

EU RO Mutual Recognition Technical Requirements

PRESSURE RELIEF VALVE IN CLASS III PIPING SYSTEM	Version	0.0
	Adoption Date:	1 January 2019
	Application Date:	1 July 2019
	Tier	7
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1. PRODUCT DESCRIPTION

1.a General description of the product

Pressure relief valve in class III piping system as defined by IACS UR P2.2 Rev.4 intended to the valves in class III pipelines systems which automatically, without the assistance of any energy other than that of the fluid concerned, discharges a quantity of the fluid so as to prevent a settled safe pressure being exceeded, and which is designed to re-close and prevent further flow of fluid after normal pressure conditions of service have been restored.

1.b Application limitations[†]

- a) These technical requirements apply to pressure relief valve dedicated to pipelines systems of Class III defined by IACS UR P2.2 Rev.4 having a flow diameter of 4 mm and above which are for use at set pressure of 0.01MPa(0.1bar) gauge and above;
- b) These technical requirements are not applicable to:
 - Pressure relief valve intended to be used on crankcase explosion relief valves
 - Valves intended to be fitted on the ship's side and valves intended to be fitted on the ship's collision bulkhead
 - Valves intended to be fitted on the sea chests for steam cleaning of inlet gratings
 - Valves intended to be fitted on boilers and pressure vessels
 - Hydraulically, electrically or pneumatically controlled devices for valves
 - Toxic and corrosive media

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- Inflammable media heated above flash point or having flashpoint below 60°C
- Liquefied gases
- Plastic valves

†The EU MR type approved product is generally not used as a stand-alone product, but integrated as component in a sub-system or system. When a product is presented with an EU RO MR Type Approval Certificate for given application, its acceptability with regards to conditions defined in 1b, 1c and 1d of this Technical Requirement will be evaluated by the EU RO in charge of classing the ship or being in charge of the unit/system certification.

1.c Intended use

Pipelines systems of Class III defined by IACS UR P2.2 Rev.4.

1.d System context

As per item 1c.

2. DESIGN EVALUATION

2.a Engineering evaluation requirements

2.a i. Technical Requirements

All technical requirements shall fulfil IACS Unified Requirements E10, latest revision in use (Rev. 6) – Test Specification for Type Approval:

- a) The design shall incorporate guiding arrangements necessary to ensure consistent operation and seat tightness;
- b) The seat of a pressure relief valve, other than when it is an integral part of the valve shell, shall be fastened securely to prevent the seat becoming loose in service;
- c) In the case of valves where the lift can be reduced to conform to the required discharge capacity, restriction of the lift shall not interfere with the operation of the valve. The lift restricting device shall be designed so that, if adjustable, the adjustable feature can be mechanically locked and access sealed. The lift restricting device shall be installed and sealed in according with the design of the manufacturer. Valve lift shall not be restricted to a value less than 30% of unrestricted lift or 1mm, whichever is the greater;

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- d) Means shall be provided to lock and/or to seal all external adjustments in such a manner so as to prevent or reveal unauthorized adjustments of the pressure relief valve; Safety valves are to be so constructed that their setting may not be increased in service and their spring may not be expelled in the event of failure. Where safety valves are provided with means for regulating their relieving capacity, they are to be so fitted that their setting cannot be modified when the valves are removed for surveys;
- e) Provision shall be made to prevent liquid collecting on the discharge side of the pressure relief valve shell. Unless additional discharge actions are taken, a relief connector is required at the lowest position in the pressure relief valve where liquids may accumulate. Drainage pipes where necessary at the relief valve's discharge side are to be of sufficient size (not less than 19 mm in bore recommended) to avoid blocking by any solid matter deposits (caused from the fluid's ingredients if applicable or any corrosion products within the discharge or vent pipe);
- f) The stress in the pressure-retaining parts (calculated in the design conditions) shall not exceed that specified in the design standards;
- g) Sealing elements which may adversely affect the operating characteristics by frictional forces are not permitted;
- h) Pressure relief valve shall be constructed so that breakage of any part, or failure of any device, will not obstruct free and full discharge through the pressure relief valve;
- i) The coefficient of discharge K_d is to be given by:

$$K_d = \frac{\sum_1^n \left(\frac{q'_m}{q_m} \right)}{n}$$

Where the theoretical flowing capacity is calculated in according with ISO 4126-7, as applicable, and, using this value together with the actual flowing capacity which recorded when testing at relieving pressure, the coefficient of discharge of the valve is calculated;

