

Industrial valves — Valves for chemical and petrochemical process industry — Requirements and tests

The European Standard EN 12569:1999 has the status of a
British Standard

ICS 23.060.01

National foreword

This British Standard is the English language version of EN 12569:1999, including corrigendum December 1999 and corrigendum November 2000.

The UK participation in its preparation was entrusted by Technical Committee PSE/7, Valves, to Subcommittee PSE/7/12, Valves for process industry, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible 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.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 16, an inside back cover and a back cover.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 December 1999

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ISBN 0 580 35420 2

Amendments issued since publication

Amd. No.	Date	Comments
10959 Corrigendum No. 1	September 2000	Table 1 amended
13061 Corrigendum No. 2	June 2001	Table 1 amended

English version

Industrial valves - Valves for chemical and petrochemical process industry - Requirements and tests

Robinetterie industrielle - Appareils de robinetterie destinés
aux procédés de l'industrie chimique et pétrochimique -
Prescriptions et essais

Industriearmaturen - Armaturen für die chemische und
petrochemische Verfahrenindustrie – Anforderungen und
Prüfungen

This European Standard was approved by CEN on 16 August 1999.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 69 "Industrial valves", the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2000, and conflicting national standards shall be withdrawn at the latest by March 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard is based on the experience of the chemical and petrochemical industry and provides requirements additional to those found in valve product standards.

The user of the standard is free to decide to which valves it applies.

1 Scope

This European Standard applies to valves of DN15 and greater, made of metallic materials for chemical and petrochemical plants. It contains additional requirements to those contained in the relevant European product standards.

Two levels of quality are included. All valves shall meet the requirements of level I. Valves shall meet the requirements of level II only when required by the order.

NOTE: It is assumed that the essential safety requirements of the PED (satisfied by European product standards) and safety requirements from other standards are satisfied.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative 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 European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 19	<i>Marking of general purpose industrial valves</i>
EN 287-1	<i>Approval testing of welders - Fusion welding - Part 1: Steels</i>
EN 288-1	<i>Specification and qualification of welding procedures for metallic materials - Part 1: General rules for fusion welding</i>
EN 736-3	<i>Valves - Terminology - Part 3: Definition of terms</i>
prEN 1092 –1:1997	<i>Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 1: Steel flanges</i>
EN 1092 –2:1997	<i>Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 2: Cast iron flanges</i>
EN 1333	<i>Pipework components – Definition and selection of PN</i>
prEN 1349:1999	<i>Industrial process control valves</i>
prEN 1503-1:1995	<i>Valves - Shell materials - Part 1: Steels</i>
prEN 1503-2:1995	<i>Valves - Shell materials - Part 2: ISO-steels</i>
prEN 1503-3:1995	<i>Valves - Shell materials - Part 3: Cast irons</i>
EN 1563	<i>Founding - Spheroidal graphite cast irons</i>
prEN 12116:1996	<i>Industrial valves – Part-turn valve actuator attachment</i>
prEN 12266-1:1999	<i>Industrial valves – Technical conditions of delivery - Part 1: Requirements to be fulfilled by every valve</i>
prEN 12266-2:1999	<i>Industrial valves - Technical conditions of delivery - Part 2: Further requirements</i>
EN 12351	<i>Industrial valves - Protective caps for valves with flanged connections</i>

EN 12454	<i>Founding - Visual examination of surface discontinuities - Steel sand castings</i>
prEN 12516-3:1999	<i>Valves - Shell design strength - Part 3: Experimental method</i>
prEN 12570:1998	<i>Valves - Permissible manual forces for operation of valves</i>
EN ISO 5210	<i>Industrial valves - Multi-turn valve actuator attachments (ISO 5210:1991)</i>
EN ISO 6708	<i>Pipework components - Definition and selection of DN (nominal size) (ISO 6708:1995)</i>
EN ISO 9001	<i>Quality systems - Model for quality assurance in design/development, production, installation and servicing (ISO 9001:1994)</i>
EN ISO 9002	<i>Quality systems - Model for quality assurance in production, installation and servicing (ISO 9002:1994)</i>
EN ISO 9003	<i>Quality systems - Model for quality assurance in final inspection and test (ISO 9003:1994)</i>
prEN ISO 10497:1996	<i>Testing of valves - Fire type-testing requirements (ISO 10497:1992)</i>

3 Definitions

For the purposes of this standard, the definitions contained in any standard referred to above, apply.

