

Valves for natural gas transportation in pipelines — Performance requirements and tests

The European Standard EN 14141:2003 has the status of a
British Standard

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National foreword

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The UK participation in its preparation was entrusted by Technical Committee PSE/7, Industrial valves, to Subcommittee PSE/7/8, Valves for the gas industry, 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;
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Foreword

This document (EN 14141:2003) 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of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

Annexes A, B, C, D, E and F are normative. Annexes G and H are informative.

This document contains a Bibliography.

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

Introduction

CEN/TC 69/WG 9 is charged to develop a proposal for a European performance standard of valves for use in pipelines for transportation of natural gas in accordance with EN 1594.

The significant properties of valves designed for a special application are defined by performance requirements accompanied by the description of tests to be carried out:

- by the manufacturer on the product during the manufacture; and
- by an independent accepted body on test samples for certification purposes;

to give proof that the valve meets the performance requirements of this European Standard.

A type test is included in this standard to satisfy the requirements of EN 1594.

1 Scope

This European Standard applies to all valves (plug valves, ball valves, gate valves and check valves) used in onshore transmission pipelines for transport of natural gas in accordance with EN 1594. It comprises all valves which are components of the pipeline.

This European Standard specifies valves for pipelines with a maximum operating pressure (MOP) over 16 bar.

Excluded from the scope are control valves, safety valves and all valves \leq DN 50.

This European Standard specifies requirements and appropriate verification tests carried out during production and for certification purposes to verify that the valves conform to the requirements. A summary of the product and type tests is given in annex H.

This European Standard makes reference to ISO 14313. All the requirements of ISO 14313 should be met unless otherwise stated. Paragraphs marked with a dot [•] indicate requirements which are identical to ISO 14313. In the case of conflict between European and International Standard, the European Standard takes precedence.

Additional national requirements and tests in accordance with individual national legal regulations not yet harmonized may be necessary and are to be advised in the purchase order.

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 (including amendments).

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

EN 571-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*.

EN 736-1, *Valves — Terminology — Part 1: Definition of types of valves*.

EN 736-2, *Valves — Terminology — Part 2: Definition of components of valves*.

EN 736-3, *Valves — Terminology — Part 3: Definition of terms*.

EN 970, *Non-destructive examination of fusion welds — Visual examination*.

EN 1289, *Non-destructive examination of welds — Penetrant testing of welds — Acceptance levels*.

EN 1290, *Non-destructive examination of welds — Magnetic particle examination of welds*.

EN 1291, *Non-destructive examination of welds — Magnetic particle testing of welds — Acceptance levels*.

EN 1369, *Founding — Magnetic particle inspection*.

EN 1371-1, *Founding — Liquid penetrant inspection — Part 1: Sand, gravity die and low pressure die castings*.

EN 1435, *Non-destructive examination of welds — Radiographic examination of welded joints*.

EN 1503-1, *Valves — Materials for bodies, bonnets and covers — Part 1: Steels specified in European Standards.*

EN 1503-2, *Valves — Materials for bodies, bonnets and covers — Part 2: Steels other than those specified in European Standards.*

EN 1515-1, *Flanges and their joints — Bolting — Part 1: Selection of bolting.*

EN 1515-2, *Flanges and their joints — Bolting — Part 2: Classification of bolt materials for steel flanges, PN-designated.*

EN 1594, *Gas supply systems — Pipelines for maximum operating pressure over 16 bar — Functional requirements.*

EN 1712, *Non-destructive testing of welds — Ultrasonic testing of welded joints — Acceptance levels.*

EN 1714, *Non-destructive examination of welds — Ultrasonic examination of welded joints.*

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method.*

EN 10204:1991, *Metallic products — Types of inspection documents.*

EN 10228-1, *Non-destructive testing of steel forgings — Part 1: Magnetic particle inspection.*

EN 10228-2, *Non-destructive testing of steel forgings — Part 2: Penetrant testing.*

EN 10228-3, *Non-destructive testing of steel forgings — Part 3: Ultrasonic testing of ferritic or martensitic steel forgings.*

EN 10228-4, *Non-destructive testing of steel forgings — Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings.*

EN 12266-1, *Industrial valves — Testing of valves — Part 1: Pressure tests, test procedures and acceptance criteria — Mandatory requirements.*

EN 12517, *Non-destructive examination of welds — Radiographic examination of welded joints — Acceptance levels.*

EN 12627:1999, *Industrial valves — Butt welding ends for steel valves.*

EN 12681, *Founding — Radiographic inspection.*

EN 45004, *General criteria for the operation of various types of bodies performing inspection.*

EN 45011, *General requirements for bodies operating product certification systems (ISO/IEC Guide 65:1996).*

prEN 12516-1, *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells.*

prEN 12516-2, *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells.*

ISO 5208, *Industrial valves — Pressure testing of valves.*

ISO 10497, *Testing of valves — Fire type-testing requirements.*

ISO 14313:1999, *Petroleum and natural gas industries — Pipeline transportation systems — Pipeline valves.*

MSS-SP-55¹⁾, *Quality standard for steel castings for valves, flanges and fittings and other piping components (visual method for evaluation of surface irregularities)*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 736-1, EN 736-2, EN 736-3 and ISO 14313 and the following apply.

3.1

full opening valve [•]

valve with an unobstructed opening capable of allowing a sphere or other internal devices of the same nominal size as the valve to pass

3.2

maximum pressure differential (MPD) [•]

maximum difference between the upstream and downstream pressure across the obturator at which the obturator may be operated

3.3

reduced-opening valve [•]

valve with the opening through the obturator smaller than at the end connection(s)

3.4

seating surfaces [•]

contact surfaces of the obturator and seat which ensure valve sealing

3.5

stem [•]

part that connects the obturator to the operator and which may consist of one or more components

NOTE This definition applies also for shafts.

3.6

test report

written statement comprising the results of the particular tests for the evaluation of the conformity of a range of valves with this standard

3.7

type test

as generally mentioned in EN 736-3, a specified group of tests to provide proof of the conformity of a range of valves with this standard

NOTE A range may include valves of the same design, the same material group and the same manufacturing method but with different size designations and different allowable pressures.