- j) The aggregate cross-sectional area f , in mm^2 , of safety valves shall not be less than:

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for saturated steam

$$f = k \frac{G}{10.2p_w+1};$$

for superheated steam

$$f = k \frac{G}{10.2p_w+1} \sqrt{\frac{V_H}{V_S}},$$

- Where
- G = design steaming capacity, kg/h;
 - p_w = working pressure, MPa;
 - V_H = specific volume of superheated steam at the appropriate working pressure and temperature, m^3/kg ;
 - V_S = specific volume of saturated steam at the appropriate pressure, m^3/kg ;
 - k = coefficient of hydraulic resistance is assumed to be equal to: d/h at $h/d \leq 0,25$; $1,25d/h$ at $h/d > 0,25$;
 - d = minimum valve diameter, mm;
 - h = height of valve lifting, mm.

Where safety valves are fitted on a common branch, the cross-sectional area of the branch shall not be less than 1,1 times the aggregate cross-sectional area of the valves installed. The cross-sectional area of the waste steam branch of the safety valve and of the pipe connected thereto, shall not be less than twice the aggregate cross-sectional area of the valves;

- k) After being regulated and locked up, the valve disc is not to run out of the valve seat when the spring is broken;
- l) The waste steam is not to come into direct contact with the loading springs;

Materials:

- m) The materials for pressure relief valve should be suitable for the fluid media, adjacent parts and the operating environment. Only approved material shall be used for pressure-retaining shells, these materials and their temperature limitations shall be suitable for pressure-containing function; The springs of the safety valves shall be protected from direct exposure to fluid and shall be manufactured from heat- and corrosion-resistant materials, as also are the sealing surfaces of seats and valves.
- n) The materials for adjacent sliding surfaces such as guide(s) and disc/disc holder/spindle shall be selected to ensure corrosion resistance and to minimize wear and avoid galling; The materials for the seat and disc of pressure relief valves

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shall be selected to ensure resistance to metallic bonding between these two surfaces in order to prevent an increase of set pressure, e.g. sticking or cold working;

- o) The materials to be used for the other component parts of the valves (i.e. connecting flange, valve disc, plate, stem and seat, spring, etc.) shall be corrosion resistant and suitable for the working medium and the intended service. Non-metallic material of gaskets or seals shall be approved in accordance with the recognized standards for the use with working medium and for design temperatures not less than 200°C;
- p) The use of asbestos is prohibited;

Type of connections:

- q) Butt welded, slip-on sleeve and socket welding joints shall be used in the connecting of valves;
- r) Threaded joints (both tapered and parallel threads) may be permitted for an outside diameter not more than 60.3mm; In particular cases, sizes in excess of those mentioned above may be accepted if they satisfy the requirements of recognized international or national standards;
- s) Metallic flange connections are permitted. Slip-on flanges as per below Figure are only permitted up to 150°C (see Figure 1a); Loose flanges as per below figure are not permitted for steam piping system (see Figure 1b);

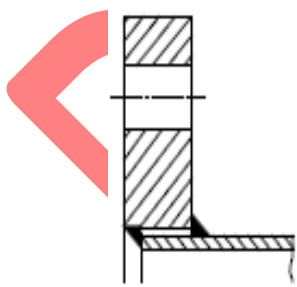


Figure 1a

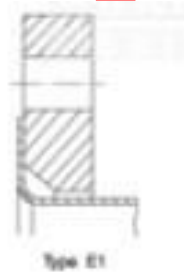


Figure 1b

- t) The inlet design of pressure relief valve end connections, whatever their type, shall be such that the internal area of the connecting piping or stub connection at the valve inlet is at least equal to that of the valve inlet connection, (see Figure 2a); The outlet design of pressure relief valve end connections, regardless of type, shall be such that the internal area of the external pipe connection at the valve