4 Requirements

Paragraphs marked with a dot [•] indicate requirements to be specified by the purchaser.

4.1 General

The design of the shell shall meet the requirements of prEN 12516-3:1999 or other accepted calculation methods. The following additional force shall allow for the undefined external moments and forces that are produced by the adjoining piping of the vessel:

The additional force, F_{ADD} , shall be calculated from:

$$F_{ADD} = p_s \times A$$

where:

p_s is the allowable pressure, in newtons per square millimetre;

A is the cross-sectional area ($D^2 \times \pi/4$), in square millimetres;

D is the value of DN, in millimetres.

It is assumed that the section modulus of the valve is equal to or greater than the adjacent pipe and that the materials strengths are equal.

Under these conditions it is assumed that correct function is preserved.

For the visual inspection and the non-destructive tests, all pressure retaining parts shall have a surface finish which makes it possible to conduct the tests in accordance with table 1.

[•] When fire test certification is required it shall be specified by the purchaser. Certification shall be in accordance with prEN ISO 10497:1996 or other standard by agreement.

The valve shall be asbestos free.

[•] If the subcontractors are not certified in accordance with EN ISO 9000 series, (EN ISO 9001, EN ISO 9002, EN ISO 9003, as appropriate), the purchasers can require to be informed about the change of subcontractors for main parts of a valve (e.g. castings, forgings for valves). The purchaser shall be informed about the use of subcontractors for complete valves. The manufacturer shall ensure in every case the interchangeability of parts.

4.2 Quality assurance

4.2.1 Semi-product manufacturer (e.g. foundry, forge, welding shop)

Semi-product manufacturers shall have suitable equipment and qualified personnel for proper manufacture of their materials and products. They shall have test equipment for tests according to applicable standards or other required technical specifications. These manufacturers shall ensure the proper manufacture and processing of the materials and products by means of a quality assurance system, in accordance with EN ISO 9000 series, (EN ISO 9001, EN ISO 9002, EN ISO 9003, as appropriate) audited at regular intervals by an authorized representative (e.g. notified body).

The documentation for materials or semi-products shall be made available to the purchaser on request.

4.2.2 Valve manufacturer

The valve manufacturer shall have suitable equipment and qualified personnel for the further processing of the materials or semi-products used. He shall operate a quality assurance system, in accordance with EN ISO 9000 series, (EN ISO 9001, EN ISO 9002, EN ISO 9003, as appropriate), audited at regular intervals by an authorized representative (e.g. notified body).

The purchaser has the right to witness the quality tests at the manufacturer's and/or supplier's premises and to carry out quality audits.

Documentation shall be made available to the purchaser on request.

4.3 Design

4.3.1 General

Valves shall meet the design requirements of their specific product standards, if such exist.

Where no applicable product standard exists safe and sound engineering practice, including the application of basic standards for industrial valves, shall apply.

The following requirements concerning design shall apply to all valves.

4.3.2 Anti-blow-out shaft/stem

The design of the shaft/stem shall be anti-blow-out type in accordance with EN 736-3.

4.3.3 Gaskets

Gaskets of the shell shall be radially retained against the pressure, except in the case of body bonnet joints up to and including PN 25 (or Class 150) valves.

Spiral wound gaskets sealing the body/cover connection shall be fully retained or provided with outer and inner guide rings.

The sealing face of spiral wound gaskets and metallic ring-joint gaskets shall not be interrupted by bolts, rings etc.

4.3.4 Fugitive emission control

[•] When required, valves shall be fitted with a stem seal specifically designed to prevent fugitive emissions to the atmosphere. If requested by the purchaser a type qualification test shall be carried out. The test procedure and the acceptance criteria shall be as agreed.