3.8

type test certification

granting of a certificate by an independent accepted body to prove the conformity of a range of valves with a standard

¹⁾ Developed and approved by the Manufacturers Standardization Society of the Valve and Fittings Industrie, Inc. 127 Park Street, NE, Vienna, Virginia 22180.

3.9
piggability
valves having in the open position a cylindrical bore which permits the unhampered passage of a pig (cleaning or measuring appliance) through the flow area

4 Functional requirements

4.1 Travel stops

Travel stops shall be provided on the valve or gearbox or actuator. They shall positively fix the position of the obturator in the open and closed position. They shall not shift unintentionally. In case of lever operated valves, the travel stop shall be independent from the lever.

4.2 Position of the obturator

Except for check valves the position of the obturator shall not be altered by the dynamic forces of the passing flow or in the case of screw operated gate valves by forces generated from internal pressure.

4.3 Protection of exposed stems and shafts

Extended and exposed stems and shafts of valves shall be protected against dust by a stem extension casing.

4.4 Piggability

Valves for transmission pipelines shall be piggable unless otherwise agreed and shall conform to the definition of the full opening valve.

4.5 Lifting lugs

[•] Valves of size DN 200 (NPS 8) and larger shall be provided with lifting lugs.

The safe working load of lifting lugs shall exceed the weight of the valve and the actuator.

4.6 Additional requirements

For special conditions the purchaser may require additional requirements, see annex G.

5 Requirements and tests

5.1 Design

5.1.1 Shell

Requirement	Verification on product	Type test
The design and dimensions of the valves shall be such as to withstand safely all stresses occurring under operating conditions. The shell design shall meet the requirements of prEN 12516-1 or prEN 12516-2. Alternatively the requirements of ISO 14313 shall be met. Welded valves of non-spherical or non-cylindrical shape shall meet the requirements of an accepted pressure vessel code.	The manufacturer shall document the design validation of the valve and shall make it available for evaluation and approval on request.	Design approval in accordance with A.4.3 and annex F.

5.1.2 End-to-end dimensions

Requirement	Test on product	Type test
[•] End-to-end dimensions of flanged and butt welding valves shall conform to ISO 14313 unless otherwise agreed by the purchaser.	Dimensional check.	Test in accordance with A.4.3.

5.1.3 Butt welding ends

Requirement	Test on product	Type test
Weld end details and thickness shall be in accordance with EN 12627:1999, Figures 2, 3, 4 and 5. The length of the butt end shall be sufficient to allow welding without damage of the internal parts of the valve. The valve supplier shall specify the maximum acceptable welding temperature. Where this cannot be achieved, pipe pup extensions may be used by agreement with the purchaser.	Dimensional check on drawing and product.	Drawing examination in accordance with A.4.3.

5.1.4 Anti-blow-out feature

Requirement	Test on product	Type test
[•] Valves shall be designed with a stem anti-blow out device to prevent stem ejection by internal pressure when the stem packing and/or retainer has been removed.	Drawing examination.	Drawing examination in accordance with A.4.3.

5.1.5 Sealant injection systems

Requirement	Test on product	Type test
<p>If a sealant injection system is provided, it shall be equipped with:</p> <ul style="list-style-type: none"> — a check valve at the connection to the body for each injection point; — a universal giant button head fitting Ø 22 mm to connect sealant injection gun. 	Drawing examination.	Drawing examination.
The injection system shall be capable of distributing sealant uniformly around the seats.		<p>A trial sealant injection shall be performed and the valve inspected to confirm adequate delivery and even distribution of sealant.</p> <p>The test shall be conducted on a closed valve with 50 % maximum differential pressure applied using a sealant recommended by the manufacturer. The valve shall be inspected to determine distribution. The sealant shall form a continuous ring on the surface of the obturator (optional test).</p>

5.1.6 Extended drain, vent and sealant lines

Requirement	Test on product	Type test
For buried valves, drain, vent and sealant lines shall be extended to the surface. These extensions shall be appropriately designed and securely fastened. These extensions shall be terminated close to the stem extension. All joints shall be made by welding.	Visual inspection	Test not required.
<p>Extended sealant lines shall be designed to withstand the maximum operating pressure of the recommended injection equipment. The purchaser shall indicate the maximum pressure of the injection equipment or the size and material of the pipe.</p> <p>Drain and vent connections on valves:</p> <ol style="list-style-type: none"> 1) They shall be fitted with at least one isolating valve; 2) Connection to the valve body shall be welded; 3) Connection to the first valve shall be welded; 4) Minimum pipe size shall be as follows: <ul style="list-style-type: none"> — \leq DN 150; DN 15 drain; — \geq DN 200; minimum DN 25 drain unless otherwise specified; 5) Vent lines shall be as specified. <p>Each sealant injection line</p> <ul style="list-style-type: none"> — shall be welded to the valve body; — shall incorporate a check valve at the point of connection to the valve body; — shall incorporate an isolating valve; — shall terminate in a giant button head fitting \varnothing 22 mm. <p>Prior to assembly the internal bores of sealant lines shall be chemically or mechanically cleaned.</p>	<p>Drawing examination</p> <p>Hydraulic pressure test at 1,5 times the rated pressure of the valve. The test may be conducted as part of valve shell test or as a test of the preassembled pipework, provided that the final connections to the valve are leak tested at a pressure agreed with the purchaser.</p> <p>No leakage is permitted.</p>	Test not required.

5.1.7 Vent, drain and sealant valves

Requirement	Test on product	Type test
Drain valves, vent valves and valves on sealant injection extensions shall have a rated pressure not less than the valve on which they are installed. Vent and drain valves shall be resistant to blow down operation.	Each unique size, type and pressure rating of vent and drain ball valve shall be subject to a gas blow down test followed by a seat leak test. One vent and drain ball valve per order to be opened/closed 3 times with a differential pressure of air or gas equal to the rated pressure of the pipeline valve (test is not required for sealant valves). Leak test valve seat shall be carried out in accordance with C.4 of ISO 14313:1999.	Test not required.

