables for piping

The PED includes the following qualifications to the Tables 6 and 7:

¾ Table 6: Exceptionally, piping intended for unstable gases and falling within Categories I or II on the basis of Table 6 should be classified in Category III.

¾ Table 7: Exceptionally, all piping containing fluids at a temperature greater than 350 °C and falling within Category II on the basis of Table 7 should be classified in Category III.

4.5 Conformity assessment procedures

Conformity assessment is required in order to demonstrate that the essential safety requirements are satisfied (PED Article 10).

The conformity assessment procedures are specified in modules available for each Category as set out in Tables 2 and 3 below.

Table 2 – Conformity assessment modules

Category	Modules
I	A
II	A1, D1, E1
III	B1 + D, B1 + F, B + E, B + C1, H
IV	B + D, B + F, G, H1

Table 3 – Description of conformity assessment modules

Module	Design	Production
A	Technical documentation	Internal production control
A1	Technical documentation	Internal production control with monitoring of the final assessment
B	Type examination	
B1	Design examination	
C1		Monitoring of final assessment
D		Quality assurance for production, final inspection and test
D1	Technical documentation	Quality assurance for production, final inspection and test
E		Quality assurance for final inspection and test
E1	Technical documentation	Quality assurance for final inspection and test
F		Product verification
G	Unit verification	Unit verification
H	Quality assurance for design, manufacture, final inspection and test	
H1	Quality assurance for design, manufacture, final inspection and test, with design examination and monitoring of final assessment	

The conformity assessment procedures corresponding to the modules are set out in PED Annex III. The procedures may include internal production control, third party inspection, and quality assurance. It is for the manufacturer to choose, depending on the Category, whether he wishes to opt for a module that requires full QA with just auditing by a notified body, or for a module with full third party inspection, or for a module with a combination. The execution of the procedure is by the manufacturer, notified body, user inspectorate or third party organisation (PED Article 13), depending on the Category.

The owner or user may specify in the contract the module that is preferred. The manufacturer can always choose to use a module from a higher Category, e.g. from Category IV (PED Article 10, clause 1.4 and Guideline 2/11).

Piping in Category I and SEP does not require the involvement of notified bodies. For piping using modules for Categories II and III, a notified body will need to be involved, except for those modules where a user inspectorate is permitted. User inspectorates are not permitted to apply any of the Category III modules (the highest piping Category). However Category IV permits the use of Module G, which can be applied by user inspectorates (PED Article 14, clause 6). It may therefore be to the user's advantage to choose to apply that Category IV module to Category III piping. It should be further noted that the use of a module from a higher Category does not change the classification of the equipment being assessed (Guideline 2/11).

For conformity assessment Modules A1, C1, F and G, designated user inspectorates may carry out the tasks of notified bodies within their own organisations. The CE marking is not to be affixed to pressure equipment and assemblies assessed by a user inspectorate.

For piping below the Category I limits conformity assessment is not required, but requirements for design, manufacture, instructions for use and markings should be in accordance with SEP of a Member State (see 4.4 above). It is expected that the basic requirements of ANSI/ASME B31.3 will be considered generally acceptable in the Member States.

Once conformity assessment has been completed, the manufacturer is required to affix the CE marking (PED Article 15) and draw up a declaration of conformity (PED Annex VII). It should be noted that the manufacturer is not required by the PED to provide the declaration of conformity to the user (see 7.3.4 below).

4.6 Hazard analysis

Hazard analysis is fundamental to the design process. Where the manufacturer of the equipment is not cognisant of overall HAZOP studies, he should be made aware of the scope of his responsibilities in respect of hazards on account of pressure.

After the manufacturer has ascertained or determined the operating conditions of the equipment (e.g. pressure, temperature, fluid etc.), and their limits, he should complete a hazard analysis (see Guideline 8/4) which will enable the essential requirements which are applicable to the equipment to be identified.

The results of this analysis (applicable essential requirements in relation to the foreseeable operating conditions) shall be included in the technical documentation, but the inclusion of full details of the analysis in the documentation is not required by PED.

5 Materials

5.1 Material selection and appraisal

The current engineering practice where designers using ANSI/ASME B31.3 would normally select one of the code's listed materials or established alternatives, and would base calculations on the material's listed properties, differs from that of the PED. Under the PED the manufacturer needs to adhere to the essential safety requirements of that Directive by using appropriate materials (pipe, flanges, elbows, weldolets and other piping components) satisfying one of the following conditions:

a) conforming to a harmonised standard;

b) covered by a European Approval of Materials (EAM) in accordance with PED Article 11;

c) evaluated by a Particular Material Appraisal (PMA) (see Guideline 9/13); PMAs may be carried out in accordance with EN 764-4.

Materials that comply with harmonised standards mandated under the PED or have EAM status ((a) and (b) above) are published in the Official Journal of the European Communities and listed on the PED website. ASTM piping materials are not generally included in the European harmonised standards.

For traditional ASME/ASTM materials the options are (b) and (c) above. However, to date (2003) materials applications submitted via the EAM route have been contested under the PED Article 11 process and are currently unsuccessful.

It is envisaged that the PMA route will be the one by which non-harmonised materials will be approved for the foreseeable future. Timing and process will need to be managed in order to avoid additional costs and project delays. The PMA is valid only for a particular application and is part of the technical documentation provided by the manufacturer. It should be noted that for pressurised parts to be used in Category III piping, the PMA needs to be performed by the notified body responsible for undertaking the conformity assessment for the piping system.

5.2 Material certification

For material certification see Guidelines 7/5, 7/7, 7/8. The material manufacturer shall provide a certificate of specific product control for main pressure bearing parts of piping in Categories II and III. For metallic materials these are inspection certificates EN 10204 type 3.1.B and type 3.1.C, and inspection reports EN 10204 type 3.2. Guideline 7/5 offers greater detail, Guideline 7/7 relates to quality control.

It should be noted that ANSI/ASME B31.3 does not require material test reports or other certification beyond that detailed in the material specifications.

For bolting parts used as a main pressure bearing part (flange bolting), EN 10204 type 3.1.B and type 3.1.C are required for piping in categories II and III. (Guideline 7/8).

6 Design and calculation

6.1 Allowable stresses

The provisions for allowable stresses and factors stated in ESR 7.1, PED Annex I, are a general rule, and the manufacturer may choose different values, provided that the choice is justifiable and consistent with good design principles, and achieves an equivalent level of safety. Much depends on the judgement of the manufacturer or, when a notified body is involved, agreement between notified body and manufacturer. If factors other than those in ESR 7.1 have been used, owners should ask for the justification in the technical documentation.

The design basis in PED Annex I (7.1) is not quite the same as in ANSI/ASME B31.3. Generally for steels ANSI/ASME B31.3 uses the lower of ⅔ yield and ⅓ tensile strength. The PED allows the lower of ⅔ yield and $^{5}/_{12}$ tensile strength. Therefore for many materials, the design stresses in ANSI/ASME B31.3 are more conservative and may be used. However for austenitic steel the PED may be more conservative. (See Table D.7, 7.1 Allowable stresses.)

For creep conditions ANSI/ASME B31.3 uses 100 000 hour data, whilst the PED is silent on the criteria to be used.

6.2 Joint coefficients

The provisions for joint coefficients stated in ESR 7.2, PED Annex I, are also a general rule and, with regard to selecting values, the same approach should be adopted as for allowable stresses.

Where joint coefficients in the PED and in ANSI/ASME B31.3 are different, use of the lower value will be conservative.

Note that ANSI/ASME B31.3 gives longitudinal weld joint factors. The PED Annex I (7.2) does not restrict itself to longitudinal welds, and its meaning should be agreed at the outset of a contract.

6.3 Isolation

Where Group 1 fluids are contained in the piping, appropriate means are to be provided to isolate any "take-off" pipes whose size represents a significant risk (see PED Annex I, 6(e)).

Positive isolation may be achieved in one of the following ways:

a) by removal of a flanged spool piece or valve and the fitting of blank flanges to the open ended pipes;

b) by (swung) line blind;

c) by a spade. The arrangements of spading points, together with venting, draining and purging facilities, should enable a section of line containing a spade to be checked as free from pressure before spade insertion or removal.

7 Fabrication and installation

7.1 Permanent joining (e.g. Welding)

For piping in Categories II and III, the joining procedures and personnel are to be approved by either of the following, at the manufacturer's discretion (see PED Annex I, sub-clause 3.1.2):

¾ a notified body; or

¾ a third-party organisation recognised for this purpose by a European Member State.

