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Safety devices for protection against excessive pressure—Direct spring loaded safety valves for steam and gas service

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the original JIS is to be the final authority.

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Boiler Association (JBA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS B 8210**:1994 is replaced with this Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Ministers and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Safety devices for protection against excessive pressure—Direct spring loaded safety valves for steam and gas service

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **ISO 4126-1** published in 2004 and the first edition of **ISO 4126-7** published in 2004, while modifying the technical contents to reflect the current condition of Japan.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the corresponding International Standards have been modified. A list of modifications with explanations is given in Annex JD.

1 Scope

This Standard specifies the direct spring loaded safety valves for steam and direct spring loaded safety valves for gas, of cylindrical coil spring (hereafter referred to as "safety valves", where no particular distinction of uses, i.e. those for gas or for steam, is required). However, the following are not included:

a) those used for the purpose of releasing the pressure of liquid;

b) those which are for use at set pressures under 0.1 MPa or over 42.9 MPa;

c) those of special construction, such as those intended for vehicles;

d) those intended for pressure regulation, such as unloaders;

e) those less than 15 mm in seat diameter.

NOTE : The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows:

ISO 4126-1:2004 *Safety devices for protection against excessive pressure—Part 1: Safety valves*

ISO 4126-7:2004 *Safety devices for protection against excessive pressure—Part 7: Common data*

(Overall evaluation: MOD)

The symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0100 *Glossary of terms for valves*

JIS B 0203 *Taper pipe threads*

NOTE : Corresponding International Standard: ISO 7-1 *Pipe threads where pressure-tight joints are made on the threads—Part 1: Dimensions, tolerances and designation* (MOD)

JIS B 0403 *Castings—System of dimensional tolerances and machining allowances*

JIS B 0405 *General tolerances—Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

JIS B 2220 *Steel pipe flanges*

JIS B 2239 *Cast iron pipe flanges*

JIS B 2240 *Copper alloy pipe flanges*

JIS B 2704 *Helical compression and extension springs—Requirements for design, performance test method*

JIS B 8201 *Stationary steel boilers—Construction*

JIS B 8225 *Safety valves—Measuring methods for coefficient of discharge*

JIS B 8240 *Construction of pressure vessels for refrigeration*

JIS B 8265 *Construction of pressure vessel—General principles*

JIS B 8602 *Pipe flanges for refrigerants*

JIS G 0581 *Methods of radiographic examination for steel castings*

JIS G 1211 *Iron and steel—Methods for determination of carbon content*

JIS G 1212 *Iron and steel—Methods for determination of silicon content*

JIS G 1214 *Iron and steel—Methods for determination of phosphorus content*

JIS G 1253 *Iron and steel—Method for spark discharge atomic emission spectrometric analysis*

JIS G 5501 *Grey iron castings*

JIS G 5502 *Spheroidal graphite iron castings*

JIS G 5705 *Malleable iron castings*

JIS H 5120 *Copper and copper alloy castings*

JIS H 5121 *Copper alloy continuous castings*

JIS Z 2201 *Test pieces for tensile test for metallic materials*

JIS Z 2241 *Method of tensile test for metallic materials*

JIS Z 2242 *Method for Charpy pendulum impact test of metallic materials*

JIS Z 2243 *Brinell hardness test—Test method*

JIS Z 2343-1 *Non-destructive testing—Penetrant testing—Part 1: General principles—Method for liquid penetrant testing and classification of the penetrant indication*

JIS Z 2611 *General rules for photoelectric emission spectrochemical analysis of metal materials*

JIS Z 3104 *Methods of radiographic examination for welded joints in steel*

JIS Z 3106 *Methods of radiographic examination for welded joints in stainless steel*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions in **JIS B 0100** and the following apply.

3.1 safety valve

valve which automatically, without the assistance of any energy other than that of the fluid concerned, discharges the quantity of the fluid so as to prevent a predetermined 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

NOTE : The valve can be characterized either by pop action (rapid opening) or by opening in proportion (not necessarily linear) to the increase in pressure over the set pressure.

3.1.1 direct spring loaded safety valve

safety valve in which the loading due to the fluid pressure underneath the valve disc is opposed only by a direct mechanical loading device, in this case, a spring

3.1.2 lift safety valve

safety valve of which the lift is 1/40 or over to and excluding 1/4 the seat diameter, and of which the seat flow area (curtain area) becomes the minimum among the flow areas when the valve disc opens

3.1.3 full bore safety valve

safety valve which is capable of obtaining such a lift where the seat flow area becomes sufficiently larger than the area of the throat of the nozzle in the lower portion than the contacting face of the valve disc and the valve seat

3.2 pressure

force per unit area working vertically to the surface

Pressure unit used in this Standard is MPa (bar), quoted as gauge or absolute pressure as appropriate.

NOTE : 1 bar = 10^5 Pa

3.2.1 set pressure

predetermined pressure at which a safety valve under operating conditions commences to open

The set pressure shall be either the start-to-discharge pressure or opening pressure, depending on the operating characteristics of the valve.

NOTE : This pressure is the gauge pressure measured at the valve inlet at which the pressure forces tending to open the valve for the specific service conditions are in equilibrium with the forces retaining the valve disc on its seat.