5.1.8 Mechanical resistance against excessive actuating forces

Requirement	Test on product	Type test
[•] The design thrust or torque for all drive train calculations shall be at least two times the break away thrust or torque (see 5.2.4).	Test not required	In accordance with annex C.

5.1.9 Body/bonnet connection

Requirement	Test on product	Type test
Bonnet seals shall be anti-blow-out design. The connection shall be frost proof, i.e. shall be tight against moisture penetrating from the outside and protected from corrosion.	Visual check of drawing.	Visual check of drawing.

5.2 Operation

5.2.1 Handwheels and levers, ease of operation

Requirement	Test on product	Type test
<p>[•] Levers for valves shall either be of an integral design or consist of a head which fits on the stem and is designed to take an extended handle. The head design shall allow permanent attachment of the extended section if specified by the purchaser.</p> <p>The maximum force required at the handwheel or lever to apply the break away torque or thrust shall not exceed 360 N.</p> <p>Levers shall not be longer than twice the face-to-face or end-to-end dimension of the valve.</p> <p>Handwheel diameter(s) shall not exceed the face-to-face or end-to-end length of the valve or 1 000 mm, whichever is the smaller, unless otherwise agreed. Spokes shall not extend beyond the perimeter of the handwheel unless otherwise agreed. Direction of closing shall be clockwise.</p>	<p>For each unique size pressure rating, material, operator combination the following test shall be performed on 10 % (minimum of 1) of the production:</p> <p>Dimensional check of handwheel/lever.</p> <p>Determination of the handwheel/lever force to apply break away torque or thrust.</p>	Test not required.

5.2.2 Protection against rapidly moving external components

Requirement	Test on product	Type test
Rapidly moving external components, e.g. rising stems, piston rods or levers on check valves, shall be fitted with protective devices (e.g. protective tubes or protective screens), for personal protection.	Visual inspection.	Test not required.

5.2.3 Manual override devices

Requirement	Test on product	Type test
Manual override devices, e.g. handwheels of electric actuators, shall be normally disengaged and shall automatically disengage when the actuator is operated.	Visual inspection.	Test not required.

5.2.4 Torque/thrust testing

Requirement	Test on product	Type test
The torque values shall be measured and documented. Measured operating torques/thrust shall not exceed the agreed values.	Torque/thrust shall be measured and recorded. — C.6 of ISO 14313:1999 shall be applied. — The test shall be conducted with liquid or gas in accordance with seat test in 5.8.1.	A soft seated valve shall be left in the closed position with the rated differential pressure applied for 12 h after which the operating torque/thrust shall be measured and shall not exceed the agreed values.

5.3 Materials

5.3.1 Material compatibility

Requirement	Test on product	Type test
<p>All metallic and non-metallic parts in contact with natural gas and accessory materials as well as lubricants and sealants shall be suitable for the service conditions specified by the purchaser and compatible with the commissioning fluids.</p> <p>Non-metallic parts of valves to be used at pressure of PN 100 (Class 600) and above shall be resistant to explosive decompression.</p> <p>Materials shall be compatible with each other and with the fluids to avoid galvanic action and galling.</p>	Test not required.	For seals: in accordance with annex B ^a .
^a See Bibliography.		

5.3.2 Shell materials

5.3.2.1 General

Requirement	Test on product	Type test
<p>Shell materials shall be selected from steels in accordance with EN 1503-1, EN 1503-2 and ISO 14313.</p> <p>Other steels not listed in these standards may be used when their suitability and allowable operating pressure and temperatures have been approved by demonstration to an inspection body which has been accredited for this purpose in accordance with EN 45004 or EN 45011.</p>	<p>Certificate in accordance with 3.1.B^a of EN 10204:1991.</p>	<p>Certificates in accordance with 3.1.C of EN 10204:1991.</p>
<p>^a Purchaser may request superior certificates.</p>		

5.3.2.2 Impact values

Requirement	Test on product	Type test
<p>All ferritic and duplex materials for pressure containing parts and welds shall have impact values as specified in EN 1594. The test temperature shall correspond to the minimum service temperature or 0 °C whichever is lower.</p>	<p>All ferritic and duplex materials for pressure containing parts shall be tested in accordance with the impact test provisions of EN 10045-1.</p> <p>Each heat of the material shall be in the final heat treated condition.</p> <p>Test coupons shall be cut from separate or attached block, taken from the same heat and where applicable given the same heat treatment as the product materials they represent.</p>	<p>As for test on product.</p>

5.3.2.3 Welding ends for on-site welding

Requirement	Test on product	Type test
<p>For welding ends of valves, the maximum carbon equivalent CEV_{max} shall not exceed:</p> <p>$CEV_{max} = 0,45$ for grades with specified minimum yield strength not exceeding 360 N/mm^2;</p> <p>$CEV_{max} = 0,48$ for grades with specified minimum yield strength above 360 N/mm^2;</p> <p>unless otherwise agreed between purchaser and manufacturer.</p> $CEV_{max} = C\% + \frac{Mn\%}{6} + \frac{Cr\% + Mo\% + V\%}{5} + \frac{Cu\% + Ni\%}{15}$ <p>where % is the percentage by weight of the ladle content of:</p> <p>C Carbon; Mn Manganese; Cr Chromium; Mo Molybdenum; V Vanadium; Cu Copper; Ni Nickel.</p> <p>Unless otherwise agreed between manufacturer and purchaser, the carbon content shall not exceed 0,21 %.</p> <p>The sulphur content shall not exceed 0,030 %, and the phosphorus content shall not exceed 0,035 %. The sum of sulphur and phosphorus as a total of the ladle analysis shall be smaller than or equal to 0,050 %.</p>	<p>Certificate in accordance with 3.1.B^a of EN 10204:1991.</p>	<p>As for test on product.</p>
<p>^a 3.1.C where required by national regulation or by the purchaser.</p>		

5.3.3 Obturator

Requirement	Test on product	Type test
<p>Obturator materials shall be selected from EN 1503-1 or EN 1503-2 and ISO 14313 unless otherwise agreed.</p>	<p>Certificate in accordance with 3.1.B of EN 10204:1991.</p>	<p>As for test on product.</p>