A list of such organisations is published in the *Official Journal of the European Communities* and may be found at the PED website (Ref. 4) under "Who is who". An *Authorized Inspector* as defined in ASME QAI-1:1998 will not be sufficient unless his organisation is also recognised as one of the above bodies under the PED.

Qualification (i.e. approval) of welding procedures and of the performance of welders should be in accordance with ANSI/ASME B31.3. For Categories II and III piping, such approval needs to be in accordance with the preceding paragraphs of this subsection.

7.2 Traceability

The manufacturer needs to ensure that suitable procedures are established and maintained for identifying the material making up those components of the equipment which contribute to pressure resistance, from receipt of the material, through production, up to the final test of the manufactured pressure equipment (see PED Annex I, sub-clause 3.1.5).

7.3 Documentation

7.3.1 Marking and labelling

ANSI/ASME B31.3 does not make reference to marking and labelling. Such requirements are dealt with elsewhere – in the United States by the local jurisdictions.

In Europe, in addition to the CE marking (accompanied by the notified body identification number where a notified body is involved at the production control phase – see Article 15, clause 1), the PED requires the following information to be provided by the manufacturer on an attached nameplate or, where allowed, in appropriate documentation (see PED Annex I, sub-clause 3.3):

a) name and address or other means of identification of the manufacturer(s);

b) year of manufacture;

c) identification of equipment (e.g. type, serial number);

d) essential maximum/minimum allowable operating limits (e.g. pressure, temperature);

e) depending on the type of pressure equipment, further information necessary for safe installation, operation or use and, where applicable, maintenance and periodic inspection such as:

   1) test pressure in bar;

   2) date of pressure test;

   3) fluid group;

   4) nominal size, DN;

   5) safety device set pressure in bar;

6) the position and route of underground piping to facilitate safe maintenance, inspection or repair (see PED Annex I, clause 6(g)).

It may be desirable that the nameplate be also marked with the equipment Category (see 7.3.4).

7.3.2 Operating instructions

The PED requires piping to be accompanied, as far as is relevant, by instructions for the user regarding mounting, putting into service, use and maintenance (see PED Annex I, sub-clause 3.4, and Guideline 8/3). Note that the PED (Annex I, sub-clause 2.2.3 (b)) requires that features of the design relevant to the life of the equipment be included, while Guideline 8/3 recommends that the intended life and design code used should be stated. If experience has shown that misuse might occur, suitable warnings need to be fixed to the piping.

7.3.3 Marking at take-off points

To minimise the risk of inadvertent discharge, the main piping needs to be clearly marked on the permanent side at all take-off points, indicating the fluid contained (see PED Annex I, clause 6 (f)).

7.3.4 Declaration of conformity

For any conformity assessment module or module combination applicable to piping, the manufacturer is required to draw up (but not to provide) a declaration of conformity (PED Annex VII). It should be noted that whilst the declaration of conformity is required to indicate the conformity assessment procedure followed, it is not required to indicate the equipment Category. Because it is permissible to use a conformity assessment procedure applicable to a Category higher than that of the equipment being assessed (4.5 above), it is recommended that equipment Category be always documented with, and preferably on, the declaration of conformity. Consideration may also be given by the owner/ user to requiring that the equipment Category (including SEP where applicable) be marked on the nameplate(s) and that copies of declarations of conformity be provided with the relevant equipment.

In addition to any declarations of conformity that may have been drawn up for items of pressure equipment by the manufacturers of those items, the manufacturer of an assembly is required to perform a global assessment (see PED Article 10, clause 2) and draw up a "global" declaration of conformity. However if assembly is done on site and under the responsibility of the user, the global conformity assessment procedure would not normally be carried out and no CE mark would be affixed. (See PED recital 5 and Guideline 3/1.)

8 Inspection and testing

8.1 Non-destructive tests

Non-destructive testing terminology in ANSI/ASME B31.3 is different from that in the PED (e.g. "spot" versus "random"), therefore care should be taken to ensure that all parties have a common understanding of the requirements.

For piping in Category III, the personnel performing non-destructive tests of permanent joints need to be approved by a third-party organisation recognised for this purpose by a European Member State, see PED Annex I, 3.1.3.

A list of such organisations is published in the *Official Journal of the European Communities* and may be found at the PED website under "Who is who".

8.2 Final inspection

Piping needs to undergo a final inspection to assess, visually and by review of the accompanying documents, compliance with the PED requirements: see PED Annex I, sub-clause 3.2.1, and Guideline 6/2. ANSI/ASME B31.3 inspection requirements cover all the PED requirements except for the requirement to examine technical documentation.

ANSI/ASME B31.3 requires an inspection by the owner’s inspector. The PED requirements depend on the conformity assessment module, for example with inspection by a notified body or user inspectorate, type approval, or quality assurance system.

For assemblies, the final assessment needs to include a check of the safety devices to verify compliance with the requirements of PED Annex I, sub-clause 2.10.

9 Safety devices

With respect to safety devices, the requirements of the PED and of ANSI/ASME B31.3 are similar.

The PED requires CE-marked safety devices to be classified as Category IV, unless the device is manufactured for specific equipment classified in a lower Category (PED Annex II, clause 2).

The PED requires that pressure limiting devices need to be so designed that the pressure will not permanently exceed the maximum allowable pressure and a short duration pressure surge will not exceed 10 % of the maximum allowable pressure. The 10 % pressure surge restriction does not apply to the fire case, see Guideline 5/2.

The allowances for pressure and temperature variations in 302.2.4 (f) of ANSI/ASME B31.3:1999 are not applicable.

Annex A
(informative)

Checklist of major actions arising from the PED

Table A.1 - Checklist of major actions

	Action	Reference clause in this guide
❑	Determine if the piping is within the scope of the PED	4.1
❑	Identify the “manufacturer” and determine and assign his responsibilities, at the start of a contract, for each component and assembly	4.2
❑	Determine fluid Groups	4.3
❑	Determine Category(ies)	4.4
❑	Choose conformity assessment modules (PED Article 10)	4.5
❑	Determine extent of notified body involvement	4.5
❑	Perform hazard analysis in order to determine the applicable ESRs	4.6
❑	Ensure that materials to be used in pressurised parts fulfil one of the requirements given in PED Annex I, 4.2 (b)	5.1
❑	Ensure that materials to be used in pressurised parts are traceable (PED Annex I, 3.1.5)	7.2
❑	Ensure third party approval for welding procedures and welder qualification for Categories II and III (PED Annex I, 3.1.2), and for NDE personnel qualification for Category III (PED Annex I, 3.1.3).	7.1
❑	Manufacturer to draw up global declaration of conformity and affix CE markings.	4.5, 7.3.1 and 7.3.4
❑	Manufacturer to identify marking and labelling requirements of the PED ESRs	7.3

Annex B
(informative)

Key articles in the PED

B.1 Introduction

This annex provides a guide to those Articles of the PED which differ from requirements in ISO 15649 and ANSI/ASME B31.3; these are termed "key articles" in this annex.

Annex D provides a similar guide to the ESRs of the PED.

B.2 Table of Key Articles in the PED

For each of the key PED Articles, Table B.1 identifies the clauses of ISO 15649, ANSI/ASME B31.3 and this Guide that are relevant to PED compliance. The required actions are listed under Notes/Actions Required.

Table B.1 is based on ANSI/ASME B31.3 – 1999 Edition, *Process Piping*, including ANSI/ASME B31.3a – 2000 Addenda.