Where bellows and diaphragms are used as primary seals, they shall be provided with a secondary packing in case of rupture.

4.3.5 Anti-static protection

The electrical resistance between body and obturator/stem of the valve shall not exceed 10^6 ohms.

4.3.6 Screwed connections

All screwed connections, e.g. body/cover connections or screwed in parts of valves, shall be properly secured (e.g. by friction or locking) against accidental loosening. Screwed body/cover connections that rely on the thread to seal are not acceptable.

The valve shall be designed so that the risk of media induced crevice corrosion will be avoided.

4.3.7 Wafer and lug type valves

Wafer and lug type valves shall not require an increase in flange bolt load above that which is necessary to seal the valve/flange joints.

4.3.8 Position of the obturator/actuator in quarter turn valves

The position of a lever or indicator shall be in the direction of the pipeline when the valve is open and perpendicular to the pipeline when the valve is closed.

Wrong assembly of the lever or indicator shall be impossible.

The shaft design and the actuator shall indicate the same obturator position whatever accessories are used (e.g. extensions).

After assembly, the position of actuators and gearboxes relative to the valve shall be physically marked in order to avoid incorrect re-assembly during maintenance.

4.3.9 Shaft or stem strength

4.3.9.1 [•] When specified by the purchaser the valve manufacturer shall supply information on:

- a) the required torque (or the necessary force) to open and to close the valve;
- b) the maximum allowable torque or force which may be applied to the stem or the shaft.

4.3.9.2 The weakest point of the shaft shall always be outside the pressure retaining shell.

4.3.10 End of line service

[•] When valves are specified for end of line isolation service they shall be capable of sealing the allowable pressure in both directions.

4.3.11 Connection to the drive

[•] When the purchaser requires an actuator attachment that is integral with the valve, it shall be in accordance with EN ISO 5210 or prEN 12116:1996.

The connection between the valve body and the gearbox or actuator shall be vented such that any product leakage from the stem or shaft cannot penetrate into the gearbox or actuator housing.

4.4 Materials

4.4.1 Principal requirements

Ferrous materials shall be chosen from prEN 1503-1:1995, prEN 1503-2:1995 and prEN 1503-3:1995, and EN 1563.

Spheroidal graphite cast iron in accordance with EN 1563 should be limited to qualities with an elongation equal to or greater than 18 %.

In the case of non-ferrous materials or steels where these standards are not appropriate, the materials shall be subject to agreement between the manufacturer and the purchaser.

[•] If other materials are needed, the materials shall be specified by the purchaser.

4.4.2 EN-GJS-400-18-Spheroidal graphite cast iron

The formation of the structure in valves made of EN-GJS-400-18 shall contain greater than 90 % spheroidal graphite formation in a largely ferritic matrix with a maximum of 5 % pearlite content.

The presence of secondary cementite in the micro-section, which can be verified at 200 times magnification, is not permitted.

In the case of EN-GJS-400-18, ferritic annealing of the components shall be carried out. The notched-bar impact energy shall be determined at - 20°C for each cast batch or heat-treatment batch on a body from the last casting box or, if not possible, on the test specimen integrally cast with the body. The thickness of the integrally cast test specimen should be less than or equal to the flange thickness. The remaining tests can be carried out in accordance with EN 1563.

In the case of small castings in which it is not possible to determine the notched-bar impact energy, the manufacturer may verify satisfactory condition of the material by means of a metallographic micro-section. In this case the micro-graph shall be supplied.

4.4.3 High alloyed materials

Austenitic stainless steel shall be supplied in a solution annealed and water quenched condition.

Where highly corrosion-resistant materials are specified, (e.g. nickel and nickel base alloys, titanium, tantalum), the manufacturer shall provide fabrication documents on chemical analysis, mechanical properties and material finish.

[•] Specific requirements, e.g. concerning material certification shall be indicated by the purchaser.

