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Piping and valves

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Foreword

NORSOK L-001:2017 was adopted as a NORSOK Standard in January 2017.

NORSOK L-001:2017 supersedes NORSOK L-001 Rev. 3, September 1999.

NORSOK is an acronym for the competitive position of the Norwegian continental shelf and comprise petroleum industry standards in Norway. The collaboration initiative in 1993 between the authorities and the petroleum industry initiated the development of NORSOK standards.

Reducing the project execution time and developing and operating cost for petroleum installations on the Norwegian shelf was the target.

The intention for the Petroleum industry is to develop and use standards providing good technical and cost effective solutions to ensure that the petroleum resources are exploited and managed in the best possible way by the industry and the authorities. The industry will actively contribute to the development and use of international standards in the global market.

The NORSOK standards shall:

- bridge the gap based on experiences from the Norwegian continental shelf where the international standards are unsatisfactorily;
- replace oil company specifications where possible;
- be available as references for the authorities' regulations;
- be cost effective;
- promote the Norwegian sector as an attractive area for investments and activities.

Developing new NORSOK standards and regular maintenance of existing standards shall contribute to maintain the competitiveness both nationally and internationally for the Norwegian petroleum industry.

The NORSOK standards are developed by experts from the Norwegian petroleum industry and approved according to the consensus principles as laid down by the guidelines given in NORSOK A-001N:2016.

The NORSOK standards are owned by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries and the Norwegian Shipowners' Association. They are managed and published by Standards Norway.

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

Attention is drawn to the possibility that some of the elements of this NORSOK standard may be the subject of patent rights.

Introduction

This standard should be seen in conjunction with other NORSOK standards for design, construction and installation of piping and systems such as:

NORSOK L-002, Piping system layout, design and structural analysis

NORSOK L-003, Piping details

NORSOK L-004, Piping fabrication, installation, flushing and testing

NORSOK L-005, Compact flanged connections

NORSOK M-001, Materials selection

NORSOK M-501, Surface preparation and protection coating

NORSOK M-601, Welding and inspection of piping

NORSOK M-630, Material data sheets and element data sheets for piping

NORSOK M-650, Qualification of manufactures of special materials

NORSOK P-002, Process system design

This fourth edition has, to a large extent, been simplified compared to previous edition. In accordance with the approved revision project description, this edition contains no valve data sheets and only a very limited number of informative example pipe class sheets. Projects shall develop pipe class sheets and valve data sheets to suit actual conditions, based on guidelines and requirements in this standard. The main focus is to establish simple, robust and cost efficient solutions.

Active links to complementary documents in Annex D and Annex E are only available in the electronic version of the standard.

1 Scope

This NORSOK standard provides requirements for piping systems.

Requirements for piping fabrication, installation, flushing and testing are provided in NORSOK L-004.

Requirements for welding and inspection of piping are provided in NORSOK M-601.

Requirements for material data sheets and element data sheets for piping are provided in NORSOK M-630.

2 Normative references

The following standards include provisions and guidelines, which, through reference in this text, constitute provisions and guidelines of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet the requirements of the referenced standards.

2014/68/EU, *Pressure Equipment Directive (PED)*

API Spec 5L, *Specification for Line Pipe Forty-fifth Edition, Includes Errata (2015)*

API Spec 6D, *Specification for Pipeline and Piping Valves, Twenty-Fourth Edition,*

API Spec 6FA, *Specification for Fire Test for Valves,*

ASME B1.1, *Unified Inch Screw Threads (UN and UNR Thread Form)*

ASME B16.5, *Pipe Flanges and Flanged Fittings*

ASME B16.9, *Factory-Made Wrought Butt welding Fittings*

ASME B16.10, *Face-to-Face and End-to-End Dimension of Valves*

ASME B16.11, *Forged Fittings, Socket-Welding and Threaded*

ASME B16.20, *Metallic Gaskets for Pipe Flanges: Ring Joint, Spiral Wound and Jacketed*

ASME B16.21, *Nonmetallic Flat Gaskets for Pipe Flanges*

ASME B16.34, *Valves – Flanged, Threaded and Welding End*

ASME B16.36, *Orifice Flanges*

ASME B16.47, *Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard*

ASME B16.48, *Line Blanks*

ASME B18.2.2, *Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)*

ASME B31.3, *Process Piping*

ASME B31T, *Standard Toughness Requirements for Piping*

ASME B36.10, *Welded and Seamless Wrought Steel Pipe*

ASME B36.19, *Stainless Steel Pipe*

ASME PCC-1, *Guidelines for Pressure Boundary Bolted Flange Joint Assembly*

ASTM A105, *Standard Specification for Carbon Steel Forgings for Piping Applications*

ASTM A106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*

ASTM A153, *Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

ASTM A182, *Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*

ASTM A193, *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service*

ASTM A194, *Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both*

ASTM A234, *Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service*

ASTM A240, *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for general Applications*

ASTM A276, *Standard Specification for Stainless Steel Bars and Shapes*

ASTM A312, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*

ASTM A320, *Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service*

ASTM A333, *Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and Other Applications with Required Notch Toughness*

ASTM A350, *Standard Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components*

ASTM A358, *Standard Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe for High-Temperature Service and General Applications*

ASTM A403, *Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings*

ASTM A420, *Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service*

ASTM A479, *Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels*

ASTM A516, *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service*

ASTM A671, *Standard Specification for Electric-Fusion-Welded Steel Pipe for Atmospheric and Lower Temperatures*

ASTM A672, *Standard Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures*

ASTM A694, *Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service*

ASTM A788, *Standard Specification for Steel Forgings, General Requirements*

ASTM A790, *Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Pipe*

ASTM A815, *Standard Specification for Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings*

ASTM A928, *Standard Specification for Ferritic/Austenitic (Duplex) Stainless Steel Pipe Electric Fusion Welded with Addition of Filler Metal*

ASTM A1082, *Standard Specification for High Strength Precipitation Hardening and Duplex Stainless Steel Bolting for Special Purpose Applications*