Table B.1 – Key articles in PED

PED Article		ANSI/ASME B31.3 Reference	Notes / Actions Required	PED Compliance	
				ISO 15649 clause	Guide clause
1	**3 The following are excluded from the scope of this Directive:**	300.1	Identify "standard pressure equipment" NOT excluded from PED	1.4	1
	3.1 Pipelines comprising piping or a system of piping designed for the conveyance of any fluid or substance to or from an installation (onshore or offshore) starting from and including the last isolation device located within the confines of the installation, including all the annexed equipment designed specifically for pipelines. This exclusion does not apply to standard pressure equipment such as may be found in pressure reduction stations or compression stations;		Identify piping etc which will be subject to PED. See also Guidelines 1/28 and 1/29.		
3	1 The pressure equipment referred to in 1.1, 1.2, 1.3 and 1.4 must satisfy the essential requirements set out in Annex I: 1.3 Piping intended for: a) gases, liquefied gases, gases dissolved under pressure, vapours and those liquids whose vapour pressure at the maximum allowable temperature is greater than 0,5 bar above normal atmospheric pressure (1013 mbar) within the following limits: — for fluids in Group 1 with a DN greater than 25 (Annex II, Table 6); — for fluids in Group 2 with a DN greater than 32 and a product of PS and DN greater than 1 000 bar (Annex II, Table 7); b) liquids having a vapour pressure at the maximum allowable temperature of not more than 0,5 bar above normal atmospheric pressure (1 013 mbar), within the following limits: — for fluids in Group 1 with a DN greater than 25 and a product of PS and DN greater than 2 000 bar (Annex II, Table 8); — for fluids in Group 2 with a PS greater than 10 bar, a DN greater than 200 and a product of PS and DN greater than 5 000 bar (Annex II, Table 9).	300.1.3(a)	Identify piping etc. which will be subject to PED Annex I Essential Safety Requirements or other national standards/guidelines		Annexe D

(*to be continued*)

Table B.1 (*continued*)

PED Article		ANSI/ASME B31.3 Reference	Notes / Actions Required	PED Compliance	
				ISO 15649 clause	Guide clause
3 (continue)	1.4 Safety and pressure accessories intended for equipment covered by 1.1, 1.2 and 1.3 including where such equipment is incorporated into an assembly. 2 The assemblies defined in Article 1, section 2.1.5, which include at least one item of pressure equipment covered by section 1 of this Article and which are listed in 2.1, 2.2 and 2.3 of this Article must satisfy the essential requirements set out in Annex I. 2.1 Assemblies intended for generating steam or superheated water at a temperature higher than 100 °C comprising at least one Item of fired or otherwise heated pressure equipment presenting a risk of overheating 2.2 Assemblies other than those referred to in 2.1, if the manufacturer intends them to be placed on the market and put into service as assemblies. 2.2 Assemblies other than those referred to in 2.1, if the manufacturer intends them to be placed on the market and put into service as assemblies. 2.3 By way of derogation from the introductory paragraph to this section, assemblies intended for generating warm water at temperatures not greater than 110°C which are manually fed with solid fuels and have a PS.V greater than 50 bar.L must comply with the essential requirements referred to in 2.10, 2.11, 3.4, 5 (a) and 5 (d) of Annex I.				
	3 Pressure equipment and/or assemblies below or equal to the limits in sections 1.1, 1.2 and 1.3 and section 2 respectively must be designed and manufactured in accordance with the sound engineering practice of a Member State in order to ensure safe use. Pressure equipment and/or assemblies must be accompanied by adequate instructions for use and must bear markings to permit identification of the manufacturer or of his authorised representative established within the Community. Such equipment and/or assemblies must not bear the CE marking referred to in Article 15.	300.1.3.(a)	“Sound engineering practice” to be defined at the start of a contract e.g. ANSI/ASME B31.3. See Guideline 9/1	1.2	4.5

(*to be continued*)

Table B.1 (*continued*)

PED Article		ANSI/ASME B31.3 Reference	Notes / Actions Required	PED Compliance	
				ISO 15649 clause	Guide clause
9	**Classification of pressure equipment** 1 Pressure equipment referred to in Article 3 (1) shall be classified by category in accordance with Annex II, according to ascending level of hazard.	300 (b) (1)	Categories to be defined by manufacturer		4.4
10	**Conformity assessment** 1.1 Before placing pressure equipment on the market, the manufacturer shall subject each item of equipment to one of the conformity assessment procedures described in Annex III, according to the conditions given in this Article.	Chapter VI	Conformity assessment and involvement of notified bodies to be stated by manufacturer		4.5
11	**European approval for materials** 1 European approval for materials, as defined in Article 1 Section 2.9, shall be issued at the request of one or more manufacturers of materials or equipment, by one of the notified bodies referred to in Article 12 specifically designated for that task. The notified body shall determine and perform, or arrange for the performance of, the appropriate inspections and tests to certify the conformity of the types of material with the corresponding requirements of this Directive; in the case of materials recognised as being safe to use before 29 November 1999, the notified body shall take account of the existing data when certifying such conformity.		Requested by manufacturer or notified body		5
14	**User inspectorates** 1 By way of derogation from the provisions relating to the tasks carried out by the notified bodies, Member States may authorise in their territory the placing on the market, and the putting into service by users, of pressure equipment or assemblies referred to in Article 1 of which conformity with the essential requirements has been assessed by a user inspectorate designated in accordance with the criteria referred to in paragraph 8.	340.1	User inspectorates need to be authorised by the Member State		4.5

(*to be continued*)

Table B.1 (*concluded*)

PED Article		ANSI/ASME B31.3 Reference	Notes / Actions Required	PED Compliance	
				ISO 15649 clause	Guide clause
15	**CE marking**		CE marking applied by manufacturer		4.5
	1 The CE marking consists of the initials 'CE' in accordance with the model in Annex VI. The CE marking shall be accompanied by the identification number, as referred to in Article 12 (1), of the notified body involved at the production control phase. 2 The CE marking shall be affixed in a visible, easily legible and indelible fashion to each: — item of pressure equipment referred to in Article 3 (1); or — assembly referred to in Article 3 (2); which is complete or is in a state permitting final assessment as described in section 3.2 of Annex I.				

Annex C
(informative)

Clauses of this guide addressing essential requirements or other provisions of the PED

Harmonised European Standards are prepared under a mandate given to the Comité Européen de Normalisation (European Committee for Standardization – CEN) by the European Commission to support the essential requirements of EU Directives. Under an agreement between the EU and the European Free Trade Association (EFTA) states of Iceland, Liechtenstein and Norway, all of which together form the European Economic Area (EEA), all New Approach directives (of which the PED is one) also apply to the EFTA EEA States.

The harmonised standards prepared in support of the PED (Directive 97/23/EC) generally include an “Annex ZA" in which the clauses in the standard which address essential requirements and other provisions of the Directive are cross referred to the particular ESRs/ provisions in the Directive itself. Compliance with the clauses of a harmonised standard listed in its Annex ZA is one means of demonstrating compliance with the directive’s ESRs.

The present document has been developed because there is no harmonised European Standard available that parallels the requirements of ISO 15649 and ANSI/ASME B31.3. Table C.1 follows the format of a typical annex ZA.

Table C.1 – Comparison between this Guide and Directive 97/23/EC

Clauses of this Guide	Content	Essential requirements of Directive 97/23/EC	
1	Scope	Annex I,	All requirements of ISO 15649 except those listed below
4.2	Responsibilities	Annex I,	Preliminary observations
5	Materials	Annex I,	4.2 (b) 4.2 (c)
6.1	Allowable stresses	Annex I,	7
6.2	Joint coefficients	Annex I,	7
6.3	Isolation	Annex I,	6 (e)
7.1	Permanent joining	Annex I,	3.1.2
7.2	Traceability	Annex I,	3.1.5
7.3	Documentation	Annex I,	3.3 6 (f) 6 (g)
8.1	Non-destructive tests	Annex I,	3.1.3
8.2	Final inspection	Annex I,	2.10 3.2.1 3.2.3
9	Safety devices	Annex I,	2.11.2 7.3

Annex D
(informative)

Comparison of ISO 15649, ANSI/ASME B31.3 and PED annex I (Essential Safety Requirements)

D.1 Introduction

This annex provides a clause-by-clause guide for compliance with the essential safety requirements (ESRs) set out in Annex I of the Pressure Equipment Directive (PED). Compliance is indicated either by reference to the relevant clauses of ISO 15649 or, where qualification is required, to the relevant clauses of this Guide. The tables also show the relevant clauses of ANSI/ASME B31.3.

The tables in this annex are based on the current ANSI/ASME B31.3 [ASME B 31.3:1999, *Process Piping*, including ASME B31.3a:2000 Addenda].

The tables are derived from the work of CEN/TC 12 AH5 [2)] that was issued as document CEN/TC 12 AH5 N11 within document CEN/TC 12 N 296 in 2000. The AH5 document was developed from a report originally commissioned by the EEMUA Piping Systems Committee. That report was a comparison between ANSI/ASME B31.3 [ASME B 31.3:1996, *Process Piping*, including ASME B31.3a: 1996 Addenda and ASME B31.3b:1997 Addenda] and the EC Pressure Equipment Directive (97/23/EC). The purpose of the original comparison was to determine the extent to which ANSI/ASME B31.3 satisfied the essential safety requirements of the PED.