5.3.4 Body/bonnet connection, bolting materials

Requirement	Test on product	Type test
<p>Materials for body/bonnet connecting parts — bolts and nuts — shall meet the requirements of ISO 14313 and may be selected from EN 1515-1 and EN 1515-2 and shall be compatible with the minimum service temperature.</p> <p>The bolting and nut materials shall be compatible with the shell material for the avoidance of galvanic corrosion.</p> <p>Other steels not listed in these standards may also be used when their suitability and allowable operating pressure and temperatures have been approved by demonstration to an inspection body which has been accredited for this purpose in accordance with EN 45004 or EN 45011.</p>	<p>Certificate in accordance with 3.1.B^a of EN 10204:1991.</p>	<p>As for test on product.</p>
<p>^a 3.1 C where required by national regulation or by the purchaser.</p>		

5.4 Repair

Requirement	Test on product	Type test
<ul style="list-style-type: none"> — Weld repair of forgings is not permitted. Repair of castings and weldments shall conform to the following requirements. — Repair shall be performed in accordance with a written procedure specifying requirements for defect removal, welding, heat treatment, non-destructive testing and reporting. — The heat treatment of repairs shall be in accordance with the original material standard. — Repairs to weldments shall be limited to no more than 15 % of the total length of the weld seam and shall have a minimum length of 50 mm. — Repair of defects which extend through the entire wall thickness is not permitted. — Minor defects may be removed by grinding without weld repair provided that there is a smooth transition between the ground area and the original contour and minimum wall thickness requirements are not affected. 	<ul style="list-style-type: none"> — After removal of defects the surface shall be subject to magnetic particle or liquid penetrant testing. This shall demonstrate complete defect removal. — The repair shall be subject to non-destructive testing as specified for the original material. — As a minimum the repair shall be subject to magnetic particle or liquid penetrant testing. 	As for test on product.

5.5 Non-destructive testing

5.5.1 Qualification of testing personnel

Non-destructive testing personnel shall be qualified in accordance with level 2 of EN 473.

5.5.2 Welding

Requirement	Test on product	Type test
All welds joining pressure containing parts shall be non-destructively tested.	<p>All welds shall be 100 % visual inspected in accordance with EN 970.</p> <p>< DN 200: penetrant testing or magnetic particle testing:</p> <ul style="list-style-type: none"> — penetrant testing in accordance with EN 571-1 (acceptance level 2 of EN 1289) or to B.7 of ISO 14313:1999; or — magnetic particle testing in accordance with EN 1290 (acceptance level 2 of EN 1291) or to B.7 of ISO 14313:1999. <p>≥ DN 200: ultrasonic or radiographic testing:</p> <ul style="list-style-type: none"> — ultrasonic testing in accordance with EN 1714, acceptance level 2 of EN 1712 ; or — radiographic testing in accordance with EN 1435, radiographic technique B, acceptance level 1 of EN 12517 or to B.10 of ISO 14313:1999. <p>where ultrasonic or radiographic examination is not possible welds are to be examined at least by</p> <ul style="list-style-type: none"> — penetrant testing in accordance with EN 571-1 (acceptance level 2 of EN 1289) or to B.7 of ISO 14313:1999, or — magnetic particle testing in accordance with EN 1290 (acceptance level 2 of EN 1291) or to B.10 of ISO 14313:1999. 	As for test on product.

5.5.3 Castings

Requirement	Test on product	Type test
All pressure containing castings shall be non-destructively tested.	<p>All castings shall be 100 % visually inspected in accordance with MSS-SP-55. All valves shall be subject to 100 % surface examination on all accessible internal and external areas by magnetic particle technique in accordance with EN 1369 (severity level 2) or by penetrant testing in accordance with EN 1371-1 (severity level 1).</p> <p>All valves $DN \geq 200$:</p> <p>Critical areas shall be examined by radiography technique in accordance with EN 12681 or in accordance with B.3 of ISO 14313:1999 with acceptance standards in accordance with B.3 of ISO 14313:1999.</p> <p>The position and the number of radiographs shall be defined by agreement between manufacturer and purchaser.</p>	As for test on product.

5.5.4 Forgings

Requirement	Test on product	Type test
Requirements for forgings shall be subject to agreement between purchaser and supplier.	<p>When required, tests shall be in accordance with Class 4 of EN 10228-1 or Class 4 of EN 10228-2. Alternatively B.9 of ISO 14313:1999 shall apply.</p> <p>Ultrasonic testing shall be in accordance with EN 10228-3, Class 3 and EN 10228-4 (as applicable).</p>	No test required.

5.5.5 Welding ends for on-site welding

Requirement	Test on product	Type test
<p>Weld ends shall have no defects liable to impair welding.</p> <p>Dimensions and volumetric examination shall be performed for a minimum length equal to the welding end thickness or 50 mm whichever is greater. Surface examination shall be performed on the machined end of the bevel.</p>	<p>Rolled and forged steel weld ends:</p> <p>100 % ultrasonic examination in accordance with EN 10228-3, Class 3 and EN 10228-4 (as applicable).</p> <p>Cast weld ends:</p> <p>100 % radiographic examination in accordance with radiographic techniques described in EN 12681 or B.3 of ISO 14313:1999 with acceptance levels in accordance with B.3 of ISO 14313:1999.</p>	As for test on product.