4.4.4 Impact testing

[•] If an impact test, additional to any required by the material specification, is necessary for low temperature applications, it shall be specified by the purchaser.

4.4.5 Painting, coating, lining and liners

Painting, coating and lining shall be conducted in accordance with a written procedure defining requirements for raw materials, surface preparation, application, bonding and control of quality including thickness, porosity etc. as applicable.

Liners shall be produced in accordance with a written procedure that defines the material used, the production process, acceptable quality and testing.

Painting, coating, lining and liners shall be of the required quality in accordance with the applicable procedure and be free of unacceptable defects.

4.4.6 Traceability

[•] When requested by the purchaser, traceability for all materials for shell components shall be maintained throughout manufacture, including assembly and test.

Bolting shall be marked with strength-class or material code and manufacturer logo.

4.5 Welding to parts of valves

4.5.1 General

All welding shall be performed in accordance with a written welding procedure.

Butt welds shall be full penetration type.

If the carbon content is greater than 0,20 % and the carbon equivalent is greater than 0,35 % the welding procedure shall define preheat temperature, interpass temperature and postweld heat treatment.

Carbon steels and ferritic alloy steels shall have carbon content limited to 0,25 % and carbon equivalent limited to 0,45 % unless otherwise agreed between manufacture and purchaser.

$$\text{Carbon equivalent} = C + \frac{\text{Mn}}{6} + \frac{\text{Cr} + \text{Mo} + \text{V}}{5} + \frac{\text{Cu} + \text{Ni}}{15}$$

The following stipulations apply to welding of castings:

- a) repair by welding to mechanically damaged (e.g. destroyed or deformed by application of force) cast steel parts is not permitted;
- b) welding to grey cast iron and spheroidal graphite cast iron is not permitted.

After welding, parts made of austenitic stainless steel shall be subjected to a surface treatment so that the parts are clean and free from rust, scale and heating dis-colouration.

4.5.2 Welder and welding procedure qualification

Welder and welding procedure qualification shall be carried out in accordance with EN 287-1 and EN 288-1.

4.5.3 Repair of castings and of fabrication welds

Repair welding is permissible on steel castings only and on fabrication welds.

All finished repairs shall be examined after heat treatment to the required severity level given in table 1.

Level I

Undocumented repairs performed before heat treatment are permissible when they do not exceed 40 % of wall thickness.

Undocumented repairs performed after heat treatment are permissible when they do not exceed 20 % of wall thickness or 25 mm whichever is smaller.

Other repairs shall be in accordance with the requirements for level II.

[•] Level II

Repairs shall be performed in accordance with a written procedure specifying the requirements for defect removal, welding, heat treatment and non-destructive examination.

Repair excavations shall be examined by liquid penetrant to ensure complete removal of the defect.

The complete repair operation shall be fully documented.

4.5.4 Heat treatment

Post weld heat treatment shall be performed when necessary to achieve the required material properties.

4.5.5 Inspection of pressure retaining welds

The following inspection of pressure retaining welds shall be performed:

- visual inspection at 100 %;
- for unalloyed or austenitic steel valves greater than DN 100 and for all alloy steel valves, 100 % surface test and 10 % volumetric test of each delivery batch;
- for unalloyed or austenitic steel valves up to and including DN 100, and for all alloyed steel valves, a random sample surface test of 10 % of each delivery batch is sufficient.

Acceptance criteria should be in accordance with annex A.

In the case of fillet welds the volumetric test may be omitted when impractical.

For welds which are performed by a fully automatic process and where the process qualification has been performed on a sample of the actual weld, inspection may be 10 % surface instead of 100 % surface test and 10 % volumetric test. Tests shall be conducted on at least the first and last sample of each production batch.

4.6 Surface finish

4.6.1 Body surface

All inner and outer surfaces shall be cleaned and deburred by a suitable method which does not result in ferritic inclusions in austenitic materials or which does not mask surface defects.

In the case of austenitic cast or welded valves a clean metallic surface shall be provided, free from rust, scale and heating dis-colouration.