D.2 Comparison tables

D.2.1 Contents of each table

Each table is dedicated to a particular section or sections of the PED Annex I, Essential Safety Requirements, as follows:

This Guide	PED Annex I	
Table Reference	**Section N°**	**Title**
D.1	—	Preliminary observations
D.2	1	General
	2	Design
D.3	3	Manufacturing
D.4	4	Materials
D.5	5	Fired or otherwise heated pressure equipment with a risk of overheating as referred to in article 3 (1) of the PED
D.6	6	Piping as referred to in article 3, section 1.3 of the PED
D.7	7	Specific quantitative requirements for certain pressure equipment

[2)] European Committee for Standardization, Technical Committee 12, ad-hoc group 5.

D.2.2 How to use the tables

For each of the ESRs, the last two columns of the tables identify the clauses of ISO 15649 and this Guide that are relevant to PED compliance.

The related paragraphs of ANSI/ASME B31.3 are also shown for information. If B31.3 already satisfies the PED this is signified by a reference to ISO 15649:2001, sub-clause 4.1 (which makes normative reference to ASME B31.3) in the penultimate column.

Table D.1 – ESRs: Preliminary observations

PED Annex I	Preliminary observations	ANSI/ASME B31.3 Reference	Notes / Comments ANSI/ASME B31.3 is referred to below as "the Code"	PED Compliance ISO 15649 clause	 Guide clause
1	The obligations arising from the essential requirements listed in this Annex for pressure equipment also apply to assemblies where the corresponding hazard exists.				
2	The essential requirements laid down in the Directive are compulsory. The obligations laid down in these essential requirements apply only if the corresponding hazard exists for the pressure equipment in question when it is used under conditions which are reasonably foreseeable by the manufacturer.	300	ANSI/ASME B31.3 states responsibilities as follows: **300 General statements** (b) Responsibilities (1) Owner. The owner of a piping installation shall have overall responsibility for compliance with this Code, and for establishing the requirements for design, construction, examination, inspection, and testing which will govern the entire fluid handling or process installation of which the piping is a part. The owner is also responsible for designating piping in certain fluid services. [See paras. 300(d)(4) and (5) and 300 (e).] (2) Designer. The designer is responsible to the owner for assurance that the engineering design of piping complies with the requirements of this Code and with any additional requirements established by the owner. *Manufacturer, Fabricator, and Erector.* The manufacturer, fabricator, and erector of piping are responsible for providing materials, components and workmanship in compliance with the requirements of this Code and of the engineering design.		4.2

(continued)

Table D.1 (*concluded*)

PED Annex I	Preliminary observations	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
			ANSI/ASME B31.3 is referred to below as "the Code"	ISO 15649 clause	Guide clause
3	The manufacturer is under an obligation to analyse the hazards in order to identify those which apply to his equipment on account of pressure; he must then design and construct it taking account of his analysis.		Responsibilities are set by the Directive (a legal instrument) and places full responsibility upon the manufacturer.		4.2
4	The essential requirements are to be interpreted and applied in such a way as to take account of the state of the art and current practice at the time of design and manufacture as well as of technical and economic considerations which are consistent with a high degree of health and safety protection.	300(c)	Intent of the Code.	4.1	
Fifth recital of the Directive (Page No. L181/1):					
5 Whereas this Directive relates also 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 must conform to this Directive; whereas, on the other hand, this Directive 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;					

Table D.2 – ESRs: General, and relevant to design

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
1		**General**				
	1.1	Pressure equipment must 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.		In the Code these are the owner's responsibility.		4.2
	1.2	In choosing the most appropriate solutions, the manufacturer must apply the principles set out below in the following order: — eliminate or reduce hazards as far as is reasonably practicable, — apply appropriate protection measures against hazards which cannot be eliminated, — where appropriate, inform users of residual hazards and indicate whether it is necessary to take appropriate special measures to reduce the risks at the time of installation and/or use.		In the Code these are the owner's responsibility.		4.2
	1.3	Where the potential for misuse is known or can be clearly foreseen, the pressure equipment must be designed to prevent danger from such misuse or, if that is not possible, adequate warning given that the pressure equipment must not be used in that way.		The Code does not cover adequate warning re misuse.	4.4	7.3.2
2		**Design**				
	2.1	**General**				
		The pressure equipment must be properly designed taking all relevant factors into account in order to ensure that the equipment will be safe throughout its intended life. The design must incorporate appropriate safety coefficients using comprehensive methods which are known to incorporate adequate safety margins against all relevant failure modes in a consistent manner.	301 Appendix F 302.3	Design Conditions: defines the temperatures, pressures and forces applicable to the design of piping and states the considerations that shall be given to various effects and their consequent loadings. Allowable Stresses and Other Stress Limits. 302.3.3 Casting Quality Factor, 302.3.4 Weld Joint Quality Factor.	4.1	

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
2		**Design (continued)**				
	2.2	**Design for adequate strength**				
	2.2.1	The pressure equipment must be designed for loadings appropriate to its intended use and other reasonably foreseeable operating conditions. In particular, the following factors must be taken into account:	301	Design Conditions.	4.6	
		— internal/external pressure;	301.2	Design Pressure.		
		— ambient and operational temperatures;	301.3	Design Temperature.		
		— static pressure and mass of contents in operating and test conditions;	301.6	Weight Effects.		
		— traffic, wind, earthquake loading;	301.5 301.3.6 321.1	Code does not mention ‘traffic’, but does include Impact, Wind, Earthquake, Vibration, Discharge Reactions.		
		— reaction forces and moments which result from the supports, attachments, piping etc.;	319.5	Reactions.		
		— corrosion and erosion, fatigue etc.;	302.4 301.10	Allowances, Cyclic Effects.		
		— decomposition of unstable fluids.	F323	Excluded from Code: 300(c)(6). Appendix F Precautionary considerations (Guidance).		
		Various loadings which can occur at the same time must be considered, taking into account the probability of their simultaneous occurrence.	301.2.1			

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
2		**Design (continued)**				
	2.2.2	Design for adequate strength must be based on:				
		- as a general rule, a calculation method, as described in 2.2.3, and supplemented if necessary by an experimental design method as described in 2.2.4, or - an experimental design method without calculation, as described in 2.2.4, when the product of the maximum allowable pressure PS and the volume V is less than 6 000 bar·L or the product PS·DN less than 3 000 bar.	302, 303, 304	302 Design Criteria: states pressure-temperature ratings, stress criteria, design allowances and minimum design values together with permissible variations of these factors as applied to the design of piping. 304 is intended for pressure design of components not covered in Table 326.1 but may be used for a special or more rigorous design of such components. Designs shall be checked for adequacy of mechanical strength under applicable loadings enumerated in 301. 303, Pressure design of piping components. 304, Pressure design of components.	4.6	
	2.2.3	Calculation method				
	2.2.3(a)	Pressure containment and other loading aspects The allowable stresses for pressure equipment must be limited having regard to reasonably foreseeable failure modes under operating conditions. To this end, safety factors must be applied to eliminate fully any uncertainty arising out of manufacture, actual operational conditions, stresses, calculation models and the properties and behaviour of the material. These calculation methods must provide sufficient safety margins consistent, where applicable, with the requirements of section 7.	302.3	Allowable Stresses and Other Stress Limits. 302.3.3 Casting Quality Factor, 302.3.4 Weld Joint Quality Factor.		6.1, 6.2
		The requirements set out above may be met by applying one of the following methods, as appropriate, if necessary as a supplement to or in combination with another method:			4.1	
		— design by formula;	304	Pressure Design of Components.		
		— design by analysis;	304.7	Pressure Design of Other Components. Experimental stress analysis, detailed stress analysis.		
		— design by fracture mechanics;	—	Code does not mention or exclude fracture mechanics.		