ASTM B265, *Standard Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate*

ASTM B363, *Standard Specification for Seamless and Welded Unalloyed Titanium and Titanium Alloy Welding Fittings*

ASTM B381, *Standard Specification for Titanium and Titanium Alloy Forgings*

ASTM B861, *Standard Specification for Titanium and Titanium Alloy Seamless Pipe*

ASTM B862, *Standard Specification for Titanium and Titanium Alloy Welded Pipe*

ASTM D1141, *Standard Practice for the Preparation of Substitute Ocean Water*

ASTM F36, *Standard Test Methods for Compressibility and Recovery of Gasket Materials*

ASTM F38, *Standard Test Methods for Creep Relaxation of a Gasket Material*
 BS 7531, *Rubber bonded fibre jointing for industrial and aerospace purposes*
 DIN 3535-6, *Gaskets for gas supply - Part 6: Gasket materials based on fibres, graphite or polytetrafluoroethylene (PTFE) for gas valves, gas appliances and gas mains*
 EN 1677 (all parts), *Components for slings*
 EN 10204, *Metallic products – Types of inspection documents*
 EN ISO 10497, *Testing of valves – Fire type-testing requirements*
 EN ISO 10684, *Fasteners – Hot dip galvanized coatings*
 EN ISO 12100, *Safety of machinery*
 EN ISO 15156 (all parts), *Petroleum and natural gas industries – Materials for use in H₂S-containing environments in oil and gas production (identical to ANSI/NACE MR0175/ISO 15156)*
 EN ISO 23936-2, *Petroleum, petrochemical and natural gas industries – Non-metallic materials in contact with media related to oil and gas production- Part 2: Elastomers*
 EN ISO 27509, *Petroleum and natural gas industries – Compact flanged connections with IX seal ring*
 ISO 3183, *Petroleum and natural gas industries – Steel pipe for pipeline transportation systems*
 MSS-SP-75, *Specification for High-Test Wrought Butt Welding Fittings*
 NORSOK L-002, *Piping system layout, design and structural analysis*
 NORSOK L-004, *Piping fabrication, installation, flushing and testing*
 NORSOK L-005, *Compact flanged connections*
 NORSOK M-001, *Materials selection*
 NORSOK M-501, *Surface preparation and protection coating*
 NORSOK M-601, *Welding and inspection of piping*
 NORSOK M-630, *Material data sheets and element data sheets for piping*
 NORSOK P-002, *Process system design*

3 Terms and definitions

3.1

can

expression in the content of a document conveying expected or conceivable material, physical or causal outcome

3.2

Company

owner or operator of the installation

3.3

manufacturer

any natural or legal person who manufactures pressure equipment or an assembly or has such equipment or assembly designed or manufactured

3.4

may

expression in the content of a document conveying consent or liberty (or opportunity) to do something

Note 1 to entry: Permissions are expressed using the verbal forms specified in ISO/IEC Directives Part 2, clause 7.4, Table 5.

3.5

purchaser

individual or organisation that buys the pipe connection on behalf of the user and/or operator or for its own use

3.6

shall

expression in the content of a document conveying objectively verifiable criteria to be fulfilled and from which no deviation is permitted if compliance with the document is to be claimed

Note 1 to entry: Requirements are expressed using the verbal forms specified in ISO/IEC Directives, Part 2, clause 7.2, Table 3.

3.7

should

expression in the content of a document conveying a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others d

Note 1 to entry: Recommendations are expressed using the verbal forms specified in ISO/IEC Directives, Part 2, clause 7.3, Table 4.

Note 2 to entry: In the negative form, a recommendation is the expression that a suggested possible choice or course of action is not preferred but it is not prohibited

4 Abbreviations

AIV	acoustic induced vibration
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BE	bevelled end
BS	British Standards
CL	class
CRA	corrosion resistant alloy
DIN	Deutsches Institute für Normung
EN	European Standard
EDS	element data sheet
FIV	flow induced vibration
FF	flat face
Galv	galvanized
ISO	International Organization for Standardisation
MDS	material data sheet
MSS	Manufacturers Standardization Society for the Valve and Fittings Industry (USA)
NACE	National Association of Corrosion Engineers
PCS	pipng class sheet
RF	raised face
RTJ	ring type joint
sch	schedule
smls	seamless
TR	tee – reducer
U03	0,3 mm undertolerance
VDS	valve data sheet
VSK	valve specification key
WN	welding neck
WOL	o'let
WT	buttweld tee
WRT	buttweld reducing tee

5 PCS – piping class sheets

5.1 General

This section includes example PCS, requirements and considerations to be made when establishing and using PCS.

5.1.1 PCS selection

PCS is owned and established by Piping. Selection and use is a multidiscipline activity.

Special attention shall be given to piping vibration from slugging, FIV and AIV when selecting or establishing PCS.

Requirements for sour service shall be considered for hydrocarbon (oil, gas, produced water and oily water) piping systems.

Connection type selection must consider maintenance requirements for disassembly. ASME RF flanges and mechanical hub type connectors are considered maintenance friendly.

Manufacturer is responsible for performing conformity assessments according to the relevant category and conformity assessment modules as to Article 14 in the Pressure Equipment Directive, and to obtain necessary conformity assessment from a PED approved notified body. The conformity assessment of NORSOK L-001, attached to Annex E should be referenced and used as a basis for project specific conformity assessments.

5.1.2 PCS numbering

When establishing new PCS, the following numbering system shall be used for the defined pressure ratings and materials below:

1st character identifies pressure rating.

A	=	Class 150
B	=	Class 300
C	=	Class 400 (not used)
D	=	Class 600
E	=	Class 900
F	=	Class 1500
G	=	Class 2500

2nd character identifies material.

C	– Carbon steels; Type 235, Type 235LT, Type 360LT
D	– Ferritic/austenitic stainless steels; Type 22Cr Duplex, Type 25Cr Duplex
R	– Austenitic stainless steels; Type 6Mo
S	– Austenitic stainless steels; Type 316
T	– Titanium
X	– High strength low alloyed steels

3rd and 4th character identifies sequential number.