[•] Where etching is required to reveal the surface structure of production welds etc., this shall be specified by the purchaser.

4.6.2 Flange facing surfaces

Turning of the facings is mandatory except for coated surfaces. The surface finish shall be in accordance with:

- for steel flanges, 5.7 of prEN 1092-1:1997;
- for cast iron flanges, 5.6 of EN 1092-2:1997.

unless otherwise specified by the purchaser.

5 Testing and inspection

5.1 Non-destructive examination of steel castings

The requirements given in table 1 shall apply.

5.2 Testing and inspection of every valve

The manufacturer shall verify that the requirements given in table 2 have been fulfilled for every valve.

Table 1: Minimum requirements for non-destructive examination of steel castings

	Steel castings (severity level)			
	level I	level I alternative	level II	Butt weld ends (see 13 below)
Prototype	S2/S3 (see 4 below)	S3/S4 (see 4 below)	S2	S1
	V3	V4	V2	V1
Production	S4 (one sample)	>50kg-S3/S4 (100 %) ≤50 kg -S3/S4 (one sample)	S2 (10 % or 3 samples min)	S1 (100 %)
	no volumetric inspection	V4 (10 % or 3 samples min)	V2 (10 % or 3 samples min)	V1 (100 %)
If sample unacceptable	Inspect 10 % (min 3 samples). If any unacceptable, inspect 100 %.	Inspect 100 %	Inspect 100 %	

- 1: For all materials and severity levels it is the responsibility of the manufacturer to apply the amount of testing necessary to guarantee the required quality taking into account the method of casting.
2: All castings shall be subjected to 100 % visual examination in accordance with EN 12454.

Required severity levels:

	Severity level	Identification
Surface inclusions	2	B 2
Gas porosity	2	C 1
Laps and cold shuts	2	D 2
Scabs	1	E 3
Chaplets	2	F 3
Welds	2	J 2

- 3: Severity levels should be in accordance with annex A.
4: The higher severity level applies to magnetic particle testing, the lower severity level applies to liquid penetrant testing.
5: A prototype casting shall be inspected for each size, pressure rating, material group and casting method. If any of these parameters are changed a new prototype inspection is required.
6: The prototype casting cannot be considered as a production sample except in the case of a single casting.
7: Where there is only one piece in a batch for which no prototype tests exist, this piece shall be tested as a prototype.
8: Surface examination shall provide 100 % coverage of the sample.
9: Volumetric examination of prototype castings shall provide 100 % coverage of the sample.
10: Volumetric examination of production castings shall provide coverage of critical sections as a minimum.
11: Critical sections shall be defined by the manufacturer after examination of the prototype casting.
12: A production sample consists of a minimum of one piece from each unique cast and heat treatment batch.
13: The maximum length of linear defects for surface test shall be 3 mm.
14: Spheroidal graphite cast iron shall be inspected to level I only when specified by purchaser.
15: Where the manufacturer is responsible for welding stub pipes to a valve, the butt welding ends of this joint can meet inspection level S2/V2.

Table 2: Requirements and tests for every valve

Requirements	Test (reference or remarks)
1 Order conformity Each valve shall conform to the ordering details.	Responsibility of the manufacturer
2. Type and equipment Design, construction and accessories shall be in accordance with the order.	Responsibility of the manufacturer
3. Marking The identification of the individual valves shall correspond to the requirements of clause 6 of this standard and be legible.	Visual inspection
4. Surface The surface shall have no defects that impair the safety or the function and shall meet the requirements of 4.6.1.	Responsibility of the manufacturer. Inspection shall take place prior to coating, lining, painting.
5. Protection coatings There shall be protective coatings where specified.	Visual inspection
6. Operability Acceptance criteria according to prEN 12266-2:1999 shall apply.	B.1. of prEN 12266-2:1999 (but at allowable pressure p_s)
7. Shell strength Acceptance criteria according to prEN 12266-1 shall apply.	A.2. of prEN 12266-1:1999
8. Shell tightness Acceptance criteria according to prEN 12266-1:1999 shall apply.	A.3. of prEN 12266-1:1999. The manufacturer is free to choose the test fluid to be applied, if not otherwise specified.
9. Seat tightness ¹⁾ Acceptance criteria according to prEN 12266-1:1999 shall apply. Leakage rate A, except for gate valves greater than DN400 where leakage rate B applies.	A.4 of prEN 12266-1:1999 (except minimum test duration for gas shall be the same as for liquid for the whole DN range. The manufacturer is free to choose the test fluid applied if not otherwise specified.
10 Material verification The valve materials shall conform to the specification.	Reviews of traceability documentation according to 4.4.6 when required.
11. Back seat leakage (if appropriate) Leakage rate C according to prEN 12266-3:1999, table A.5 shall apply.	A.3 of prEN 12266-2:1999
¹⁾ For the control valves the requirement of prEN 1349:1999 shall apply	