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
2		**Design (continued)**				
	2.2.3(b)	Resistance Appropriate design calculations must be used to establish the resistance of the pressure equipment concerned. In particular:			4.1	
		— the calculation pressures must not be less than the maximum allowable pressures and take into account static head and dynamic fluid pressures and the decomposition of unstable fluids. Where a vessel is separated into individual pressure-containing chambers, the partition wall must be designed on the basis of the highest possible chamber pressure relative to the lowest pressure possible in the adjoining chamber;	301.2 301.2.1	Covered.		
		— the calculation temperatures must allow for appropriate safety margins;	301.3	Design Temperature. Covered.		
		— the design must take appropriate account of all possible combinations of temperature and pressure which might arise under reasonably foreseeable operating conditions for the equipment;	301.2.1	Design Pressure: General. Covered.		
		— the maximum stresses and peak stress concentrations must be kept within safe limits;	304, 319.4, 321.1.3 304.7.2 319.3.6 302.3.5	Covered.		
		— the calculation for pressure containment must utilize the values appropriate to the properties of the material, based on documented data, having regard to the provisions set out in section 4 together with appropriate safety factors. Material characteristics to be considered, where applicable, include:				
		— yield strength, 0,2 % or 1,0 % proof strength as appropriate at calculation temperature;	302.3.2 Table A-1	Covered.		
		— tensile strength;	302.3.1(a) Tables A-1 and A-2	Covered.		
		— time-dependent strength, i.e. creep strength.	302.3.2	Covered.		

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
2		**Design (continued)**				
	2.2.3(b) (continued)	— fatigue data;	302.3.5, 319.3.6	Fatigue data: Fatigue is taken into account in ANSI/ASME B31.3 in two ways: (a) by reducing the allowable stress range based on the number of cycles (302.3.5); and (b) by applying stress intensification factors (319.3.6) when calculating the displacement stress range.		
			K304.8, K319, X302.1.3	Chapter IX (K304 etc.) covers high pressure piping & Appendix X covers metallic bellows expansion joints.		
		— Young's modulus (modulus of elasticity);	319.3.2, Table C-6	Covered.		
		— appropriate amount of plastic strain;	302.3.5	ANSI/ASME B31.3 addresses this indirectly by limiting the maximum stress for sustained and displacement loads.		
		— impact strength;	323.3	Impact Testing Methods and Acceptance Criteria. Covered.		
		— fracture toughness;	301.9			
		— appropriate joint factors must be applied to the material properties depending, for example, on the type of non-destructive testing, the materials joined and the operating conditions envisaged;	302.3.4, Table 302.3.4	Weld Joint Quality Factors.		6.2
		— the design must take appropriate account of all reasonably foreseeable degradation mechanisms (e.g. corrosion, creep, fatigue) commensurate with the intended use of the equipment. Attention must be drawn, in the instructions referred to in section 3.4, to particular features of the design which are relevant to the life of the equipment, for example:	302.3.4, Table 302.3.4			
		— for creep: design hours of operation at specified temperatures;	302.3.2	ANSI/ASME B31.3 basically has a single time dependent criterion, the 100 000 hours described in 302.3.2 as a basis for allowable stresses.	4.1	
		— for fatigue: design number of cycles at specified stress levels;	302.3.5			
		— for corrosion: design corrosion allowance.	302.4, 304.1.1	c = sum of the mechanical allowances. Covered.		

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
2		**Design (continued)**				
	2.2.3(c)	Stability aspects Where the calculated thickness does not allow for adequate structural stability, the necessary measures must be taken to remedy the situation taking into account the risks from transport and handling.	302.4.1	Not specifically addressed in ANSI/ASME B31.3. However ANSI/ASME B31.3 does not permit thicknesses less than that required for structural stability.	4.1	
	2.2.4	Experimental design method				
		The design of the equipment may be validated, in all or in part, by an appropriate test programme carried out on a sample representative of the equipment or the category of equipment. The test programme must be clearly defined prior to testing and accepted by the notified body responsible for the design conformity assessment module, where it exists. This programme must define test conditions and criteria for acceptance or refusal. The actual values of the essential dimensions and characteristics of the materials which constitute the equipment tested shall be measured before the test. Where appropriate, during tests, it must be possible to observe the critical zones of the pressure equipment with adequate instrumentation capable of registering strains and stresses with sufficient precision. The test programme must include: (a) A pressure strength test, the purpose of which is to check that, at a pressure with a defined safety margin in relation to the maximum allowable pressure, the equipment does not exhibit significant leaks or deformation exceeding a determined threshold. The test pressure must be determined on the basis of the differences between the values of the geometrical and material characteristics measures under test conditions and the values used for design purposes; it must take into account the differences between the test and design temperatures;	304.7.2 304.7.2(a,b,c,d)	Proof test in accordance with either ANSI / ASME B16.9, MSS SP-97 or Section VIII, Division I, UG-101. Covered. Covered.	4.1	

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
2		**Design (continued)**				
	2.2.4	Experimental design method (continued)				
		(b) where the risk of creep or fatigue exists, appropriate tests determined on the basis of the service conditions laid down for the equipment, for instance hold time at specified temperatures, number of cycles at specified stress-levels, etc.;	K304.8 K304.8.5 X302.1.3	Fatigue Analysis. Fatigue Evaluation by Test. Fatigue Analysis: Metallic Bellows Expansion Joints.		
		(c) where necessary, additional tests concerning other factors referred to in 2.2.1 such as corrosion, external damage, etc.	F323	Selection of Material to Resist Deterioration in Service is not within the scope of the Code. (Guidance).		
	2.3	**Provisions to ensure safe handling and operation**				
		The method of operation specified for pressure equipment must be such as to preclude any reasonably foreseeable risk in operation of the equipment. Particular attention must be paid, where appropriate, to:	Appendix G	Safeguarding. Covered.	4.1	
		— closures and openings;				
		— dangerous discharge of pressure relief blow-off;	G300.2(d)			
		— devices to prevent physical access whilst pressure or a vacuum exists;				
		— surface temperature taking into consideration the intended use;				
		— decomposition of unstable fluids.	F323	Covered.		
		In particular, pressure equipment fitted with an access door must be equipped with an automatic or manual device enabling the user easily to ascertain that the opening will not present any hazard.				
		Furthermore, where the opening can be operated quickly, the pressure equipment must be fitted with a device to prevent it being opened whenever the pressure or temperature of the fluid presents a hazard.				

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
2		**Design (continued)**				
	2.4	**Means of examination**	300 (c)	300(c) Intent of the Code	4.1	
	2.4(a)	Pressure equipment must be designed and constructed so that all necessary examinations to ensure safety can be carried out;		(2) This Code is not intended to apply to the operation, examination, inspection, testing, maintenance, or repair of piping that has been placed in service. The provisions of this Code may optionally be applied for those purposes although other considerations may also be necessary.		
	2.4(b)	Means of determining the internal condition of the equipment must 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;				
	2.4(c)	Other means of ensuring the safe condition of the pressure equipment may be applied: — where it is too small for physical internal access, or — where opening the pressure equipment would adversely affect the inside, or — 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.		Examination techniques such as ultrasonic or radiographic examination and acoustic emission testing can be used to ensure the safe condition of piping.		
	2.5	**Means of draining and venting**		The Code does not adequately cover draining and venting.	4.5	
		Adequate means must be provided for the draining and venting of pressure equipment where necessary: — to avoid harmful effects such as water hammer, vacuum collapse, corrosion and uncontrolled chemical reactions. All stages of operation and testing, particularly pressure testing, must be considered, — to permit cleaning, inspection and maintenance in a safe manner.				

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
2		**Design (continued)**				
	2.6	**Corrosion or other chemical attack**				
		Where necessary, adequate allowance or protection against corrosion or other chemical attack must be provided, taking due account of the intended and reasonably foreseeable use.	302.4, 304.1.1	302.4 Allowances. Covered.	4.1	
	2.7	**Wear**				
		Where severe conditions of erosion or abrasion may arise, adequate measures must be taken to: — minimise that effect by appropriate design, e.g. additional material thickness, or by the use of liners or cladding materials; — permit replacement of parts which are most affected; — draw attention, in the instructions referred to in 3.4, to measures necessary for continued safe use.	302.4, 323.4.3, 323.5	Not adequately covered in the Code. Cladding and Lining Materials and Deterioration of Materials in Service.	4.9	
	2.8	**Assemblies**				
		Assemblies must be so designed that: — the components to be assembled together are suitable and reliable for their duty, — all the components are properly integrated and assembled in an appropriate manner.	Chapter II 335	Parts 3, 4, 5 & 6. Assembly and Erection.	4.1	
	2.9	**Provisions for filling and discharge**				
		Where appropriate, the pressure equipment must be so designed and provided with accessories, or provision made for their fitting, as to ensure safe filling and discharge in particular with respect to hazards such as: (a) on filling: — overfilling or overpressurization having regard in particular to the filling ratio and to vapour pressure at the reference temperature; — instability of the pressure equipment; (b) on discharge: the uncontrolled release of the pressurized fluid; (c) on filling or discharge: unsafe connection and disconnection.	Appendix G	Covered.	4.1	

