



**SLOVENSKI STANDARD**  
**SIST-TP CEN/TR 14549:2004**  
**01-maj-2004**

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

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

Erdöl- und Erdgasindustrien - Alternative für metallische industrielle Rohrleitungen

**iTeh STANDARD PREVIEW**

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

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**Ta slovenski standard je istoveten z: CEN/TR 14549:2004**

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RAPPORT TECHNIQUE  
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**CEN/TR 14549**

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**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.

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## 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 29<sup>th</sup> November 1999 and has been mandatory throughout all Member States of the EU and the rest of the European Economic Area (EEA) on 30<sup>th</sup> 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 <sup>1)</sup> \* 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.

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<sup>1)</sup> 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 term 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:

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

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

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

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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.

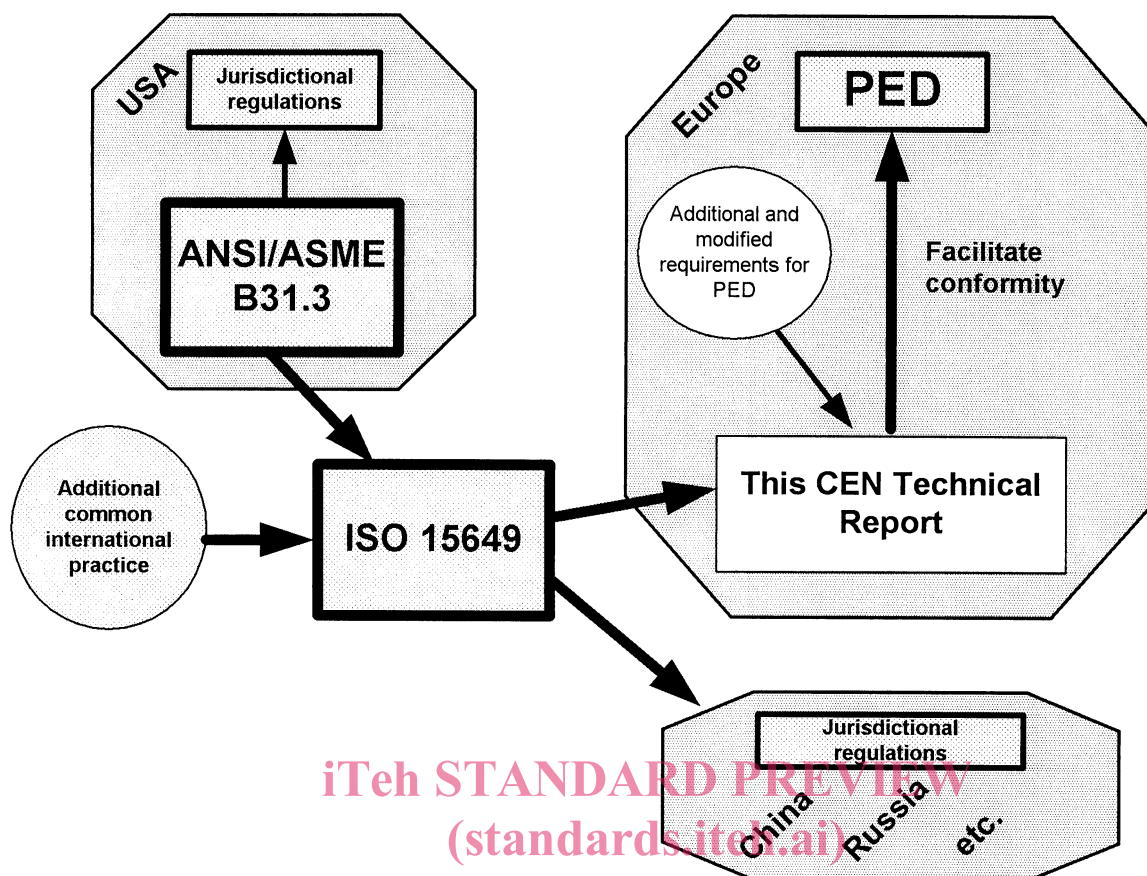
Europa has published a guide for the oil industry on the use of the PED with particular emphasis on refinery operations, whilst EEMUA has published a guide for purchasers of valves under the PED (EEMUA Publication 196).

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.



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**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 DGEnterprise 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>.