3.2.2 start-to-discharge pressure; start-to-leak pressure

the inlet side pressure when an extremely small outflow of fluid is detected at the discharge side by the pressure increase at the inlet side

NOTE : The extremely small outflow of fluid, in this case, is such an outflow as clearly detectable by visual inspection or sound detection, in the case of steam, and by sound detection or by a soap water applied over the exit outlet and the like within the allowable limit of start-to-discharge pressure, in the case of gas, and not the outflow due to valve seat leakage.

3.2.3 opening pressure; popping pressure

the pressure at the inlet side when the safety valve pops

NOTE : "Popping" means the action of the safety valve to blow out the inside fluid when the lift increases instantaneously.

3.2.4 closing pressure; reseating pressure

value of the inlet static pressure at which, after a decrease in this inlet pressure, the disc re-establishes contact with the seat or at which the lift becomes zero

NOTE : It is also referred to as "reseating pressure".

3.2.5 blowdown

difference between the start-to-discharge pressure or opening pressure and the closing pressure, stated in the real value (MPa) or as a percentage of set pressure

3.2.6 overpressure

pressure increase over the set pressure, at which the safety valve attains the lift specified by the manufacturer, usually expressed as a percentage of the set pressure

NOTE : This is the overpressure used to certify the discharge capacity of a safety valve.

3.2.7 allowable overpressure

the allowable pressure over the set pressure of a safety valve

3.2.8 maximum allowable pressure

the maximum set pressure the equipment is designed for, which is specified by the manufacturer of the pressure equipment

3.2.9 cold differential test pressure (CDTP)

set pressure (inlet static pressure) at which a safety valve is set to commence to open on the test bench, including corrections for service conditions, e.g. back pressure and/or temperature

3.2.10 back pressure

the pressure existing at the discharge side of the safety valve

NOTE : The back pressure can be either a built-up back pressure and a superimposed back pressure.

3.2.11 built-up back pressure

pressure existing at the outlet of a safety valve caused by flow through the valve and the discharge system

3.2.12 superimposed back pressure

pressure existing at the outlet of a safety valve at the time when the device is required to operate, which is the result of pressure in the discharge system from other sources

3.2.13 balanced bellows

bellows device which minimizes the effect of superimposed back pressure on the set pressure of a safety valve

3.3 coefficient of discharge

value of actual flowing capacity (from tests) divided by the theoretical flowing capacity (from calculation)

3.4 certified derated coefficient of discharge

coefficient to be used for the calculation of certified capacity, which is the product of coefficient of discharge and derated coefficient

Derated coefficient is the ratio of the certified derated coefficient of discharge to the coefficient of discharge, which is generally set to be 0.9.

3.5 flow rating pressure; relieving pressure

the inlet side pressure at the time of calculating the certified capacity of a safety valve, which is the sum of the set pressure and the allowable overpressure

3.6 theoretical discharge capacity

calculated capacity expressed in mass or volumetric units of a theoretically perfect nozzle having a cross-sectional flow area equal to the flow area of a safety valve

3.7 certified capacity; rated relieving capacity

the discharge capacity guaranteed for individual safety valves, which shall be in accordance with one of the following:

a) measured discharge capacity × derated coefficient of discharge;

b) theoretical discharge capacity × coefficient of discharge × derated coefficient;

c) theoretical discharge capacity × certified derated coefficient of discharge;

d) discharge capacity decided by the specification of Annex JA.

3.8 lift

actual travel, in the axial direction, of the valve disc away from the closed position to the open position where the valve is discharging

3.9 rated lift

design value of lift at which certified capacity is obtained

3.10 seat diameter

the inside radius of the contact face of the valve disc with the valve seat (see figure JA.1)

3.11 throat diameter; bore diameter

the inside diameter of the narrowest portion of the nozzle from the fluid intake opening to the valve seat surface (see figure JA.1)

3.12 throat area; bore area

the flow area corresponding to the throat diameter

3.13 seat flow area; curtain area

the flow area of the cylindrical or conical shaped opening between the valve disc and the valve seat surface obtained by the lift of the valve disc

3.14 flow area

the flow area of the portion which determines the flow rate passing through the safety valve, and which is the area to be used for calculating the certified capacity (see figure JA.1)

3.15 nominal size

nominal dimension to express the size of safety valve

NOTE : The nominal size of safety valve shall be the nominal size at the inlet side and generally nominal size specified in **JIS B 2001** shall be applied.

4 Symbols and units

Symbols and units are as follows.

A :	Flow area	(mm^2)
C :	Isentropic factor (function of the isentropic exponent)	
K_b :	Theoretical capacity correction factor for subcritical flow	
K_d :	Coefficient of discharge [1)]	
K_{dr} :	Certified derated coefficient of discharge ($K_d \times 0.9$) [1)]	
K_{dr}' :	Derated coefficient of discharge [1)]	
K_v :	Viscosity correction factor	
k :	Isentropic exponent	
M :	Molar mass	(kg/kmol)
n :	Number of tests	
p_o :	Relieving pressure	(MPa abs or bar abs)
p_b :	Back pressure	(MPa abs or bar abs)
p_c :	Critical pressure	(MPa abs or bar abs)
Q_m :	Mass flow rate	(kg/h)
q_m :	Theoretical specific discharge capacity	[kg/(h·mm^2)]