5.1.3 Piping system design code

NORSOK L-001 use ASME B31.3 as design code for piping systems. The complete code is used together with allowable stresses and quality factors given in the appendices.

Lame's equation for thick cylinder, as historically listed in ASME B31.3, is accepted for use.

If 0,3 mm under tolerance is used in the PCS in lieu of 12,5 % under tolerance, the applicable material shall be supplied and marked accordingly.

5.1.3.1 Use of ASME B31.3 in NORSOK L-001 under PED

NORSOK L-001 considers ASME B31.3 to be acceptable for use under PED.

Requirements for piping fabrication, installation, flushing and testing are provided in NORSOK L-004. Requirements for welding and inspection of piping are provided in NORSOK M-601. Requirements for material data sheets and element data sheets for piping are provided in NORSOK M-630.

Weld and casting quality factors and weld joint strength reduction factors shall be established based on requirements in ASME B31.3 including the additional requirements given in this standard, in NORSOK M-601 and in NORSOK M-630.

The weld joint quality factor and the weld joint strength reduction factor per ASME B31.3 will added together constitute the weld efficiency given in the example piping classes and correspond to the joint coefficient as per 2014/68/EU (PED).

Manufacturers welding qualifications and welding operators for category II, III, and IV, and NDT personnel for category III and IV shall be qualified by a recognized third-party organisation within the European Community.

Manufacturers quality assurance system shall be certified by a body established within the European Community.

Carbon steel to NORSOK M-630 MDS C01 shall be used within the limitations of ASME B31.3, Table 323.2.2A, Curve B (without impact testing limited to a maximum wall thickness of 12,7 mm) in normalized or QT condition, and with the modifications in chemical composition as specified in MDS C01/C02. NORSOK L-001 considers under these limitations and modifications MDS C01 acceptable for use under PED down to and including -29 °C.

Flange and clamp connector bolting is considered as pressure bearing components and is thus not considered as primary pressure bearing components. Studs and bolts to MDS X08 ASTM A193 Grade B7/B7M and nuts to MDS X08 ASTM A194 Grade 2H/2HM is used in L-001 without requirement for impact toughness testing. NORSOK L-001 considers MDS X08 acceptable for use under PED in piping classes with minimum design temperature down to and including -46 °C.

Alternative flange pressure rating according to ANSI B16.5, version of 1981, may be used.

- Group 1.2 for 22Cr Duplex and 25Cr Duplex piping.
- Group 1.1 for titanium piping class 150, up to and including 50 °C. 15 barg at 100 °C.
- Group 1.1 for titanium piping class 300, up to and including 50 °C. 35 barg at 100 °C.

5.1.4 Piping system design pressure at temperature

ASME B31.3 does not use the term maximum allowable working pressure (MAWP), instead the complete piping system has a design pressure. The design pressure is nominal. Allowable pressure and temperature variations is an inherent part of the code.

5.1.4.1 Allowable variations of pressure and temperature

ASME B31.3 allows for the piping to be exposed to temperature and pressure above the design in periods as defined in ASME B31.3 § 302.2.4. The use of this paragraph is encouraged where significant cost and weight savings can be achieved, see 5.1.4.3 below.

5.1.4.2 Pressure rating tables

Pressure rating tables in the PCS shall be based on ASME B16.5/ASME B16.34 or any other dimensioning component if this component has a lower pressure rating (however see 5.1.3.1 above).

NORSOK L-001 permits the use of interpolation and extrapolation as described in ASME B16.5 in order to establish intermediate pressure ratings for use in PCS. When intermediate rating is used, due consideration should be used to avoid over-conservative design temperature as this will increase wall thickness and hydrostatic test pressure.

5.1.4.3 Design pressure considerations

A PCS is an assembly of standardized components with individual maximum allowable pressure ratings. The design code is nominal allowing for pressure and temperature variations depending on design conditions. Thus, the PCS design pressure is not necessarily given in ASME B16.5 for flange ratings and ASME B16.34 for valve ratings, but could also be stated based on an intermediate rating or calculated based on a specific pipe size and could also include allowances for pressure and temperature variations as given in ASME B31.3.

According to ASME B31.3 §322.6.3, PSV set pressure may be set up to 120 % of the PCS design pressure if applicable considerations is met and relieving pressure is limited to 133 % of the PCS design pressure.

5.1.4.4 PCS temperature limitations

Upper operational temperature limitations when exposed to marine chloride containing environments are provided in NORSOK M-001.

The temperature limitations in the PCS shall reflect the actual temperature range for the piping system to avoid over-dimensioned design.

Special considerations shall be given to PCS for seawater piping systems to avoid designing for unrealistic maximum and minimum temperatures.

Maximum temperature limitations for metallic materials is given in the appendices of ASME B31.3.

Minimum temperature limitations for materials is given in ASME B31.3 and ASME B31T, ASME B31.3 allows for the use of piping below the impact test temperature under certain conditions.

If the stress ratio does not exceed 0,3, i.e. blow down or pressure relieving events, the allowable minimum material temperature is extended as described in ASME B31.3 and ASME B31T, without additional impact test requirements. This principle shall be evaluated and incorporated in piping system design.

Flange stress should also be considered when piping is used below the impact test temperature.

5.1.5 Unlisted components to ASME B31.3

NORSOK L-001 allows for comprehensive pressure design calculations or verifications of listed and unlisted components as described in ASME B31.3, in order to extend or establish pressure-temperature ratings.

5.1.5.1 API Spec 6D valves

API Spec 6D valves are accepted for pressure design without additional requirements.

5.1.5.2 Flanges and blanks

Calculation of flanges according to requirement in ASME B31.3 may be performed for sizes, pressures and temperatures outside the scope range of listed standards. If possible, geometry from existing range in the listed component standards should be used as basis for the comprehensive calculations used for pressure design of unlisted flanges and blanks.

Compact flanges according to EN ISO 27509 and NORSOK L-005 are accepted for pressure design without additional requirements beyond the requirements provided in NORSOK L-001 and NORSOK M-630.