5.6 Shell test

Requirement	Test on product	Type test
<p>The valves shall be submitted to a shell tightness and a shell strength test.</p> <p>The test applies also to the extended drain, vent and sealant lines.</p>	<p>[•] In accordance with 10.3 of ISO 14313:1999^a.</p> <p>Minimum test duration shall be in accordance with Table 10 of ISO 14313:1999.</p> <p>At the request of the purchaser an additional leak test with gas shall be carried out after the hydraulic test at 1,1 times rated pressure in accordance with Test P11 of EN 12266-1.</p>	<p>As for test on product with a minimum test duration of 10 min^a.</p>
<p>^a This test meets the requirements of Test P10 of EN 12266-1.</p>		

5.7 External tightness

5.7.1 Stem/shaft sealing

Requirement	Test on product	Type test
<p>Where the user specifies the requirement to change the packing of the stuffing box of a gate valve under pressure, the stem shall be designed with a back seat face, it being possible to check the back seat for tightness by means of bore with bleed connection.</p>	<p>In accordance with 10.2 of ISO 14313:1999.</p>	<p>As for test on product.</p>

5.7.2 External pressure relief

Requirement	Test on product	Type test
<p>Where fitted, external relief valves shall be provided with isolating valves to allow maintenance work on the relief valve to be carried out. The isolating valve shall be included in the shell strength test.</p>	<p>Test not required.</p>	<p>Test not required.</p>

5.7.3 Fire test (optional if requested)

Requirement	Test on product	Type test
<p>[•] If specified by the purchaser, fire resistance certification of the design shall be provided, in accordance with A.5 of ISO 14313:1999.</p>	<p>Document check.</p>	<p>In accordance with ISO 10497.</p>

5.8 Internal tightness

5.8.1 Seat tightness

Requirement	Test on product	Type test
All valves shall be subject to a differential pressure test to verify seat tightness. Each seat shall be subject to a high pressure gas seat test and a low pressure gas seat test.	<p>Hydraulic high pressure gas test in accordance with 10.4 of ISO 14313:1999 or if requested air test in accordance with C.4 of ISO 14313:1999.</p> <p>Low pressure gas test in accordance with C.3 of ISO 14313:1999, type 2, or on request type 1.</p> <p>Acceptance criteria: Valves utilizing polymeric or elastomeric seat seals and lubricated plug valves shall meet leakage rate A, metal-seated valves shall meet leakage rate C in accordance with ISO 5208.</p>	<p>High pressure gas test in accordance with C.4 of ISO 14313:1999.</p> <p>Low pressure gas test in accordance with C.3 of ISO 14313:1999, type 2, or on request type 1.</p> <p>Acceptance criteria: valves utilizing polymeric or elastomeric seat seals and lubricated plug valves shall meet leakage rate A, metal seated valves shall meet leakage rate C in accordance with ISO 5208.</p>

5.8.2 Functional test on clean service (optional)

Requirement	Test on product	Type test
Valves shall be of sufficient resistance to erosion by clean gas under the determined operation conditions.	Test not required.	Test method of annex D.
NOTE National regulations may require this type test to be mandatory.		

5.8.3 Abrasion resistance test on dirty service (optional)

Requirement	Test on product	Type test
Valves shall be of sufficient resistance to erosion by solid particles under the determined operation conditions.	Test not required.	Test method of annex E.

6 Certification

Certification of products shall be in accordance with 3.1.B of EN 10204:1991 as a minimum. Type test shall be in accordance with 3.1.C of EN 10204:1991.

7 Quality

Requirement	Test on product	Type test
For design, production and testing the manufacturer shall implement a quality assurance system. This should comply with EN ISO 9001 verified by an independent accepted body.	No tests required.	Reference documents should be in accordance with EN ISO 9001.

8 Type tests

Type tests shall be carried out in accordance with the procedure given in annex A.

9 Functional and other qualification tests

(as listed in annexes B to F).

General definitions on purpose, range of qualification, testing body, assessment, test procedures and corrective actions on modified valve range.

— Purpose

To provide proof of the conformity of a range of valves with this standard.

— Range of qualification

A range of valves qualified by the tests is stated in annexes B to F.

— Certification body

All tests shall be certified by an independent accepted body.

— Test procedure

Tests shall only be performed on valves which have passed all the specified tests on product successfully. All tests shall be carried out in accordance with a written procedure based on annexes B to F.

— Modifications on tested valve range

When a valve design is modified by the manufacturer then functional qualification tests in accordance with annexes B to F, with modifications in accordance with Table 1, shall be reviewed by the independent accepted body.

Table 1 — Modifications on tested valve range

Modifications	B	C	D ^a	E ^a	F
Design of shell	—	X	X	X	X
Design of stem	—	X	—	—	—
Design of obturator/seat	—	X	X	X	—
Material of stem	—	X	—	—	—
Material of obturator/stem	—	X	X	X	—
Material and design stem seals	X	X	—	—	—
Material and design seat seals	X	X	X	X	—
^a Optional.					

Annex A (normative)

Type test on general design and production of pipeline valves

A.1 General

This annex applies to the type testing of pipeline valves in accordance with the requirements of this standard up to DN 700 and Class 600. Applicable national legal requirements shall also be satisfied.

A.2 Purpose

A type test in accordance with this annex is a test on a representative sample of production.

A type test demonstrates that the manufacturer can produce one valve which:

- meets design requirements (size, rating, materials, design details);
- meets material requirements;
- meets test requirements (functional, performance).

In the case of valves, for which a type test has been conducted by an independent accepted body and a type mark granted, the design verification on qualified valves shall be dispensed with and the tests can be conducted by the manufacturer himself within the framework of the required acceptance test. The type mark is granted on the basis of a type test for a range of valves.

A.3 Type test qualification limits

A.3.1 Size range

A test of any valve type within the nominal size ranges (see Table A.1) qualifies any valves within the nominal size range.

A test of any pressure class shall qualify any valves having an equal or lower pressure class.

Table A.1 — Nominal size ranges

NPS	DN
≤ 6	≤ 150
$8 \leq 18$	$200 \leq 500$
$20 \leq 28$	$500 \leq 700$

A.3.2 Design

A type of valve covers valves with the same features with regard to the type of valve (ball, plug, gate, etc.), shell materials, product form (cast, forged, welded), bonnet or closure design, sealing system (seats, stems, closures, pressure etc.).

A.3.3 Material

A.3.3.1 Shell (body, bonnet)

Type approval covers all steel shell materials having mechanical properties equal to or superior to those of the test valve.

Changes of steel materials does not require a new type test provided that the requirement of A.3.3 are met.

A.3.3.2 Obturator/stem materials

Changes likely to reduce the performance of the valve (e.g. strength, galling) shall require a new test.

A.3.3.3 Sealing materials

Major change of sealing materials (e.g. metal to plastic or plastic to elastomer) shall require a new type test.

A.3.4 Type of manufacture

A distinction is made between the following types of manufacture of the valve body:

- 1) forged included welding construction;
- 2) cast steel included welding construction;
- 3) welded from plates or pipes.