5.3 Random testing

The manufacturer shall verify by random testing during production that the requirements listed in table 3 have been fulfilled.

Table 3: Requirements and tests by random testing

Requirements	Test (reference or remarks)
1. Dimensions The dimensions of the valve shall conform to the applicable standards and with the order within the permitted tolerances.	Responsibility of the manufacturer
2. Finish of the flange facings The finish of the flange facings shall be in accordance with 4.6.2.	Responsibility of the manufacturer. Reference specimen may be used instead of measuring devices.
3. Operating forces Requirements according to prEN 12570:1998 shall apply.	Responsibility of the manufacturer
4. Paintings, coatings, linings and liners Requirements according to 4.4.5 shall apply. Temporary coatings for avoiding the formation of rust are not subject to this requirement.	Responsibility of the manufacturer

6 Marking

Marking shall comply with EN 19 and the relevant product standard. If there is no product standard the following shall be indicated on the valve body:

- material;
- PN according to EN 1333 (or Class);
- normal size (DN) according to EN ISO 6708 (or NPS);
- manufacturer's mark.

Where valves are not designed to standard PN (or Class) ratings the allowable pressure and temperature shall be indicated.

The following markings shall apply to all valves:

- the identification of the manufacturer of shell materials (casting, forging etc.);
- symbols, letters or numbers which relate the certificate and the body material to each other (not required in the case of grey cast iron);
- if the identification is made by stamping, the quality assurance stamp shall be made next to it;
- if needed, an indication of the flow direction;
- the conformity of a valve with this standard may be expressed by the mark EN and the number of this standard.

7 Preparation for shipment

The valves shall be delivered in such a condition that their functionality is not impaired.

All valves shall be dry and protected from corrosion and damage during transportation.

Valves manufactured from stainless steels (e.g. austenitic, duplex) shall not be painted.

The valve ends shall be fitted with temporary covers or closures. In the case of valves having flange connections, protective caps according to EN 12351 shall be used. In the case of wafer-type valves and valves with welded and threaded ends, equivalent protection shall be used.

8 Technical documentation

The manufacturer shall be responsible for obtaining and maintaining the documentation for materials, valves and accessories and shall make this available to the purchaser on request.

Annex A (informative)

Explanations for acceptance criteria

This standard identifies some acceptance criteria which are not available in existing standards e.g. EN ISO. Until appropriate EN standards exist this annex gives reference to appropriate documents in the following manner:

- In table 1, note 3 refers to a standard covering non-destructive examination requirements for steel castings which has yet to be produced. Until this standard is published the requirements of DIN 1690-2 "Technical delivery conditions for castings made from metallic materials - Steel castings - Classification into severity levels on the basis of non-destructive testing" should be used;
- Clause 4.5.5 refers to the European Pressure Vessel Code requirements for non-destructive examination of welds which have yet to be produced. Until this standard is published the requirements of AD-Merkblatt HP 5/3 "Herstellung und Prüfung der Verbindungen; Zerstörungsfreie Prüfung der Schweißverbindungen" (Manufacturing and testing of connections; Non destructive tests of welded joints) should be used.

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