Threaded/reducing flange shall be in accordance with ASME B16.5, Table 6, Reducing Threaded Flanges, and shall only be used complete with safety bleed plug.

5.1.6 Mechanical strength in piping sizes below 2"

Reference is made to NORSOK P-002. Sufficient mechanical strength, i.e. step on strength, shall be included in all PCS for sizes ½", ¾", 1" and 1 ½" to ensure sufficient mechanical strength. Minimum schedule 40/40S should be used.

5.1.7 Threaded fittings

Threaded fittings is not part of NORSOK L-001. Reference is made to NORSOK L-002.

5.1.8 Bolt material selection

Topside flange bolting and pressurized bolting for valve should be selected in accordance with plant design lifetime and life cycle cost considerations.

Bolt material recommendations are included in material master classes in Appendix B. Bolt materials included in NORSOK M-630 may be used.

Galvanized carbon steel bolts are predictable and a low cost alternative, but have limited life expectancy when exposed to marine atmosphere.

CRA bolting should be considered in cases where lines are:

- cold and condensing;
- insulated;
- located below cellar deck.

If washers are used, they should be in equal material as bolting.

All bolt material selection, with or without coating, shall be approved by the Company material and piping engineer.

5.1.9 Gaskets

Gaskets for hydrocarbon systems shall be manufactured in fire resistant materials like graphite and -or metal. Fibre and Teflon gaskets can be used for utility systems

5.1.10 The use of PCS

Line sizing, piping class selection and valve selection is a multidiscipline activity.

The velocity and pressure loss limitations of NORSOK P-002 may be challenged in a holistic way, balancing piping line size with, but not limited to; actual mechanical strength in PCS, pressure loss in components and valves, output pressures from pumps and compressors in order to achieve cost effective solutions.

5.1.10.1 PCS for flare systems

Additional wall thickness should be evaluated to accommodate need for mechanical resistance to vibration in flare systems. In such cases the minimum thickness shall be schedule 40S. However, a maximum pipe wall thickness of 14,27 mm is considered to be sufficient. Example PCS AR41 is established with minimum thickness requirements. Design requirements for AIV is given in NORSOK L-002.

5.1.10.2 PCS for topside risers piping systems

According to PED, topside riser piping systems are outside of the PED scope. However, individual standard pressure equipment (e.g. valves) may be subject to PED requirements and require CE marking.

A specific topside riser piping class for the applicable NPS should be developed and should when relevant contain long radius bend, barred tee and valves suitable for pigging. Branching should not be part of the topside riser pipe class sheet; instead a reference to the applicable topside piping class sheet should be made. Inside diameter shall be within the range of the pigging solution, if applicable.

Piping class specification break towards the pipeline/riser side for topside riser piping class may be at the mechanical connector at hang-off, or between the hang-off and the riser side of the first topside valve, for flexible risers. For steel catenary risers the pipe specification break may be between the hang off and the

riser side of the first topside valve. The pipe specification break may be at a mechanical connector, a flange, a pup-piece or a weld.

If valves with both ends welded is used in at topside riser piping class, top entry valves should be considered for maintenance purposes.

Where relevant, possibilities for multi or dual bore pigging should be evaluated. The intention is to avoid having the riser and the topside riser piping system the same size as the pipeline if it is unnecessary from a pigging perspective. Added pressure loss must be evaluated and compensated if necessary.

5.2 Example PCS

Example PCS are enclosed in Annex A. The PCS's included are typical PCS's reflecting typical content of a PCS.

5.3 Material master classes

Material master classes are enclosed in Annex B.

6 EDS – element data sheet

These sheets cover additional requirements for design and procurement not listed in the PCS. Some of the EDS listed in previous NORSOK L-001 revision 3, have been removed from this standard as they are included in NORSOK M-630.

The characters in the EDS number (e.g. NIP2) have the following meaning:

1st character identifies N for NORSOK standard.

2nd and 3rd character identifies type of standard sheet:

AF	=	ASME flanges
BE	=	bending
BO	=	bolting
BR	=	branches
GA	=	gaskets
HF	=	hardfacing
IP	=	internal parts
LB	=	line blinds
MJ	=	mechanical joints
OL	=	o'let
SM	=	seal materials
SR	=	seal ring
TR	=	trim materials

4th character identifies sequential number.

5th character when used, is reserved for special application.

EDS's are enclosed in Annex C and in NORSOK M-630.

7 VDS – valve data sheet

7.1 General

When establishing new PCS, the following numbering system shall be used for the defined valve types and end connections below:

1st and 2nd character identify valve type:

BL	=	ball valve
BU	=	butterfly valve
CB	=	combination valve (several valves combined in one piece)
CH	=	check valve
DM	=	diaphragm valve
GB	=	globe valve
GT	=	gate valve
NE	=	needle valve
PG	=	plug valve
SV	=	special valve

3rd character identifies pressure rating, ref. 5.2.

4th character identifies material as defined in 5.2.

5th character identifies sequential number.

6th character sequential number. (One letter to be used in place of this number when deviating from NORSOK standard).

7th character identifies end connection:

B	=	butt welding end or pup piece with butt welding end
C	=	clamp type end connection
F	=	flat face flange
J	=	RTJ end connection
K	=	compact flange end
R	=	raised face flange
T	=	female threaded end

Current revision does not contain VDS. VDS from NORSOK L-001 revision 3 can be used, (<http://www.standard.no/norsokL001rev3>).

Intermediate valve rating requiring a new VDS should be limited to pressure/temperature ratings above ASME class 900 and as defined in ASME B 16.34, except that it shall not be limited to welding end valves.

7.2 Design code

The valve design code should be limited to ASME B16.34, API Spec 6D or the listed API design codes for valves in ASME B31.3. API equivalent ISO design codes for valves are acceptable.

7.3 Pressure rating

ASME B16.34 shall be used for pressure rating. Intermediate rating is permitted, see 5.1.3.1.