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outlet is at least equal to that of the valve outlet, except for those valves with female threaded outlet connections., (see Figure 2b);

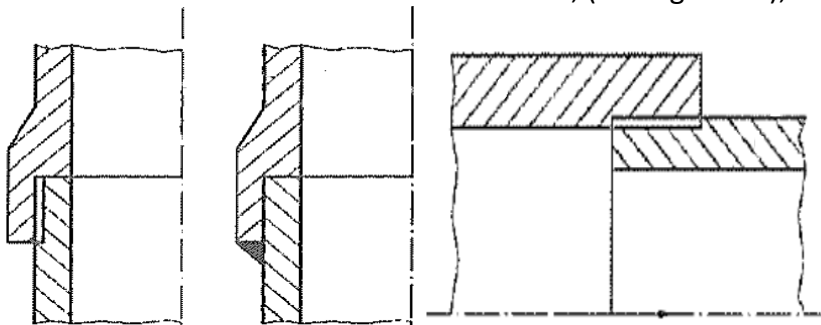


Figure 2a

Figure 2b

- u) The dimensions of flanges and relative bolts shall be chosen in accordance with the relevant national standards. Flange attachments shall be in accordance with national or international standards that are relevant to the piping system and are to recognize the applicable boundary fluids, design pressure and temperature conditions, external or cyclic loading and location.

2.a.ii. Technical documents to be submitted

- a) The standard used by the manufacturer shall be clearly identified in the documentation submitted;
- b) Assembly drawings showing dimensions, internal parts (valve body and connecting flange, valve disc, plate, stem and seat, spring, etc.), materials, internal seals/gaskets data sheet, type of connections shall be submitted for EU RO review;
- c) Design analysis shall be submitted. Design analysis may be based on design by rule (according to a recognized standard) or based on experimental method (such as burst test according to a recognized standard);
- d) Product descriptions including nominal diameter, intended services, installation locations, intended fluids, working medium, rated flow, discharge calculations, design pressure, temperature range, certificates and reports of relevant tests previously carried out, instructions on operation, performance specification shall be submitted for EU RO review.

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2.b Type testing requirements

- a) Type tests shall be carried out as per the referenced standard. The operating and flow characteristics of relief valves shall be determined. Valves for steam, air or other gas service shall be tested using steam, air or any other gas of known characteristics. Valves for liquid service shall be tested using water or other liquid of known characteristics;
- b) Inspection of structural dimension, appearance of main components and overall visual inspection should be carried out firstly; The performance tests, include Spring performance test, set/relieving/reseating pressure tests, mechanical characteristic, lift, and so on, should be determined in accordance with recognized standards such as ISO standards, API specifications, EU RO RULES, etc.;
- c) Test specimens shall be selected from the production line or 'at random' from stock*;
- d) Hydrostatic test. Where there are various sizes of the type of valve requiring approval, a minimum of three separate sizes representative of the range from each type of joints (minimum, middle and maximum nominal diameter) shall be subject to the hydrostatic test at the following value of pressure:
 $PH = 1,5P$, but not less than 0.1 MPa
where PH = test pressure (MPa), P = design pressure (MPa)
or the pressure indicated by the reference standard for valves, whichever is the largest;
- e) Pneumatic testing. Pressure testing with air or other suitable gas should be avoided but may be carried out in place of the standard shell hydrostatic test with the agreement of all parties involved in the cases that valves of such design and construction make it not practicable for them to be filled with liquid, valves that are to be used in service where even small traces of water cannot be tolerated. The pressure and duration of the test shall be specified as for hydrostatic test;
- f) Tightness test. (hydrostatic seat leakage test) shall be carried out at the test leakage is found at the outlet through visual or audible inspection; For pressure relief valve with metallic sealing face for air or other gases, the bubble leakage rate per minute should be satisfied with the referenced standard; For pressure relief valve with non-metallic sealing face for air or other gases, no leakage is allowed; For pressure relief valve for water or other liquids, no drop of water is allowed on the sealing face with the valve maintained at the operating pressure for 2 min;