A.4 Type test

A.4.1 Prerequisites for manufacturing

A.4.1.1 The manufacturer shall have suitable equipment and methods for production and testing to ensure that all valves meet the requirements of this standard.

The valve manufacturer shall supply proof of this to the independent accepted body.

A.4.1.2 Responsible and suitably qualified inspectors independent of production shall be nominated in agreement with the independent accepted body for performance of the works tests on the valves in the course of continuous manufacture.

A.4.2 Stress evaluation and safety design check

All valves in a range shall be checked on the basis of drawings and other data for:

- 1) conformance with the design requirements of this standard;
- 2) use of permissible materials and suitable sealing materials. Sealing materials shall be suitable for the respective fluid, tested and approved in accordance with annex B;

- 3) proper processing of the materials.

A.4.3 Test on valves

In addition to the tests in accordance with this standard the independent accepted body shall conduct within the range the following tests on at least two valves, which are representative with regard to the nominal size and allowable operating pressure.

- 1) Inspection of the valves to ensure that the dimensions and production conform to the drawings and other data checked in accordance with 5.1.1.
- 2) Check for proper processing.
- 3) Witness non-destructive tests.
- 4) Check on the mechanical properties of hot-formed and heat-treated components.
- 5) Check on conformity of the individual components with the required material verifications including marking.

A.4.4 Documentation

Certification requirements for material, non-destructive examination and production testing shall be in accordance with this standard and agreed with the independent accepted body.

A.5 Check on the production and testing by the independent accepted body

The valve manufacturer shall request the independent accepted body, usually once annually, to check the continuous manufacture and testing of valves, for which a type mark was granted. For the purpose of the check the independent accepted body shall be granted access to all production and test facilities at all times without previous notification.

If production is not continuous, the time shall be fixed by agreement between the valve manufacturer and the independent accepted body.

During the check the independent accepted body shall verify:

- by random tests the unchanged production and proper testing of the valves;
- a list of the valves bearing component marks and the records agreed in A.4.4;
- the continuing validity of the type test.

The report concerning the check by the independent accepted body shall be submitted to the manufacturer.

A.6 Modification of valves with type mark

A.6.1 Revisions to this standard

In the case of revisions to this standard or new European Directives the valve manufacturer shall adapt valves, for which a type mark has been granted, accordingly.

A.6.2 Notification of modifications

Modifications to the design, production or testing of valves as well as modification on the basis of adaptation to amended specifications shall be notified by the valve manufacturer to the independent accepted body.

Such modifications might require a reconfirmation of the certification of the valve e.g. by further type testing.

A.7 Procedure

A.7.1 Application for type test

A.7.1.1 Applications for a type test shall be submitted to the independent accepted body.

A.7.1.2 The following documentation in duplicate shall be enclosed with the application.

- 1) Details of the valves grouped in the range (type of construction, materials, manufacturing procedure, nominal sizes and maximum operating pressures).
- 2) Drawings and other data for stress evaluation and safety design check in accordance with A.4.2.
- 3) Details of the documentation in accordance with A.4.4.
- 4) Details of the proposed marking of the valves.

A.7.2 Test report

After completion of the type test by the independent accepted body the applicant receives a test report in one copy. A set of the documents delivered by the applicant and drawn up by the relevant independent accepted body shall be enclosed as an annex. The report may be passed on or published by the applicant only in its unabridged form.

A.7.3 Type mark

A.7.3.1 The type mark is granted on the basis of the test report by the independent accepted body after the valve manufacturer has submitted a written declaration in accordance with A.8.3.

A.7.3.2 The type mark is granted for a period of five years. The period is extended on application, if the requirements of the regulations forming the basis of the component test have not been amended.

The type mark may be withdrawn before expiry of validity if:

- defects affecting safety result during use of the valves or if operating experience reveals that the requirements of this standard are not fulfilled;
- the check on manufacture by the independent accepted body in accordance with A.5 reveals that the conditions governing the granting of the type mark (see also the declaration of obligation in accordance with A.8.3) no longer exist.

A.7.3.3 The type mark is applied by the manufacturer to the valve and consists of the following details:

- 1) the mark of the independent accepted body;
- 2) the type approval number;
- 3) the year of type approval.

A.8 Notification of valves with type mark

A.8.1 Approvals

The independent accepted body shall keep and publish a list of all granted type approvals.

A.8.2 Expiry

The independent accepted body shall publish a list of expired or withdrawn type approvals.

A.8.3 Specimen of declaration of obligation

Declaration of obligation

We, (Name of company) _____

declare to (Name of independent accepted body) will meet the requirements of annex A of prEN 14141:2003

— Type test procedure on general design and production of valves for pipelines.

In particular we undertake:

— to apply the type mark granted to the following valves

type, series:

drawing No.:

only to valves, which have been qualified by the type test

— to order the independent accepted body to check usually once annually that the production of the valves conforms to the drawings and that the required testing equipment is suitable and effective.

Furthermore, we undertake not to use the type mark, if

1) the validity period has expired

or

2) the independent accepted body has revoked its issuing of the mark

or

3) we become aware of defects to the valves which adversely affect their safety or realize from operating experience that the requirements of EN 14141 are not met.

(place, date)

(authorised signatory)

Signed on behalf of company

Name:

Function:

Signature:

Date:

Annex B

(normative)

Functional test on behaviour of valve sealing materials towards liquids in natural gas

B.1 Purpose

The purpose of this test procedure is to determine the behaviour of elastomers, with the exception of foams, towards liquids, and gases, hereinafter referred to as the "test medium". Greases shall be regarded as highly viscous liquids. The test procedure shall be applied both to testing as part of quality control and to monitoring of the long term behaviour.

A type tested sealing material shall be acceptable for use with all valve sizes and classes using the same material compound and durometer hardness.

B.2 Performance of test

Tests are preferably to be performed on a rod or a disk.

The temperature of the test media shall be ambient temperature. The test media shall be:

- test a: a mixture of three parts standard gasoline and one part toluene;
- test b: lubricating oils;
- test c: 99,5 % methanol;
- test d: potable water.

For every test, at least three test specimens shall be used.