(continued)

Table D.2 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
2		**Design (continued)**				
	2.10	**Protection against exceeding the allowable limits of pressure equipment.**			4.1	
		Where, under reasonably foreseeable conditions, the allowable limits could be exceeded, the pressure equipment must be fitted with, or provision made for the fitting of, suitable protective devices, unless the equipment is intended to be protected by other protective devices within an assembly. The suitable device or combination of such devices must be determined on the basis of the particular characteristics of the equipment or assembly. Suitable protective devices and combinations thereof comprise: (a) safety accessories as defined in Article 1, section 2.1.3, (b) where appropriate, adequate monitoring devices such as indicators and/or alarms which enable adequate action to be taken either automatically or manually to keep the pressure equipment within the allowable limits.	301.2.2 322.6 G300	Required Pressure Containment or Relief. Covered. Pressure Relieving Systems. Safeguarding.		9
	2.11	**Safety accessories**				
	2.11.1	Safety accessories must: — 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; — be independent of other functions, unless their safety function cannot be affected by such other functions, — comply with appropriate design principles in order to obtain suitable and reliable protection. These principles include, in particular, fail-safe modes, redundancy, diversity and self-diagnosis.	322.6.3	Pressure Relieving Devices. Code makes reference to BPV Code, Section VIII, Division I, UG-125(c), UG-126 through UG-128, and UG-132 through UG-136, excluding UG-135(e) and UG-136(c).		9

(continued)

Table D.2 (*concluded*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
2		**Design (continued)**				
	2.11.2	Pressure limiting devices These devices must be so designed that the pressure will not permanently exceed the maximum allowable pressure PS; however a short duration pressure surge in keeping with the specifications laid down in 7.3 is allowable, where appropriate.	322.6.3(b)	7.3 of the PED: 10 % of the maximum allowable pressure. Relief Set Pressure; the Code makes reference to BPV Code, Section VIII, Division I which allows exceptions which exceed 10 %. 302.2.4 Allowances for Pressure and Temperature Variations, permits pressure ratings or the allowable stress for pressure design at the temperature of the increased condition to be exceeded.		9
	2.11.3	Temperature monitoring devices These devices must have an adequate response time on safety grounds, consistent with the measurement function.	G300.3(a)(1)	Engineering Safeguards. Covered.	4.1	
	2.12	**External fire**				
		Where necessary, pressure equipment must be so designed and, where appropriate, fitted with suitable accessories, or provision made for their fitting, to meet damage-limitation requirements in the event of external fire, having particular regard to its intended use.	F323.1 G300	General Considerations (Guidance). Covered. Safeguarding (Guidance). Covered.	4.1	

Table D.3 – ESRs Relevant to manufacturing

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
3		**Manufacturing**				
	3.1	**Manufacturing procedures**				
		The manufacturer must 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.	300(b)(3)		4.1	
	3.1.1	Preparation of the component parts				
		Preparation of the component parts (e.g. forming and chamfering) must not give rise to defects or cracks or changes in the mechanical characteristics likely to be detrimental to the safety of the pressure equipment.	Chapter V 332	Fabrication, Assembly and Erection. 332.1 General, 332.2 Bending, 332.3 Forming.	4.1	
	3.1.2	Permanent joining				
		Permanent joints and adjacent zones must be free of any surface or internal defects detrimental to the safety of the equipment. The properties of permanent joints must 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. For pressure equipment, permanent joining of components which contribute to the pressure resistance of equipment and components which are directly attached to them must be carried out by suitably qualified personnel according to suitable operating procedures.	Chapter V 328	Fabrication, Assembly and Erection. Welding. 328.1 Welding Responsibility, 328.2 Welding Qualifications, 328.3 Welding Materials, 328.4 Preparation for Welding, 328.5 Welding Requirements, 328.6 Weld Repair, 330 Preheating.	4.1	

(continued)

Table D.3 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
3	3.1.2	Manufacturing (*continued*)				
		For pressure equipment in categories II, III and IV, operating procedures and personnel must be approved by a competent third party which, at the manufacturer's discretion, may be: — a notified body; — a third-party organization recognized by a Member State as provided for in Article 13.		The categories in the Code are not consistent with those in the Directive. Code required qualification requirements are normally to ANSI / ASME BPV Code Section IX.		7.1
		To carry out these approvals the third party must perform examinations and tests as set out in the appropriate harmonized standards or equivalent examinations and tests or must have them performed.		ANSI/ASME B31.3 does not require welding, brazing or bonding qualifications to be performed by a third party.		7.1
	3.1.3	Non-destructive tests				
		For pressure equipment, non-destructive tests of permanent joints must be carried out by suitable qualified personnel. For pressure equipment in categories III and IV, the personnel must be approved by a third-party organization recognized by a Member State pursuant to Article 13.	342	Examination Personnel The categories in the Code are not consistent with those in the Directive. ANSI/ASME B31.3 does not require that examination be carried out by a third party.		8.1
	3.1.4	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 must be applied at the appropriate stage of manufacture.	331	Heat Treatment.	4.1	
	3.1.5	Traceability				
		Suitable procedures must 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.		Marking of individual components (pipe, flanges, butt welding fittings etc.) is covered in the relevant ASME specification e.g. B16.5, B16.9 etc. Transfer of marking when cutting plate/pipe is not covered in ANSI/ASME B31.3. Although the PED calls for traceability the requirements are not specific to this level of detail.	4.3.3	7.2

(continued)

Table D.3 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
	3.2	**Final assessment**				
		Pressure equipment must be subjected to final assessment as described below.				
	3.2.1	Final inspection				
		Pressure equipment must undergo a final inspection to assess visually and by examination of the accompanying documents compliance with the requirements of the Directive. Test carried out during manufacture may be taken into account. As far as is necessary on safety grounds, the final inspection must 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).	Chapter VI	Documentation to verify compliance with the requirements of the Directive are not covered by the Code. Inspection, Examination and Testing.		8.2
	3.2.2	Proof test				
		Final assessment of pressure equipment must 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 laid down in 7.4. 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 recognised 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, must be applied before those tests are carried out.	345	Testing. 345.4 Hydrostatic Leak (Pressure) Test. 345.5 Pneumatic Leak Test, 345.9 Alternative Leak (Pressure) Test.	4.1 4.1	
	3.2.3	Inspection of safety devices				
		For assemblies, the final assessment must also include a check of the safety devices intended to check full compliance with the requirements referred to in 2.10.		Outside scope of Code.		8.2

(continued)

Table D.3 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
	3.3	**Marking and labelling**				
		In addition to the CE marking referred to in Article 15, the following information must be provided: (a) for all pressure equipment: — the year of manufacture; — identification of the pressure equipment according to its nature, such as type, series or batch identification and serial number; — essential maximum/minimum allowable limits; (b) depending on the type of pressure equipment, further information necessary for safe installation, operation or use and, where applicable, maintenance and periodic inspection such as: — the volume V of the pressure equipment in 1; — the nominal size for piping DN; — the test pressure PT applied in bar and date; — safety device set pressure in bar; — output of the pressure equipment in kW; — supply voltage in V (volts); — intended use; – filling ratio kg/L; — maximum filling mass in kg; — tare mass in kg; — the product group. (c) where necessary, warnings fixed to the pressure equipment drawing attention to misuse which experience has shown might occur.		Outside scope of Code.		7.3

(continued)

Table D.3 (*concluded*)

PED Annex I		Essential Safety Requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
	3.3	**Marking and labelling (continued)**				
		The CE marking and the required information must be given on the pressure equipment or on a dataplate firmly attached to it, with the following exceptions: — where applicable, appropriate documentation may be used to avoid repetitive marking of individual parts such as piping components, intended for the same assembly. This applies to CE marking and other marking and labelling referred to in this Annex; — where the pressure equipment is too small, e.g. accessories, the information referred to in (b) may be given on a label attached to that pressure equipment; — labelling or other adequate means may be used for the mass to be filled and the warnings referred to in (c), provided it remains legible for the appropriate period of time.				
	3.4	**Operating instructions**				
		(a) When pressure equipment is placed on the market, it must be accompanied, as far as relevant, with instructions for the user, containing all the necessary safety information relating to: — mounting including assembling of different pieces of pressure equipment; — putting into service; — use; — maintenance including checks by the user; (b) Instructions must cover information affixed to the pressure equipment in accordance with 3.3, with the exception of serial identification, and must be accompanied, where appropriate, by the technical documents, drawings and diagrams necessary for a full understanding of these instructions; (c) If appropriate, these instructions must also refer to hazards arising from misuse in accordance with 1.3 and particular features of the design in accordance with 2.2.3.	Appendix G	Outside scope of Code. Not relevant to piping systems.	N/A	N/A