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- g) Relieving capacity test. Mount the safety valve to the test device and open the flow control valve; when the medium pressure reaches the set pressure, the safety valve will begin relieving continuously; when the pressure rises to the rated relieving pressure, measure and record the relieving capacity and calculate the coefficient of discharge K_d ;
- h) Type tests for type approval shall be carried out in the presence of a RO surveyor. In cases where the tests are conducted at Nationally Accredited Laboratories, the presence of the EU RO Surveyor may be omitted*.

*For further clarification of witnessing of tests and sampling the test specimen(s), refer to paragraphs 6, 7 and 8 of the EU RO "Design Evaluation Scheme" procedure (Appendix V of EU RO Framework Document for the Mutual Recognition of Type Approval found on <https://www.euomr.org/technical-requirements>)

3. PRODUCTION REQUIREMENTS

- a) Refer to EU RO "Product Quality Assurance (PQA)" procedure (Appendix VI of EU RO Framework Document for the Mutual Recognition of Type Approval); found on <https://www.euomr.org/technical-requirements>
- b) All valve bodies shall be subject to a hydrostatic test (Pneumatic testing, if applicable) at the following value of pressure:
 $PH = 1,5P$, but not less than 0.1 MPa (1bar) where PH = test pressure (MPa),
 P = design pressure (MPa);
- c) After adjustment of the set or cold differential test pressure, the valves shall be checked for leakage in accordance with recognized standard such as API 527;
- d) Each relief valve shall be adjusted to its designated set or cold differential test pressure;
- e) Certificate of test is to be delivered.

4. MARKING REQUIREMENTS

Marking on the shell of a pressure relief valve may be integral with the shell or on a plate securely fixed on the shell. The following minimum information shall be marked on all valves:

- a) Size designation (inlet) DN;
- b) Material designation of the shell;
- c) Manufacturer 's name or trademark;

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d) An arrow showing the direction of flow where the inlet and outlet connection have the same dimensions or the same pressure rating.

The following information shall be given on an identification plate securely fixed to the valve:

- e) Set pressure;
- f) Manufacturer 's type reference;
- g) Certified de-rated coefficient of discharge indicating reference fluid: G for gas, S for steam and L for liquid;
- h) Flow area;
- i) Minimum value of lift.

5. TYPE APPROVAL CERTIFICATE CONTENT

The EU RO MR Type Approval Certificate shall contain the minimum information as defined in the "EU RO Framework Document for the Mutual Recognition of Type Approval" - see Appendix I EU RO MR Type Approval Certificate Information.

6. APPROVAL DATE AND REVISION NUMBER

Date	Revision	Comment
2018-07-01	0.0	Approved by EU RO MR Steering Committee

7. BACKGROUND INFORMATION / REFERENCES

- a) EU RO Framework Document for the Mutual Recognition of Type Approval;
- b) IACS UR P2 (Rev.2 Nov 2001) "Rules for piping design, construction and testing";
- c) ISO 4126-1:2013+A1:2016 "Safety devices for protection against excessive pressure".

8. MAINTENANCE & CLARIFICATION OF TECHNICAL REQUIREMENTS

Anyone wishing to propose changes to this document or request clarification of technical issues should contact the EU RO MR Group Secretariat in the first instance:

Secretariat@euomr.org.

Review and approval of change requests shall follow the EU RO MR Maintenance Process detailed in the EU RO Framework Document for the Mutual Recognition of Type Approval: <https://www.euomr.org/technical-requirements>

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