The test vessels shall be made of materials which are resistant to the test media and do not act as a catalyst (e.g. do not contain copper). They should preferably be made of glass. The size of the vessels shall be selected so that the test specimen lies in a sufficient amount of the test medium. The vessels shall be sealed to avoid any contact with the ambient air.

NOTE During the performance of the test in accordance with these instructions, the influence of atmospheric oxygen, which can cause additional ageing, is to be avoided.

B.3 Acceptance criteria

After residence periods of 24 h and 72 h and 30 days, the properties of the test specimen shall be examined with regard to their volume, any change in mass, volume and tensile strength at break, hardness and elongation.

At the end of the test, the tensile strength, hardness and elongation shall meet the specified values.

Annex C (normative)

Strength test on torque/thrust

C.1 Purpose

The purpose is to demonstrate the integrity of the drive train.

C.2 Performance of test

The test is performed after the test in C.6 of ISO 14313:1999 as given in 5.2.4.

Apply the greater of twice the manufacturer's predicted break away torque/thrust or the measured break away torque/thrust with the obturator blocked for a minimum time of 1 min.

NOTE For gate valves thrust normally means the maximum tensile force.

C.3 Acceptance criteria

For ball and plug valves, the total torsional deflection of the extended drive train when delivering the design torque shall not exceed the overlap contact angle between the seat and obturator.

The test shall not cause any permanent visible deformation of the drive train.

Annex D (normative)

Functional test on clean gas (on option)

D.1 Purpose

The purpose of this test is to determine the ability to function under the influence of clean gas and appropriate operation. This means that the valve withstands several operation cycles under full differential pressure without damage.

D.2 Performance of test

The seat test shall be carried out in accordance with 5.8.1.

The test medium shall be air, nitrogen or natural gas.

The valve shall have been thoroughly dried before these tests are conducted.

In every duty cycle the valve shall open and close fully. The number of duty cycles shall be:

- < DN 100 200 cycles;
- ≥ DN 100 100 cycles at constant pressure (= rated pressure); 50 cycles with differential pressure (= MPD).

The test shall be performed at ambient temperature. The differential pressure shall be MPD.

The manufacturer's instructions on admissible duty cycle speeds and frequencies shall be observed.

A storage vessel capacity of $V_E = 4 \times (DN)^3$ in mm³ shall be provided upstream the valve. There shall be no reduction of nominal size between the storage vessel and the valve.

With regard to the dimensions of the test facility and the reduction of noise emissions, the outlet cross-section or the outlet volume can be restricted so that at least 90 % of the initial pressure differential is effective.

The full pressure shall have built up upstream of the obturator before each opening motion.

With double sealing valves, the seat tightness test shall be repeated with reverse flow direction or the entire fatigue test shall be performed with another test specimen with the same nominal size but with the reverse flow direction.

Before and after the test, the torque and the leakage tests in accordance with this standard shall be conducted.

D.3 Acceptance criteria

For external tightness, no visible leakage shall be allowed.

Soft seated valves and lubricated plug valves shall conform to Rate B in accordance with ISO 5208, and metal seated valves to Rate D in accordance with ISO 5208.

The increase in operating torque shall not exceed 15 %.

Annex E (normative)

Functional test for abrasion resistance to dirty service of ball valves (on option)

E.1 Purpose

The purpose of this test is to determine the abrasion resistance to solid substances entrained in the gaseous transport medium. The following pipeline operations shall be simulated.

- During by-pass operation with the main valve closed, e.g. after the pipeline has been closed down, solid contaminants settle upstream of the closed obturator. When the main valve is opened, the sealing elements are impacted with the dirt which has collected.
- During a pigging operation, the branch valves are closed. Solid contaminants which are pushed forward in front of the pig enter the branches and impact the sealing elements when the valve is opened.

E.2 Performance of test

This type test covers all sizes and pressure ratings.

The test shall be performed on a single valve Class 600 with minimum diameter DN 300 and the largest diameter equal to the diameter of the test rig.

- 20 open-close cycles are carried out at a high transport rate in the presence of solid contaminants.
- A defined amount of contaminants²⁾ is introduced into the system upstream 20 cm of the closed test valve. The composition of the test contaminant should be reproducible. It may, for example, be the result of a physical analysis of the material collected during a pigging operation. Table E.1 contains a representative example.
- A certain amount of gas is passed through the by-pass. The amount of gas corresponds to a transport flow in the test valve of approximately 10 m/s in open position.
- The test valve is opened in accordance with pipeline operation practice in a duration of about 60 s. The mere throttling of the test valve causes the contaminant to start to move and impact the exposed part of the sealing element. Whilst opening the test valve, the by-pass will synchronously be closed.
- After the 1st, 3rd, 10th and 20th cycle a seat tightness test is performed.

Seat tightness shall be determined by measurement of leakage of the closed valve via overflow at the body cavity vent. Upstream and downstream pressure shall be monitored.

The initial break away torque, continuous torque and valve position shall be measured.

²⁾ 1 kp for DN 400; adaptation of quantity related to the squared diameter ratio in case of modified DN.

E.3 Acceptance criteria

The test result is representative of the wear resistance of the test valve. Permissible leakage shall be:

- permissible leakage rate $< 5 \text{ m}^3/\text{h}$ in each direction;
- permissible leakage rate $< 10 \text{ m}^3/\text{h}$ measured via overflow (drain or vent lines) at the cavity connection with pressure applied to both sides simultaneously.

Table E.1 — Composition of the contaminant mixture

Contaminant	Particle sizes s mm	Share %(V/V)
Welding sinter	50 % $0,1 < s \leq 1,0$ 50 % $0,1 < s \leq 2,0$	10
Welding pearls	$1,5 < s \leq 2,5$	15
Coarse-grained sand	50 % $0,1 < s \leq 1,0$ 50 % $0,1 < s \leq 2,0$	75
NOTE In addition, per litre of this mixture <ul style="list-style-type: none"> — 10 cm^3 of glass splinters; — 3 welding rods residue diameter 3,25 mm/length 20 mm. 		

Annex F (normative)

Wall thickness measurement

F.1 Purpose

The purpose of this test is to confirm that the wall thickness of the valve shell is in accordance with the design documents.