Table D.4 — ESRs Relevant to Materials

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
4		**Materials**				
		Materials used for the manufacture of pressure equipment must be suitable for such application during the scheduled lifetime unless replacement is foreseen. Welding consumables and other joining materials need fulfil only the relevant requirements of 4.1, 4.2 (a) and the first paragraph of 4.3, in an appropriate way, both individually and in a joined structure.		The exclusion of section 4.2(b) means that there is no requirement to have welding consumables in compliance with a harmonised standard or subject to a European Approval for Materials. Not relevant.	N/A	N/A
	4.1	**Materials for pressurised parts must:**				
		(a) have appropriate properties for all operating conditions which are reasonably foreseeable and for all test conditions, and in particular they should be sufficiently ductile and tough. Where appropriate, the characteristics of the materials must comply with the requirements of 7.5. Moreover, due care should be exercised in particular in selecting materials in order to prevent brittle-type fracture where necessary; where for specific reasons brittle material has to be used appropriate measures must be taken; (b) be sufficiently chemically resistant to the fluid contained in the pressure equipment; the chemical and physical properties necessary for operational safety must not be significantly affected within the scheduled lifetime of the equipment; (c) not be significantly affected by ageing; (d) be suitable for the intended processing procedures; (e) be selected in order to avoid significant undesirable effects when the various materials are put together.	Chapter III	Materials 323 General Requirements 323.1 Materials and Specifications, 323.2 Temperature Limitations, 323.4 Fluid Service Requirements, 323.5 Deterioration of Materials in Service.	4.1	

(continued)

Table D.4 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
	4.2	(a) The pressure equipment manufacturer must define in an appropriate manner the values necessary for the design calculations referred to in 2.2.3 and the essential characteristics of the materials and their treatment referred to in 4.1;		(a) In the Code this is not the manufacturer's responsibility.		4.2
		(b) the manufacturer must provide in his technical documentation elements relating to compliance with the materials specifications of the Directive in one of the following forms:		(b) Most American materials are not included in European Harmonised Standards. Those not covered would require European Approval of Materials (see Article 11, section 1 below). ANSI/ASME B31.3 does not require that American materials be used: EN materials are not excluded. They are acceptable as unlisted materials.		5
		— by using materials which comply with harmonized standards;				
		— by using materials covered by a European approval of pressure equipment materials in accordance with Article 11;		PMA is currently (2003) the main practical route pending publication of harmonised standards which are compatible with the design approach.		
		— by a particular material appraisal;				
		(c) for pressure equipment in categories III and IV, particular appraisal as referred to in the third indent of (b) must be performed by the notified body in charge of conformity assessment procedures for the pressure equipment.		(c) Not covered by Code.		5

(continued)

Table D.4 (*concluded*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
	4.3	The equipment manufacturer must take appropriate measures to ensure that the material used conforms with the required specification. In particular, documentation prepared by the material manufacturer affirming compliance with a specification must be obtained for all materials. For the main pressure-bearing parts of equipment in categories II, III and IV, this must take the form of a certificate of specific product control. Where a material manufacturer has an appropriate quality-assurance system, certified by a competent body established within the Community and having undergone a specific assessment for materials, certificates issued by the manufacturer are presumed to certify conformity with the relevant requirements of this section.	300(b)(3), 341.2(a), 341.4.1(a)(1), 341.4.1(c)	Implicit in 300(b)(3). Not addressed in the Code.	4.1	
Article 11						
European approval for materials						
1	European approval for materials, as defined in Article 1, section 2.9, shall be issued at the request of one or more manufacturers of materials or equipment, by one of the notified bodies referred to in Article 12 specifically designated for that task. The notified body shall determine and perform, or arrange for the performance of, the appropriate inspections and tests to certify the conformity of the types of material with the corresponding requirements of this Directive; in the case of materials recognized as being safe to use before 29 November 1999, the notified body shall take account of the existing data when certifying such conformity.					

Table D.5 – ESRs: Specific pressure equipment requirements

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
		In addition to the applicable requirements of sections 1 to 4, the following requirements apply to the pressure equipment covered by sections 5 and 6.				
5		**Fired or otherwise heated pressure equipment with a risk of overheating as referred to in article 3 (1)**				
		This pressure equipment includes: — steam and hot-water generators as referred to in Article 3, section 1.2, such as fired steam and hot-water boilers, superheaters and reheaters, waste-heat boilers, waste incineration boilers, electrode or immersion-type electrically heated boilers, pressure cookers, together with their accessories and where applicable their systems for treatment of feedwater and for fuel supply, and — process-heating equipment for other than steam and hot water generation falling under Article 3, section 1.1, such as heaters for chemical and other similar processes and pressurized food-processing equipment.			N/A	N/A

(continued)

Table D.5 – ESRs: specific pressure equipment requirements *(concluded)*

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
5		**Fired or otherwise heated pressure equipment with a risk of overheating as referred to in article 3 (1) (following)**				
		This pressure equipment must be calculated, designed and constructed so as to avoid or minimize risks of a significant loss of containment from overheating. In particular it must be ensured, where applicable, that: (a) appropriate means of protection are provided to restrict operating parameters such as heat input, heat take-off and, where applicable, fluid level so as to avoid any risk of local and general overheating; (b) sampling points are provided where required to allow evaluation of the properties of the fluid so as to avoid risks related to deposits and/or corrosion; (c) adequate provisions are made to eliminate risks of damage from deposits; (d) means of safe removal of residual heat after shutdown are provided; (e) steps are taken to avoid a dangerous accumulation of ignitable mixtures of combustible substances and air, or flame blowback.		Not relevant to piping.	N/A	N/A

Table D.6 – ESRs: Requirements for piping

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
6		**Piping as referred to in article 3, section 1.3**				
		Design and construction must ensure:				
		(a) that the risk of overstressing from inadmissible free movement or excessive forces being produced, e.g. on flanges, connections, bellows or hoses, is adequately controlled by means such as support, constraint, anchoring, alignment and pre-tension;	321	Piping Support. Covered.	4.1	
		(b) that where there is a possibility of condensation occurring inside pipes for gaseous fluids, means are provided for drainage and removal of deposits from low areas to avoid damage from water hammer or corrosion;	301.5.1	Impact. Covered.		
		(c) that due consideration is given to the potential damage from turbulence and formation of vortices; the relevant parts of 2.7 are applicable;	302.4	Allowances. Covered.		
		(d) that due consideration is given to the risk of fatigue due to vibrations in pipes;	301.10 Chapter IX, Appendix X	Chapter IX and Appendix X cover only High Pressure Piping and Bellows Expansion Joints.		
		(e) that, where fluids of Group 1 are contained in the piping, appropriate means are provided to isolate 'take-off' pipes the size of which represents a significant risk;		Not covered.	4.4	6.3
		(f) that the risk of inadvertent discharge is minimized; the take-off points must be clearly marked on the permanent side, indicating the fluid contained;		Not covered.	4.4	7.3.2
		(g) that the position and route of underground piping is at least recorded in the technical documentation to facilitate safe maintenance, inspection or repair.		Not covered.		7.3.1

Table D.7 – ESRs: Specific quantitative requirements for certain pressure equipment

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
7		**Specific quantitative requirements for certain pressure equipment**				
		The following provisions apply as a general rule. However, where they are not applied, including in cases where materials are not specifically referred to and no harmonized standards are applied, the manufacturer must demonstrate that appropriate measures have been taken to achieve an equivalent overall level of safety. This section is an integral part of Annex I. The provisions laid down in this section supplement the essential requirements of sections 1 to 6 for the pressure equipment to which they apply.	Chapter III	Materials. Chapter III states limitations and required qualifications for materials based on their inherent properties. Their use in piping is also subject to requirements and limitations in other parts of the Code.	4.1	
	7.1	**Allowable stresses**				
	7.1.1	Symbols				
		$R_{e/t}$, yield limit, indicates the value at the calculation temperature of: — the upper flow limit for a material presenting upper and lower flow limits, — the 1,0 % proof strength of austenitic steel and non-alloyed aluminium, — the 0,2 % proof strength in other cases. $R_{m/20}$ indicates the minimum value of the ultimate strength 20 °C. $R_{m/t}$ designates the ultimate strength at the calculation temperature.		Symbols in ANSI/ASME B31.3 are not consistent with the Directive.	4.1	