7.4 Temperature

Temperature limitations shall be given on the VDS, design temperature according to PCS and operations temperature according to process requirements.

7.5 Materials

Pressure retaining materials shall comply to NORSOK M-630.

7.6 Body and bonnet

Material for body and bonnet shall be proposed by the piping/valve engineer in cooperation with the material engineer and is subject to Company approval. Material from bar may be used up to NPS 4. Valve material may be of other type than the piping specification. Focus shall be on cost effective solutions with minimum of additional requirements.

7.7 Valve internals

Valve internals shall be selected with focus on functionality.

7.8 Surface treatment

Requirements for surface treatment are given in NORSOK M-501.

7.9 End connections

End connections shall be according to PCS.

7.10 End to end dimension

Valves with ASME flanges should be according to ASME B16.10 long pattern.

Valves with other connectors should be according to ASME B16.10 long pattern RF.

7.11 Fire safe design

Fire safe design according to API Spec 6FA, EN-ISO 10497 or equivalent shall be included where relevant.

7.12 Testing

Pressure testing and seat leakage testing to be performed according to requirements given in the valve design code. A functional acceptance test – FAT should typically be performed on a 10 % spot check level.

Any optional and additional test requirements should only be included if necessary and relevant.

7.13 Double block and bleed – DBB

The definition given in API Spec 6D shall be used.

7.14 Double isolation and bleed – DIB

The definition given in API Spec 6D shall be used.

8 VSK – valve specification key

VSK, if established, should cover additional requirements for design, purchase, testing and marking of valves. Current revision does not contain VSK. VSK from NORSOK L-001 revision 3 can be used (<http://www.standard.no/norsokL001rev3>, choose VSK).

Annex A (Informative)

Example piping class sheets

A.1 AC40

PIPING CLASS SHEET AC40										CLASS 150									
DESIGN CODE: ASME B31.3										Corr. allow: 3,0 mm									
Maximum design pressure:		Barg	19,6	19,6	19,2	17,7	15,8	13,8	12,1	10,2	8,4								
At temperature:		°C	-29	38	50	100	150	200	250	300	350								
PIPE SIZE AND WALL THICKNESS																			
Nom.size (in)	0,5	0,75	1	1,5	2	3	4	6	8	10	12	14	16	18	20	24	30	36	
Dia. (mm)	21,3	26,7	33,4	48,3	60,3	88,9	114,3	168,3	219,1	273,1	323,9	355,6	406,4	457,2	508,0	609,6	762,0	914,0	
Wall th. (mm)	4,78	5,56	6,35	5,08	5,54	5,49	6,02	7,11	6,35	6,35	6,35	7,92	7,92	7,92	9,53	9,53	12,70	12,70	
Schedule	160		80		40		20												
WALL THICKNESS UNDER TOLERANCES: -12,5 % a)																			
LONGITUDINAL WELD EFFICIENCY: 1,0 a)																			
ELEMENT NAME	DIMENSION STANDARDS							NOM. SIZE FROM TO incl. incl.		TYPE			MATERIAL NAME		MDS	EDS			
PIPE	ASME B36.10M							0,5 30	36 36	Seamless, Welded			A106 Gr.B API Spec 5L PSL1 SAWL		C01				
BENDING	Made from pipe															NBE2			
FITTINGS	ASME B16.9							0,5	36				A234 WPB		C01				
BRANCHES	O'let ASME B16.9							As fittings					A105 A234 WPB		C01 C01	NOL1 NBR3			
REINFORCED NIPOFLANGE	Drilled to ASME B16.5							1	2	CL150 RF WN			A105		C01	NOL1			
FLANGES	ASME B16.5 ASME B16.47 Series A							0,5 30	24 36	CL150 RF WN CL150 RF WN			A105 A105		C01 C01	NAF1 NAF1			
FLG. BLIND	ASME B16.5 ASME B16.47 Series A ASME B16.5 ASME B16.47 Series A							0,5 30 0,5 30	24 36 24 36	CL150 RF CL150 RF CL150 RF CL150 RF			A105 A105 A516 Gr.70 A516 Gr.70		C01 C01 C01 C01				
ORIF. FLANGES	ASME B16.36							1	24	CL300 RF WN			A105		C01	NAF1			
RED. THR'D FLANGE	ASME B16.5							0,75	2	CL150 RF NPT (F)			A105		C01	NAF1			
LINE BLINDS	Spect bl. Spade/spacer Spect bl. Spade/spacer							0,5 14 0,5 14	12 36 12 36	CL150 FF CL150 FF CL150 FF CL150 FF			A105 A105 A516 Gr.70 A516 Gr.70		C01 C01 C01 C01	NLB1 NLB1 NLB1 NLB1			
BOLTING	ASME B16.5/16.47 Series A									Stud bolts galv. Hex. nuts galv.			A320 L7 A194 7		X07 X07	NBO1 NBO1			
GASKET	ASME B16.20									Spiral wound CI150						NGA5			
PLUGS	ASME B16.11							0,5	1	Hex. head			A105		C01				
SAFETY BLEED PLUG								0,5	0,75	NPT male			SS316						
a) The specified under-tolerance and weld factor in this table summarizes only the minimum requirements for the piping items used in this piping class. As stricter requirement may apply for an individual piping item, this information shall be used for design only and not as part of the purchase specification.																			