F.2 Description of test

Measure the wall thickness in at least four critical strength areas of the shell or on complete shell.

Castings shall be measured in opposite areas.

F.3 Test method

Measurements shall be carried out by measuring tool with suitable accuracy of reading calibrated to expected wall thickness.

F.4 Acceptance criteria

The minimum wall thickness at each measurement point shall be not less than the minimum value stated on the drawing.

Annex G

(informative)

Additional requirements

G.1 Bending strength

This standard assumes that forces and moments transmitted by the pipe will be such that valve performance is not affected. Where unusual conditions apply, the purchaser should advise the manufacturer. A bending test may be required by the purchaser. In this case, the purchaser should specify a suitable testing procedure to be applied, including bending moments and acceptance criteria.

G.2 Protection against excessive torques

At the request of the purchaser the valve should be fitted with a protection against excessive torque transmitted from the operator (e.g. by a shear pin) placed outside the shell.

Annex H (informative)

Summary of tests on product and type tests

Table H.1 gives a summary of the mandatory or optional tests to be carried out in accordance with this standard.

Table H.1 - Summary of the mandatory or optional tests to be carried out in accordance with this standard.

Requirement clause	Application	Test	Test method	Test on product	Type test
Design					
5.1.1	Shell design and dimension	Design approval	A.4.3, respectively annex F	—	M
5.1.2	End-to-end dimensions	Dimensional check	A.4.3 ^a	M	M
5.1.3	Butt welding ends	Dimensional check	A.4.3 ^a	M	M
5.1.4	Anti-blow out feature	Drawing examination	A.4.3 ^a	M	M
5.1.5	Sealant injection systems	Drawing examination	—	M	M
		Trial sealant injection	5.1.5	—	O
5.1.6	Extended drain, vent and sealant lines				
	— Securely fastened	Visual inspection	—	M	—
	— Design	Drawing examination	—	M	—
	— Pressure test	Hydraulic test ^b	—	M	—
5.1.7	Vent, drain and sealant valves	Gas blow down test	5.1.7	M	—
		Seat leak test	C.4 of ISO 14313:1999	M	—
5.1.8	Mechanical resistance against excessive actuating forces	Stem test on torque/thrust	Annex C	—	M
5.1.9	Body/bonnet connection	Visual check of drawing	—	M	M
Operation					
5.2.1	Handwheels and levers, ease of operation	Measurement of torque/thrust and of handwheel/lever force	5.2.1	M	—
5.2.2	protection against rapidly moving external components	Visual inspection	—	M	—
5.2.3	Manual override devices	Visual inspection	—	M	—
5.2.4	Torque/thrust testing (agreed values)	Measurement of torque/thrust	C.6 of ISO 14313:1999	M	M
Materials					
5.3.1	Material compatibility	Behaviour of sealing materials	Annex B	—	M

Requirement clause	Application	Test	Test method	Test on product	Type test
5.3.2.1	Shell materials	— Check of certificate	5.3.2	M	M
5.3.2.2	— Impact values	— Check of certificate	EN 10045-1	M	M
5.3.2.3	— Welding ends for on-site welding	— Check of certificate	5.3.2.3	M	M
5.3.3	Obturator	Check of certificate	5.3.3	M	M
5.3.4	Body/bonnet connection, bolting materials	Check of certificate	5.3.4	M	M
Repair					
5.4	Repair welding	Non-destructive testing	5.5.2	M ^C	M ^C
Non-destructive testing					
5.5.2	Welds joining pressure containing parts				
	— < DN 200	Penetrant testing or Magnetic particle testing	EN 571-1 or B.7 of ISO 14313:1999 EN 1290 or B.7 of ISO 14313:1999	M	M
	— ≥ DN 200	ultrasonic testing or Radiographic testing or (if not suitable) Penetrant testing or Magnetic particle testing	EN 1714 EN 1435 or B.10 of ISO 14313:1999 EN 571-1 or B.7 of ISO 14313:1999 EN 1290 or B.10 of ISO 14313:1999	M	M
5.5.3	Pressure-containing castings	— Visual inspection	MSS-SP-55	M	M
		— Surface examination Magnetic particle testing or Penetrant testing	EN 1369 EN 1371-1	M	M
	— ≥ DN 200	Critical areas radiographic examination	EN 12681 or B.3 of ISO 14313:1999	M	M

Requirement clause	Application	Test	Test method	Test on product	Type test
5.5.4	Forgings	Magnetic particle testing or Penetrant testing and (as applicable) Ultrasonic testing	EN 10228-1 or B.9 of ISO 14313:1999 EN 10228-2 EN 10228-3 or EN 10228-4	O	—
5.5.5	Welding ends for on-site welding — Rolled and forged — Cast steel	100 % ultrasonic examination Radiographic examination	EN 10228-3 or EN 10228-4 EN 12681 or B.3 of ISO 14313:1999	M M	M M
Shell test					
5.6	Tightness and strength of shell	Shell tightness and shell strength test Leak test with gas	10.3 of ISO 14313:1999 Test P.11 of EN 12266-1	M O	M M
External tightness					
5.7.1	Stem/shaft sealing	Stem backseat test	10.2 of ISO 14313:1999	O	O
5.7.3	Fire test	— Document check — Fire test	— ISO 10497	O —	— O
Internal tightness					
5.8.1	Seat tightness	— High pressure gas seat test — Low pressure gas seat test	C.4 of ISO 14313:1999 C.3 of ISO 14313:1999	M M	M M
5.8.2	Functional test for clean service	Erosion test with clean gas	Annex D	—	O
5.8.3	Functional test for dirty service	Erosion test with solid contaminants	Annex E	—	O
NOTE M = mandatory O = optional					
a Only applicable for type test.					
b Test is part of shell test specified in 5.6.					
c If applicable.					

Bibliography

- [1] Norsok standard M-710 *Qualification of non-metallic sealing materials and manufacturers* (Norwegian Technology Centre Oscarsgt. 20, Postbox 7072 Majorstua, N-0306 Oslo, Norway).
- [2] EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2000)*.

BSI — British Standards Institution

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