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European Pressure Equipment Directive – A guide for the oil industry [Europa]. <http://europa.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
<b>Group 1</b>	<ul style="list-style-type: none"> <li>– explosive</li> <li>– extremely flammable</li> <li>– highly flammable</li> <li>– flammable (where the maximum allowable temperature is above the flash point)</li> <li>– very toxic</li> <li>– toxic</li> <li>– oxidizing</li> </ul>
<b>Group 2</b>	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

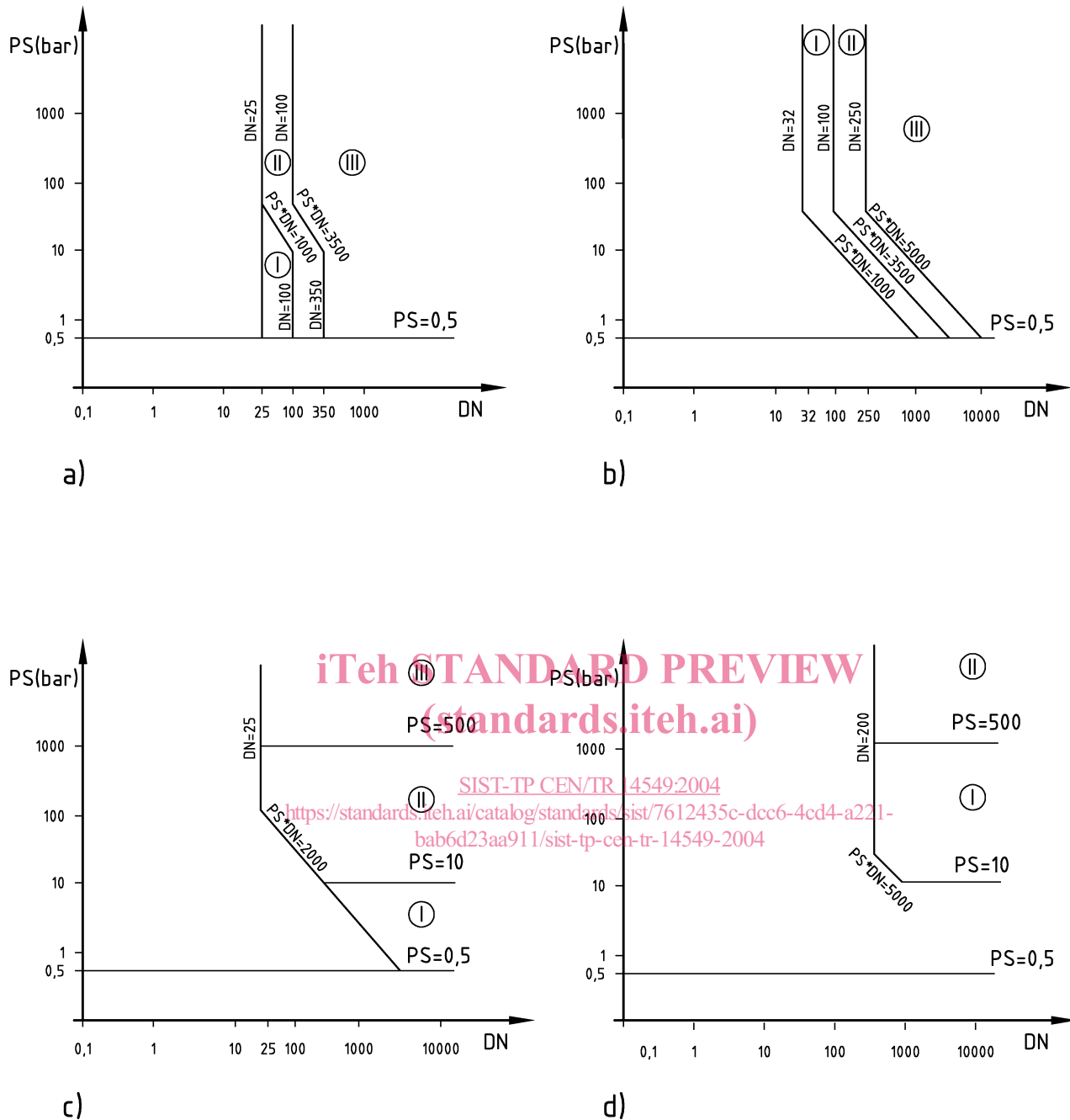
The manufacturer is responsible for classifying the piping into the appropriate conformity assessment category in accordance with the PED Annex II, Tables 6, 7, 8, 9, (see Figure 2 below) depending on the state (gas or liquid), fluid group, pressure and nominal diameter (DN). The purpose of the category 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.

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## 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:

- 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.
- 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).

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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.

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**5 Materials**

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**5.1 Material selection and appraisal**

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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  $\frac{2}{3}$  yield and  $\frac{1}{3}$  tensile strength. The PED allows the lower of  $\frac{2}{3}$  yield and  $\frac{5}{12}$  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.

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### 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):

- a notified body; or
- 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).

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#### 7.3 Documentation

##### 7.3.1 Marking and labelling

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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.