A.2 AC45

PIPING CLASS SHEET AC45									CLASS 150														
DESIGN CODE: ASME B31.3									Corr. allow: 3,0 mm														
Maximum design pressure:				Barg	19,6	19,6	19,2	17,7	15,8	13,8													
At temperature:				°C	-46	38	50	100	150	200													
PIPE SIZE AND WALL THICKNESS																							
Nom.size (in)	0,5	0,75	1	1,5	2	3	4	6	8	10	12	14	16	18	20	24	30	36					
Dia. (mm)	21,3	26,7	33,4	48,3	60,3	88,9	114,3	168,3	219,1	273,1	323,9	355,6	406,4	457,2	508,0	609,6	762,0	914,0					
Wall th. (mm)	4,78	5,56	6,35	5,08	5,54	5,49	6,02	7,11	6,35	6,35	6,35	7,92	7,92	7,92	9,53	9,53	12,70	12,70					
Schedule	160			80		40			20														
WALL THICKNESS UNDER TOLERANCES: -12,5 % a)																							
LONGITUDINAL WELD EFFICIENCY: 1,0 a)																							
ELEMENT NAME	DIMENSION STANDARDS							NOM. SIZE FROM TO incl. incl.		TYPE				MATERIAL NAME			MDS	EDS					
PIPE	ASME B36.10M							0,5 8	24 36	Smls, Welded				A333 Gr6 A671 CC60/70			C11 C11						
BENDING	Made from pipe							0,5	36									NBE2					
FITTINGS	ASME B16.9							0,5 2	1,5 36					A420 WPL6			C11						
BRANCHES	O'let ASME B16.9							As fittings						A350 LF2 A420 WPL6			C11 C11	NOL1 NBR3					
REINFORCED NIPOFLANGE	Drilled to ASME B16.5							0,5	2	CL150 RF WN				A350 LF2			C11	NOL1					
FLANGES	ASME B16.5 ASME B16.47 Series A							0,5 30	24 36	CL150 RF WN CL150 RF WN				A350 LF2 A350 LF2			C11 C11	NAF1					
FLG. BLIND	ASME B16.5 ASME B16.47 Series A ASME B16.5 ASME B16.47 Series A							0,5 30 0,5 2 30	1,5 36 1,5 2 30	CL150 RF WN CL150 RF WN CL150 RF CL150 RF CL150 RF				A350 LF2 A350 LF2 A516 Gr.70 A516 Gr.70 A516 Gr.70			C11 C11 C11 C11 C11						
ORIF. FLANGES	ASME B16.36							1	24	CL300 RF WN				A350 LF2			C11	NAF1					
RED. THR'D FLANGE	ASME B16.5							0,75 2	1,5 2	CL150 RF NPT female CL150 RF NPT female				A350 LF2 A694 F52			C11 C21	NAF1					
LINE BLINDS	Spect bl. Spade/spacer Spect bl. Spade/spacer							0,5 14 0,5 14	12 36 12 36	CL150 FF CL150 FF CL150 FF CL150 FF				A350 LF2 A350 LF2 A516 Gr.70 A516 Gr.70			C11 C11 C11 C11	NLB1					
BOLTING	ASME B16.5/16.47 Series A							0,5 0,5	36 36	Stud bolts galv. Hex. nuts galv.				A320 L7 A194 7			X07 X07	NBO1 NBO1					
GASKET	ASME B16.20							0,5	36	Spiral wound CL 150								NGA5					
PLUGS	ASME B16.11							0,5	1	Hex. head				A350 LF2			C11						
BLEED PLUG								0,5	0,75	NPT male				SS316									
a) The specified under-tolerance and weld factor in this table summarizes only the minimum requirements for the piping items used in this piping class. As stricter requirement may apply for an individual piping item, this information shall be used for design only and not as part of the purchase specification.																							

A.3 AD40

PIPING CLASS SHEET AD40										CLASS 150																	
DESIGN CODE: ASME B31.3										Corr. allow.: 0,0 mm																	
Maximum design pressure:				Barg	20,0	20,0	19,5	17,7	15,8	13,8	12,1																
At temperature:				°C	-46	38	50	100	150	200	250																
PIPE SIZE AND WALL THICKNESS																											
Nom. size (in)	0,5	0,75	1	1,5	2	3	4	6	8	10	12	14	16	18	20	24	28	30	36								
Dia. (mm)	21,3	26,7	33,4	48,3	60,3	88,9	114,3	168,3	219,1	273,1	323,9	355,6	406,4	457,2	508	610	711	762	914								
Wall th. (mm)	2,77	2,87	3,38	3,68	2,77	3,05	3,05	3,4	3,76	4,19	4,57	4,78	4,78	4,78	5,54	6,35	7,92	7,92	7,92								
Schedule	40S				10S												10	10S	10								
WALL THICKNESS UNDER TOLERANCES: -12,5% a)																											
LONGITUDINAL WELD EFFICIENCY: 0,8 a)																											
ELEMENT NAME		DIMENSION STANDARDS						NOM. SIZE FROM TO incl. incl.		TYPE		MATERIAL NAME				MDS		EDS									
PIPE		ASME B36.10/19 ASME B36.10/19						0,5 1		8 36		SmIs Welded		A790 S31803 A928 S31803 Cl.5				D41 D42									
BENDING		Made from pipe						0,5 36										NBE2									
FITTING		ASME B16.9						0,5 36				A815 S31803 S/W				D43											
BRANCHES		O'let ASME B16.9						0,5 0,5		36 36				A182 F51 A815 S31803 S/W				D44 D43		NOL1 NBR3							
ORIF. FLANGE		ASME B16.36						1 24		CL300 RF WN		A182 F51				D44											
FLANGES		ASME B16.5 ASME B16.47 Series A						0,5 30		24 36		CL150 RF WN CL150 RF WN		A182 F51 A182 F51				D44 D44		NAF1							
FLG. BLIND		ASME B16.5 ASME B16.5 ASME B16.47 Series A ASME B16.47 Series A						0,5 0,5 30 30		24 24 36 36		CL150 RF CL150 RF CL150 RF CL150 RF		A182 F51 A240 S31803 A182 F51 A240 S31803				D44 D45 D44 D45									
RED. THR'D FLANGE		ASME B16.5						0,75 2		CL150 NPT female		A182 F51				D44											
LINE BLINDS		Spect bl. Spect bl. Spade/spacer Spade/spacer						0,5 0,5 18 18		16 16 36 36		CL150 RF CL150 RF CL150 RF CL150 RF		A182 F51 A240 S31803 A182 F51 A240 S31803				D44 D45 D44 D45		NLB1							
BOLTING		ASME B16.5/B16.47 Series A						0,5 0,5		36 36		Stud bolts galv. Hex. nuts galv.		A193 B7 A194 2H				X08 X08		NBO1 NBO1							
GASKET		ASME B16.20						0,5 36		Spiral wound CL 150								NGA5									
PLUGS		ASME B16.11						0,5 1		Hex. head		A182 F51				D44											
BLEED PLUG								0,5 0,75		0,5 1		10 000 PSI Bushing – hex		A182 F44 A182 F51				R14 D44									
a) The specified under-tolerance and weld factor in this table summarizes only the minimum requirements for the piping items used in this piping class. As stricter requirement may apply for an individual piping item, this information shall be used for design only and not as part of the purchase specification.																											

A.4 AD45

PIPING CLASS SHEET AD45										CLASS 150																									
DESIGN CODE: ASME B31.3										Corr. allow: 0,0 mm																									
Maximum design pressure:				Barg	20,0	20,0	19,5	17,7	16,6																										
At temperature:				°C	-46	38	50	100	130																										
PIPE SIZE AND WALL THICKNESS																																			
Nom.size (in)	0,5	0,75	1	1,5	2	3	4	6	8	10	12	14	16	18	20	24	30	36																	
Dia. (mm)	21,3	26,7	33,4	48,3	60,3	88,9	114,3	168,3	219,1	273,1	323,9	355,6	406,4	457,2	508,0	609,6	762,0	914,0																	
Wall th. (mm)	2,77	2,87	3,38	3,68	2,77	3,05	3,05	3,40	3,76	4,19	4,57	4,78	4,78	4,78	5,54	6,35	7,92	7,92																	
Schedule	40S				10S																				10										
WALL THICKNESS UNDER TOLERANCES: -12,5 % a)																																			
LONGITUDINAL WELD EFFICIENCY: 0,8 a)																																			
ELEMENT NAME		DIMENSION STANDARDS						NOM. SIZE FROM TO incl. incl.		TYPE		MATERIAL NAME						MDS	EDS																
PIPE		ASME B36.19M ASME B36.19M/.10M						0,5 6	8 36	Seamless Welded		A790 S32750/760 A928 S32750/760 Cl.5						D51 D52																	
BENDING		Made from pipe						0,5	36										NBE2																
FITTINGS		ASME B16.9						0,5	36			A815 S32750/760 Cl. S/W						D53																	
BRANCHES		O'lets, lightweight ASME B16.9						0,5 0,5	36 36			A182 F53/F55 A815 S32750/760 Cl. S/W						D54 D53	NOL1																
PIPE NIPPLE		ASTM A733						0,5	1,5	Sch 160 BOE/TOE Bev to match sch 40S		A790 S32750/760						D51																	
REINFORCED NIPOFLANGE		Drilled to ASME B16.5						1	2	CL150 RF WN		A182 F53/F55						D54	NOL1																
FLANGES		ASME B16.5 ASME B16.47 Series A						0,5 30	24 36	CL150 RF WN CL150 RF WN		A182 F53/F55 A182 F53/F55						D54 D54	NAF1																
FLG. BLIND		ASME B16.5 ASME B16.47 Series A						0,5 30	24 36	CL150 RF CL150 RF		A182 F53/F55 A182 F53/F55						D54 D54																	
ORIF. FLANGES		ASME B16.36						1	24	CL300 RF WN		A182 F53/F55						D54	NAF1																
RED. THR'D FLANGE		ASME B16.5						0,75	2	CL150 RF NPT female		A182 F53/F55						D54																	
LINE BLINDS		Spect bl. Spect bl. Spade/spacer Spade/spacer						0,5 0,5 14 14	12 12 36 36	CL150 FF CL150 FF CL150 FF CL150 FF		A240 S32750/760 A182 F53/F55 A240 S32750/760 A182 F53/F55						D55 D54 D55 D54	NLB1																
BOLTING		ASME B16.5/B16.47 Series A						0,5 0,5	36 36	Stud bolts galv. Hex. nuts galv.		A320 L7 A194 7						X07 X07	NBO1 NBO1																
GASKET		ASME B16.20						0,5	36	Spiral wound CL 150									NGA5																
PLUGS		ASME B16.11						0,5	1	Hex. head		A182 F53/F55						D54																	
BLEED PLUG								0,5	0,75	NPT male		B446 N06625 Annealed																							
a) The specified under-tolerance and weld factor in this table summarizes only the minimum requirements for the piping items used in this piping class. As stricter requirement may apply for an individual piping item, this information shall be used for design only and not as part of the purchase specification.																																			

A.5 AR40

PIPING CLASS SHEET AR40										CLASS 150															
DESIGN CODE: ASME B31.3										Corr. allow: 0,0 mm															
Maximum design pressure:				Barg	20,0	20,0	19,5	17,7	15,8	13,8	12,1	10,2													
At temperature:				°C	-101	38	50	100	150	200	250	300													
PIPE SIZE AND WALL THICKNESS																									
Nom.size (in)	0,5	0,75	1	1,5	2	3	4	6	8	10	12	14	16	18	20	24	30	36							
Dia. (mm)	21,3	26,7	33,4	48,3	60,3	88,9	114,3	168,3	219,1	273,1	323,9	355,6	406,4	457,2	508,0	609,6	762,0	914,0							
Wall th. (mm)	2,77	2,87	3,38	3,68	2,77	3,05	3,05	3,40	3,76	4,19	4,57	4,78	4,78	4,78	5,54	6,35	7,92	7,92							
Schedule	40S				10S														10						
WALL THICKNESS UNDER TOLERANCES: -12,5 % a)																									
LONGITUDINAL WELD EFFICIENCY: 0,8 a)																									
ELEMENT NAME		DIMENSION STANDARDS						NOM. SIZE FROM TO incl. incl.		TYPE		MATERIAL NAME			MDS	EDS									
PIPE		ASME B36.19M ASME B36.19M ASME B36.10M						0,5 1 36	8 30 36	Seamless Welded Welded		A312 S31254 A358 S31254 CL 1/3 A358 S31254 CL 1/3			R11 R12 R12										
BENDING		Made from pipe						0,5	36							NBE1									
FITTINGS		ASME B16.9						0,5	36			A403 S31254 CL S/W			R13										
BRANCHES		O'let, lightweight ASME B16.9						0,5 0,5	36 36			A182 F44 A403 S31254 CL S/W			R14 R13	NOL1									
PIPE NIPPLE		ASTM A733						0,5	1,5	Sch 160 BOE/TOE Bev to match sch 40S		A312 S31254			R11										
REINFORCED NIPOFLANGE		Drilled to ASME B16.5								CL150 RF WN		A182 F44			R14	NOL1									
FLANGES		ASME B16.5 ASME B16.47 Series A						0,5 30	24 36	CL150 RF WN CL150 RF WN		A182 F44 A182 F44			R14 R14	NAF1									
FLG. BLIND		ASME B16.5 ASME B16.47 Series A						0,5 0,5 30 30	24 24 36 36	CL150 RF CL150 RF CL150 RF CL150 RF		A182 F44 A240 S31254 A182 F44 A240 S31254			R14 R15 R14 R15										
ORIF. FLANGES		ASME B16.36						1	24	CL300 RF WN		A182 F44			R14	NAF1									
RED. THR'D FLANGE		ASME B16.5						0,75	2	CL150 RF NPT female		A182 F44			R14	NAF1									
LINE BLINDS		Spect bl. Spade/spacer						0,5 14	12 36	CL150 FF CL150 FF CL150 FF CL150 FF		A182 F44 A240 S31254 A182 F44 A240 S31254			R14 R15 R14 R15	NLB1									
BOLTING		ASME B16.5/B16.47 Series A						0,5 0,5	36 36	Stud. bolts galv. Hex. nuts galv.		A320 L7 A194 7			X07 X07	NBO1 NBO1									
GASKET		ASME B16.20						0,5	36	Spiral wound CL 150						NGA5									
PLUGS		ASME B16.11						0,5	1	Hex. head		A182 F44													
BLEED PLUG								0,5	0,75	NPT male		B446 N06625 Annealed													
a) The specified under-tolerance and weld factor in this table summarizes only the minimum requirements for the piping items used in this piping class. As stricter requirement may apply for an individual piping item, this information shall be used for design only and not as part of the purchase specification.																									

A.6 AR41

PIPING CLASS SHEET AR41										CLASS 150																					
DESIGN CODE: ASME B31.3										Corr. allow: 0,0 mm																					
Maximum design pressure:		Barg		20,0	20,0	19,5	17,7	15,8	13,8	12,1	10,2																				
At temperature:		°C		-101	38	50	100	150	200	250	300																				
PIPE SIZE AND WALL THICKNESS																															
Nom.size (in)	0,5	0,75	1	1,5	2	3	4	6	8	10	12	14	16	18	20	24	28	30	36												
Dia. (mm)	21,3	26,7	33,4	48,3	60,3	88,9	114,3	168,3	219,1	273,1	323,9	355,6	406,4	457,2	508	610	711	762	914												
Wall th. (mm)	2,77	2,87	3,38	3,68	3,91	5,49	6,02	7,11	8,18	9,27	9,53	9,53	9,53	9,53	9,53	9,53	9,53	9,53	9,53												
Schedule	40S																	STD	STD	STD											
WALL THICKNESS UNDER TOLERANCES: -12,5 % a)																															
LONGITUDINAL WELD EFFICIENCY: 0,8 a)																															
ELEMENT NAME		DIMENSION STANDARDS						NOM. SIZE FROM TO incl. incl.		TYPE				MATERIAL NAME				MDS		EDS											
PIPE		ASME B36.10/19 ASME B36.10/19						0,5 1	8 36	Smls Welded				A312 S31254 A358 S31254 Cl.5				R11 R12													
BENDING		Made from pipe																	NBE1												
FITTINGS		ASME B16.9						0,5	36					A403 S31254 S/W				R13													
BRANCHES		O'let Saddle type o'let b) ASME B16.9						0,5	36					A182 F44 A182 F44 A403 S31254 S/W				R14 R14 R13	NOL1 NBR5												
ORIF. FLANGES		ASME B16.36						1	24	CL300 RF WN				A182 F44				R14													
FLANGES		ASME B16.5 ASME B16.47 Series A						0,5 30	24 36	CL150 RF WN CL150 RF WN				A182 F44 A182 F44				R14 R14	NAF1												
FLG. BLIND		ASME B16.5 ASME B16.5 ASME B16.47 Series A ASME B16.47 Series A						0,5 0,5 30 30	24 24 36 36	CL150 RF CL150 RF CL150 RF CL150 RF				A182 F44 A240 S31254 A182 F44 A240 S31254				R14 R15 R14 R15													
RED. THR'D FLANGE		ASME B16.5						0,75	2	CL150 NPT female				A182 F44				R14													
LINE BLINDS		Spect bl Spect bl. Spade/spacer Spade/spacer						0,5 0,5 18 18	16 16 36 36	CL150 RF CL150 RF CL150 RF CL150 RF				A182 F44 A240 S31254 A182 F44 A240 S31254				R14 R15 R14 R15	NLB1												
BOLTING		ASME B16.5 / B16.47 Series A						0,5 0,5	36 36	Stud bolts galv. Hex. nuts galv.				A320 L7 A194 7				X07 X07	NBO1 NBO1												
GASKET		ASME B16.20						0,5	36	Spiral wound CL 150									NGA5												
PLUGS		ASME B16.11						0,5	1	Hex. head				A182 F44				R14													
BLEED PLUG								0,5 0,75	0,5 1	10 000 PSI Bushing – Hex				A182 F44 A182 F44				R14 R14													
a) The specified under-tolerance and weld factor in this table summarizes only the minimum requirements for the piping items used in this piping class. As stricter requirement may apply for an individual piping item, this information shall be used for design only and not as part of the purchase specification.																															
b) Standard type o'lets can be used if saddle type o'lets are not required for preventing acoustic fatigue.																															