(*continued*)

Table D.7 (*continued*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	**Sub-section**				**ISO 15649 clause**	**Guide clause**
	7.1.2	The permissible general membrane stress for predominantly static loads and for temperatures outside the range in which creep is significant must not exceed the smaller of the following values, according to the material used: —in the case of ferritic steel including normalized (normalized rolled) steel and excluding fine-grained steel and specially heat-treated steel, 2/3 of $R_{e/t}$ and 5/12 of $R_{m/20}$; — in the case of austenitic steel: — if its elongation after rupture exceeds 30 %, 2/3 of $R_{e/t}$ — or, alternatively, and if its elongation after rupture exceeds 35 %, 5/6 of $R_{e/t}$ and 1/3 of $R_{m/t}$; — in the case of non-alloy or low-alloy cast steel, 10/19 of $R_{e/t}$ and 1/3 of $R_{m/20}$; — in the case of aluminium, 2/3 of $R_{e/t}$; — in the case of aluminium alloys excluding precipitation hardening alloys 2/3 of $R_{e/t}$ and 5/12 of $R_{m/20}$.	302.3	Allowable Stresses and Other Stress Limits. Covers many materials and factors but not all the factors are consistent with the Directive.		6.1
	7.2	**Joint coefficients**				
		For welded joints, the joint coefficient must not exceed the following values: — for equipment subject to destructive and non-destructive tests which confirm that the whole series of joints show no significant defects: 1, — for equipment subject to random non-destructive testing: 0,85, — for equipment not subject to non-destructive testing other than visual inspection: 0,7. If necessary, the type of stress and the mechanical and technological properties of the joint must also be taken into account.	302.3.4, Table A-1B	Weld Joint Quality Factor E_j. The values in the Code do not comply completely with the Directive. However the first paragraph of this Table states that the following provisions apply as a general rule. However an equivalent overall level of safety must be achieved.		6.2

(*continued*)

Table D.7 (*concluded*)

PED Annex I		Essential safety requirements	ANSI/ASME B31.3 Reference	Notes / Comments	PED Compliance	
Section	Sub-section				ISO 15649 clause	Guide clause
	7.3	**Pressure limiting devices, particularly for pressure vessels**				
		The momentary pressure surge referred to in 2.11.2 must be kept to 10 % of the maximum allowable pressure.		322.6.3(b) permits greater than 10 % above the maximum allowable pressure.		9
	7.4	**Hydrostatic test pressure**				
		For pressure vessels, the hydrostatic test pressure referred to in 3.2.2 must be no less than: — that corresponding to the maximum loading to which the pressure equipment may be subject in service taking into account its maximum allowable pressure and its maximum allowable temperature, multiplied by the coefficient 1,25, or — the maximum allowable pressure multiplied by the coefficient 1,43, whichever is the greater.	345.4	See CEC/PED/WPG Guideline 8/2.	4.1	
	7.5	**Material characteristics**				
		Unless other values are required in accordance with other criteria that must be taken into account, a steel is considered as sufficiently ductile to satisfy 4.1 (a) if, in a tensile test carried out by a standard procedure, its elongation after rupture is no less than 14 % and its bending rupture energy measured on an ISO V test-piece is no less than 27 J, at a temperature not greater than 20 °C but not higher than the lowest scheduled operating temperature.	Chapter III	Materials. Covers impact testing in great detail but does not meet the 27 J value for all carbon and low alloy steels. Not covered.		5

Annex E
(informative)

Sources of further information and guidance

E.1 Established guidelines

E.1.1 General

NOTE Abbreviations used in this annex and not defined elsewhere in this Guide are listed in E.3 below.

E.1.2 European Commission (CEC) guidelines

Although they have no formal legal force, these Guidelines, being published by the CEC, are the most authoritative interpretations of the PED in the EU.

The Guidelines are ratified by the *Working Group Pressure (CEC/PED/WGP),* which operates under the auspices and chairmanship of the CEC and comprises: representatives of all Member State (MS) governments and relevant pan-European bodies, such as the European standards organisation (CEN), manufacturers (via ORGALIME and others), users (via ECUI, CEFIC, Europia and others) and the Notified Bodies Forum (NBF). Shortly after the formation of WGP, it became obvious that this group was far too large and cumbersome to produce the necessary guidance in a timely manner; so the CEC created – again under its chairmanship – the much smaller *Working Party on Guidelines (CEC/PED/WPG),* comprising, by invitation, single representatives from: seven selected MSs, and individual experts from CEN, ORGALIME, NBF and Users (ECUI/CEFIC/Europia).

Copies of the *List of Questions on PED*, which includes all ratified Guidelines, are readily obtainable via the CEC, national government and ORGALIME websites (see E.2.1 below).

E.1.3 Other guidelines

Two additional sets are ORGALIME “fiches”, and French government “CLAP” forms, both of which are often used as the basis for CEC Guidelines and then withdrawn if the authors are satisfied with the result; consequently these sets are continually changing. The former are produced by the ORGALIME PED Workgroup (on which users are represented) and published in the *ORGALIME Guide* and website (see E.2.1 and E.2.2, below); the latter are obtainable via the AFNOR website (see E.2.1, below)

E.2 Other sources of information

E.2.1 Websites

Useful addresses are:

- AFNOR — *http://www.afnor.fr*
- CEC (general, English) — http://europa.eu.int/index_en.htm
- CEC (PED specific) — http://ped.eurodyn.com
- CEN (general) — http://www.cenorm.be
- CEN (Harmonised European Standards Related to the New Approach Directives) — http://www.newapproach.org/directivelist.asp

- DIN — http://www.din.de/
- DTI (UK government) — http://www.dti.gov.uk/strd/pressure.htm
- EEMUA (including ECUI) — http://www.eemua.co.uk
- EPERC — http://eperc.jre.ul1
- Europia (SOEAG, Issue no.2) — http://europia.standardsline.net/
- Harmonised European Standards Published in OJ — http://europa.eu.int/comm/enterprise/newapproach/standardization/harmstds/reflist/equippre.html
- ORGALIME — http://www.orgalime.org

E.2.2 Published Guidance guidance documents

- CLAP (French committee for pressure equipment) guidelines: http://www.afnor.fr/selection1/normedirect/direquippress.htm
- DTI (UK government, telephone: 0870-1502-500):
- SI 1999 No 2001 The Pressure Equipment Regulations 1999 (UK transposing regulations) [3)]
- URN 99/1147 Pressure Equipment – Guidance Notes on the UK Regulations, November 1999 [3)]
- URN 99/1051 Pressure Equipment Directive: Guidelines for the Appointment of Conformity Assessment Bodies[3)]
- EEMUA Publication 196: Valve Purchasers' Guide to the PED: http://www.eemua.co.uk/publications/cat-mec3.htm
- Europia PED Guide for the Oil Industry (not yet available at time of publication of the present Guide), to be available at: http://europia.standardsline.net/
- ORGALIME Guide on the EC Directive on Pressure Equipment, Apr 99: http://www.orgalime.org/longpub.htm#Anchor-GENERAL-25010

E.2.3 Miscellaneous sources

From time to time, meetings (e.g. the UK Pressure Equipment Co-ordination Forum – PECF), conferences, symposia, workshops, and training courses are held. Also, articles and reports may be published in technical journals.

E.3 Abbreviations

The following abbreviations used in this annex are not defined elsewhere in the main text of this Guide:

- AFNOR, Association Française de Normalisation (the French standards organisation);
- CEFIC, Conseil Européen des Fédérations de l'Industrie Chimique (European Council of Chemical Industry Federations);
- CLAP, Comité de Liaison des Appareils à Pression (Liaison Committee for Pressure Equipment) (France);

[3)] Available also from DTI website (see E.2.1, above).

- DIN, Deutsches Institut für Normung (German Standards Institute);
- DTI, (UK) Department of Trade and Industry;
- ECUI, European Committee of User Inspectorates;
- EPERC, European Pressure Equipment Research Council;
- ORGALIME, (Liaison Group of the European Mechanical, Electrical, Electronic & Metalworking Industries—the European trade association for engineering industries);
- SI, (UK) Statutory instruments;
- SOEAG, Standardisation of Oil Equipment Action Group.

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL