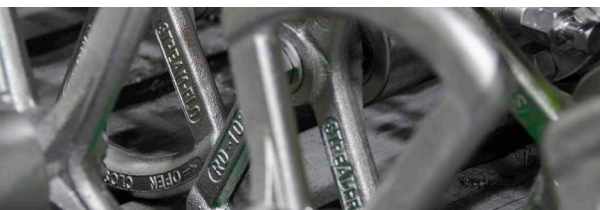
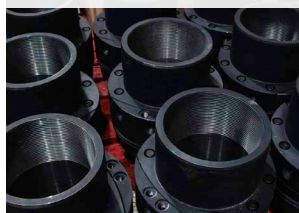


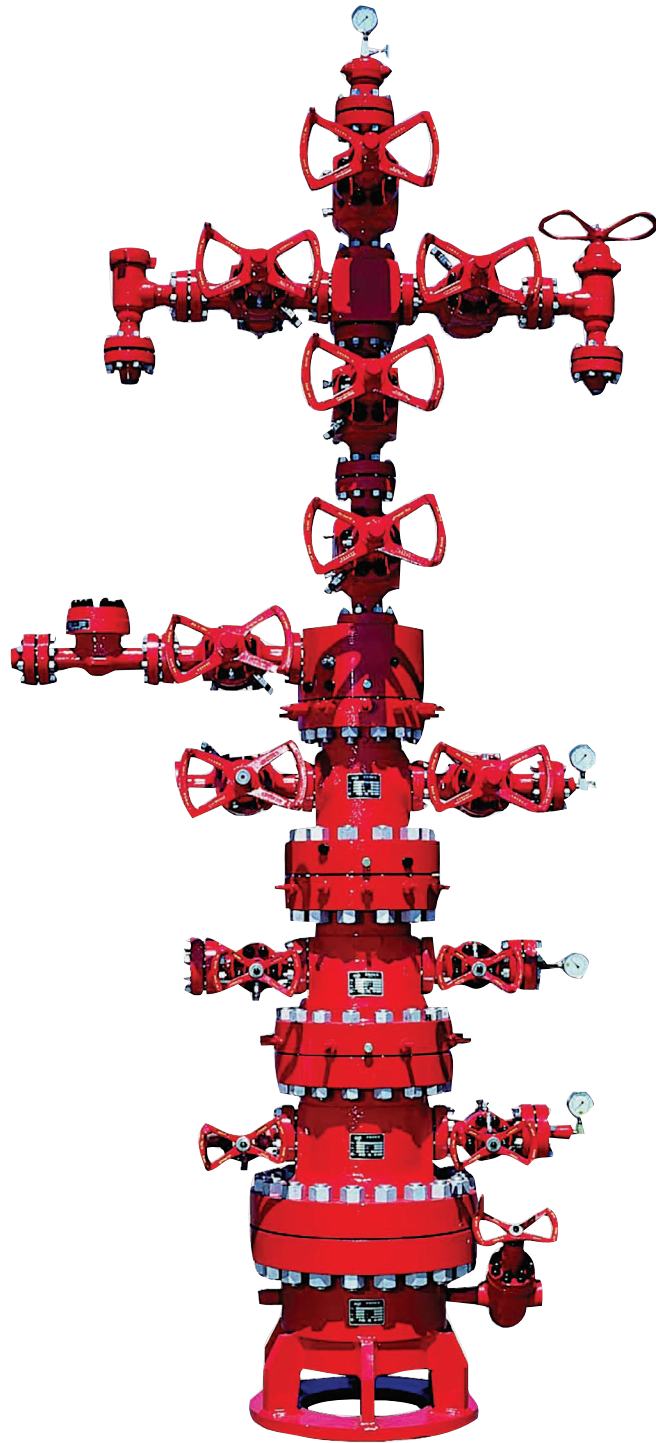


Purchasing Guide for Wellhead & Tree Equipment



WORLDWIDE EXPERTISE | GLOBAL STRENGTH

With Reference to API 6A, 21st Edition



When coupled with Stream-Flo processes, provisions, and customer applications, this booklet provides insight into API requirements for equipment and quality management systems. It also provides a fundamental approach to purchasing equipment for the petroleum, petrochemical, and natural gas industries.

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API Specification 6A

API Specification 6A is the recognized industry standard for wellhead and tree equipment. It was formulated to provide safe, dimensionally and functionally interchangeable wellhead and tree equipment. The specification includes detailed requirements for manufacturing tubular suspension equipment, valves, and fittings used at oil and gas well locations to contain and control pressure and fluid flow.

Specification 6A also serves as the reference source for the design of flanged end and outlet connections for use at 2,000 to 20,000 psi maximum rated working pressures and a family of gate valves for use over these same pressure ranges.

This booklet covers the 21st Edition with references to the 20th Edition.

Abbreviated Terms

AQL	Acceptable Quality Level	PR	Performance Requirement
CRA	Corrosion Resistant Alloy	PSL	Product Specification Level
DAC	Distance Amplitude Curve	QTC	Qualification Test Coupon
ER	Equivalent Round	RMS	Root Mean Square
FEA	Finite Element Analysis	R _p	Yield Strength
HAZ	Heat Affected Zone	R _m	Ultimate Tensile Strength
HBW	Brinell Hardness	ROE	Radius of Exposure
HIP	Hot Isostatic Pressing	SSV	Surface Safety Valve
HRB	Rockwell Hardness Scale B	TPI	Threads Per Inch
HRC	Rockwell Hardness Scale C	UNS	Unified Numbering System
NDE	Nondestructive Examination	USV	Underwater Safety Valve
NPT	National Pipe Thread	WPQ	Welder Performance Qualification
OEC	Other End Connection	WPS	Welding Procedure Specification
OEM	Original Equipment Manufacturer	PPM	Parts Per Million
PQR	Procedure Qualification Record		



API 6A Applicable Equipment

Wellhead Equipment

- Casing head housing and spools
- Tubing head spools
- Cross-over spools
- Multi-stage head housing and spools

Connectors & Fittings

- Cross-over connectors
- Tubing head adaptors
- Top connectors
- Tees and crosses
- Adaptor and spacer spools
- Bullplugs

Casing & Tubing Hangers

- Mandrel hangers
- Slip hangers

Other Equipment

- Actuators
- Ring gaskets

- Valves removal plugs

Valves & Chokes

- Single valves
- Multiple valves
- Actuated valves
- Valves prepared for actuators
- Check valves
- Chokes
- Surface and underwater safety valves and actuators
- Back-pressure valves

Loose Connectors

- Weld neck connections
- Blind connectors
- Threaded connectors

Note:

API 6A defines service conditions in terms of pressure, temperature and material class for the well-bore constituents and operating conditions.



Significant Differences Between API 20th and 21st Editions

API 6A, 21st Edition is no longer associated with ISO 10423. Therefore, if you meet one standard you can no longer meet the other as well. Stream-Flo product shall meet API 6A, 21st Edition and can not equally meet ISO 10423.

Minimum Production Specification Level (PSL) is now required based on material class and pressure rating. Previous API editions did not specify a minimum PSL but was driven by client specific requirements.

Casting Specification Level (CSL) is now required and will be determined by PSL. CSL is outlined by API 20A and Stream-Flo castings shall meet these outlined requirements based off PSL. Previously, API 6A 20th Edition did not outline any requirements regarding CSL.

The naming convention for bolting is now identified as “closure bolting” and no longer “studs and nuts,” as stated in API 6A 20th Edition. With this addition, Bolting Specification Level (BSL) shall now qualify closure bolting, and be manufactured in accordance with API 20E and API 20F. BSL will be determined based on PSL.

Equipment that has been tested and qualified under API 6A Annex F can now have a PR2F designation applied. Previously, if product was Annex F tested, there was no separate marking requirement.

API 6A, 20th Edition, states, “Where no H2S limit is defined by ISO 15156 (all parts) (NACE MR0175) for the partial pressure, “NL” shall be used for marking (i.e. “DD-NL”).” Stream-Flo would designate or mark parts with no H2S limit by placing the “-NL” after the material class identification. API 6A 21st Edition, states that “Where no H2S limit is defined by NACE MR0175/ISO 15156 for the partial pressure, no partial pressure shall be marked”. Therefore Stream-Flo will no longer designate or mark the “-NL” on parts with no H2S limit.

API 6A, 20th Edition, states that, “Material requirements for pressure-boundary penetrations shall be as specified by the manufacturer. Pressure boundary penetrations directly exposed to well-bore fluid and used in sour service (material classes DD, EE, FF, and HH) shall meet the requirements of ISO 15156 (all parts) (NACE MR0175; see Clause 2)”. API 6A, 21st

Edition, states, “Material requirements for pressure boundary penetrations shall be as specified by the manufacturer and shall be compatible with the body material. Pressure boundary penetrations used in material classes DD, EE, FF, and HH equipment shall meet the requirements of NACE MR0175/ISO 15156”.

Additional material controls have been added in the 21st Edition for PSL 3 bodies. For PSL 3 bodies that require a yield strength of 75 ksi or greater and where the part’s weight during heat-treat is greater than 454 kg (1000 lb), the QTC (Quality Test Coupon) ER (Equivalent Round) shall be the same or greater than the part it qualifies but is not required to exceed 250 mm (10 in.).

Annex H from API 6A 20th Edition, “Design and manufacture of surface wellhead running, retrieving and testing tools, clean-out tools and wear bushings” has been removed from API 6A 21st Edition. Therefore going forward we cannot monogram these items. API has published API Technical Report 6RT that covers this topic.

API 6A 20th Edition Annex I “Design validation procedure for surface safety valves and underwater safety valves” has been removed from the 21st Edition and replaced with API 6AV1.

API 6A 20th Edition Annex J “Repair and remanufacture requirements” has been removed from the 21st Edition and replaced with API 6AR.

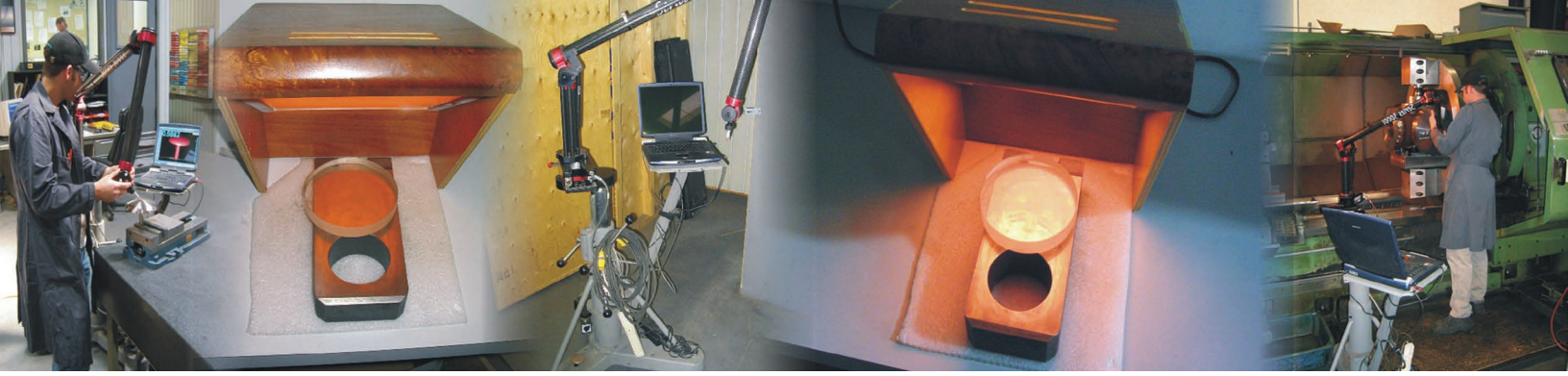
Annex M - The latest edition of API 6A changed Annex M (Heat-Treating Furnace Survey) from informative to normative. Quality systems have been updated to account for this requirement.

Design – ASME Method has been removed and replaced with an API 6X document, which is based on ASME BPVC 2004 Section 2.

OEC (Other End Connections) have been removed from the licensing scope of API 6A. OEC design and quality requirements are still covered in API 6A 21st Edition and therefore OECs can be part of a monogramable piece of equipment, but the OEC cannot be monogrammed as a stand alone item.

API 6A, Table 33

Hydrostatic Shell Test Pressure						
Working Pressure Rating MPa (psi)	Nominal Size of Flange mm (in)		Line Pipe and Tubing Threads MPa (psi)	Casing Threads mm (in)		
	346 (13 5/8) and smaller MPa (psi)	425 (16 3/4) and larger MPa (psi)		114.3 to 273.1 (4 1/2 to 10 3/4) MPa (psi)	298.5 to 339.7 (11 3/4 to 13 3/8) MPa (psi)	406.5 to 508.0 (16 to 20) MPa (psi)
13.8 (2000)	27.6 (4000)	20.7 (3000)	27.6 (4000)	27.6 (4000)	27.6 (4000)	15.5 (2250)
20.7 (3000)	41.5 (6000)	31.0 (4500)	41.5 (6000)	41.4 (6000)	31.0 (4500)	—
34.5 (5000)	51.7 (7500)	51.7 (7500)	51.7 (7500)	51.7 (7500)	—	—
69.0 (10,000)	103.5 (15,000)	103.5 (15,000)	103.5 (15,000)	—	—	—
103.5 (15,000)	155.0 (22,500)	155.0 (22,500)	—	—	—	—
138.0 (20,000)	207.0 (30,000)	—	—	—	—	—

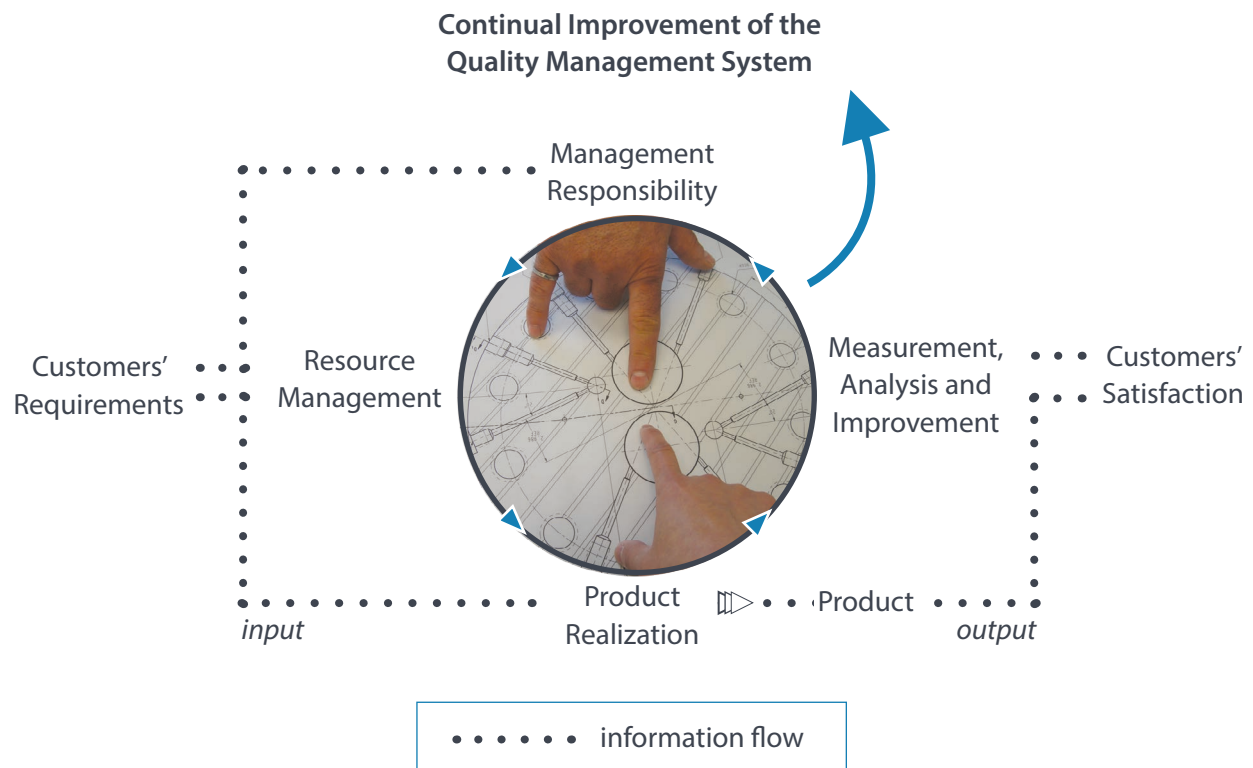


Plan-Do-Check-Act

Our customers play a significant role in defining requirements as inputs, as the model of a process-based quality management system illustrates. Monitoring of customer satisfaction requires the evaluation of information relating to customer perception as to whether the organization has met customer requirements.

The Plan-Do-Check-Act (**PDCA**) process can be applied to all processes:

- Plan** Establish the objectives and processes necessary to deliver results in accordance with customer requirements and the organization's policies.
- Do** Implement the processes.
- Check** Monitor and measure the processes and product against policies, objectives and requirements for the product and report the results.
- Act** Act to continually improve process performance.





API 6A, Table 7

Material Designations for Pressure Ratings ^a						
Part	13.8 MPa (2000 psi)	20.7 MPa (3000 psi)	34.5 MPa (5000 psi)	69.0 MPa (10,000 psi)	103.5 MPa (15,000 psi)	138.0 MPa (20,000 psi)
	Body ^b , Bonnet					
	36K, 45K 60K, 75K, NS	36K, 45K 60K, 75K, NS	36K, 45K 60K, 75K, NS	36K, 45K 60K, 75K, NS	45K, 60K 75K, NS	60K, 75K NS
	Integral End Connector					
Flanged	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	75K, NS	75K, NS
Threaded	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	NA	NA	NA
Other ^c	PMR	PMR	PMR	PMR	PMR	PMR
Loose Connector						
Weld-neck	45K	45K	45K	60K, 75K, NS	75K, NS	75K, NS
Blind	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	75K, NS	75K, NS
Threaded	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	NA	NA	NA
Other ^c	PMR	PMR	PMR	PMR	PMR	PMR
<p>a. NS indicates nonstandard materials as specified in 6.3.1.2.</p> <p>b. If end connectors are of the material designation indicated, design is in accordance with Section 5 and welding is in accordance with Section 7.</p> <p>c. As specified by the manufacturer.</p>						



API 6A, Table 8

Standard Material Property Requirements Bodies, Bonnets, and End and Outlet Connections				
Material Designation	0.2 % Offset Yield Strength min. MPa (psi)	Tensile Strength min. MPa (psi)	Elongation in 50 mm (2 in.) min. %	Reduction in Area min.%"
36K	248 (36,000)	483 (70,000)	21	No requirement
45K	310 (45,000)	483 (70,000)	19	32
60K	414 (60,000)	586 (85,000)	18	35
75K	517 (75,000)	655 (95,000)	17	35

API 6A, Table 9

Minimum Average Impact Value, J (ft-lb)					
Temperature		Transverse Direction		Longitudinal Direction	
		Wrought or Cast Material, Weld Qualification		Alternate Method for Wrought Products Only	
Class	Test °C (°F)	PSL 1 and PSL 2	PSL 3 and PSL 4	PSL 1 and PSL 2	PSL 3 and PSL 4
K	−60 (−75)	20 (15)	20 (15)	27 (20)	27 (20)
L	−46 (−50)	20 (15)	20 (15)	27 (20)	27 (20)
N	−46 (−50)	20 (15)	20 (15)	27 (20)	27 (20)
P	−29 (−20)	20 (15)	20 (15)	27 (20)	27 (20)
S	−18 (0)	—	20 (15)	—	27 (20)
T	−18 (0)	—	20 (15)	—	27 (20)
U	−18 (0)	—	20 (15)	—	27 (20)
V	−18 (0)	—	20 (15)	—	27 (20)
X	−18 (0)	—	20 (15)	—	27 (20)
Y	−18 (0)	—	20 (15)	—	27 (20)



Temperature Ratings

API 6A, Table 2

Temperature Class	Temperature Range			
	°C		°F	
	min.	max.	min.	max.
K	-60	82	-75	180
L	-46	82	-50	180
N	-46	60	-50	140
P	-29	82	-20	180
S	-18	60	0	140
T	-18	82	0	180
U	-18	121	0	250
V	2	121	35	250
X	-18	180	0	350
Y	-18	345	0	650

Note:

- Minimum temperature is the lowest ambient temperature to which the equipment can be subjected.
- Maximum temperature is the highest temperature of the fluid that can directly contact the equipment.



Pressure Ratings

API Pressure Rating in MPa	API Pressure Rating in PSI
13.8	2,000
20.7	3,000
34.5	5,000
69.0	10,000
103.5	15,000
138.0	20,000

API 6A, Table G.2—Optional Pressure-Temperature Ratings for 6B Flanges

Pressure Rating for Classes K to U MPa (psi)	De-rated Pressure	
	Class X, MPa (psi)	Class Y, MPa (psi)
13.8 (2000)	13.1 (1905)	9.9 (1430)
20.7 (3000)	19.7 (2860)	14.8 (2145)
34.5 (5000)	32.8 (4765)	24.7 (3575)

NOTE: See Table G.1 for temperature ratings.



API 6A, Table 3—Material Classes

Material Class		Body, Bonnet, End and Outlet Connectors	Mandrel Hangers, Valve Bore Sealing Mechanisms, Choke Trim, and Stems
AA	General service	Carbon or low-alloy steel, or stainless steel or CRA ^d	Carbon or low-alloy steel, or stainless steel or CRA ^d
BB	General service	Carbon or low-alloy steel, or stainless steel or CRA ^d	Stainless steel or CRA ^d
CC	General service	Stainless steel or CRA ^d	Stainless steel or CRA ^d
DD	Sour service ^a	Carbon or low-alloy steel or CRA ^{b,d}	Carbon or low-alloy steel or CRA ^{b,d}
EE	Sour service ^a	Carbon or low-alloy steel or CRA ^{b,d}	Stainless steel or CRA ^{b,d}
FF	Sour service ^a	Stainless steel or CRA ^{b,d}	Stainless steel or CRA ^{b,d}
HH	Sour service ^a	CRA ^{b,c,d}	CRA ^{b,c,d}
Footnotes:		^c CRA required on retained fluid-wetted surfaces only; CRA cladding of low-alloy or stainless steel is permitted (see 7.5.1.2).	
^a As defined by NACE MR0175/ISO 15156.		^d CRA as defined in 3.1.22; NACE MR0175/ISO 15156 definition of CRA does not apply.	
^b In accordance with NACE MR0175/ISO 15156.			

Material Class ZZ

Note: NACE MR0175/ISO 15156 includes provisions, by means of testing or documented field history, for the qualification of materials for a specific sour-service application that is outside the parameters defined in NACE MR0175/ISO 15156. This can include the use of materials in fluid conditions exceeding the limits defined in NACE MR0175/ISO 15156, or the use of materials not addressed in NACE MR0175/ISO 15156. For such sour-service applications, equipment may be described and marked as material class ZZ.

It shall be the responsibility of the purchaser to evaluate and determine the applicability of the documented data for the intended application. For material class ZZ, the manufacturer shall meet material specifications supplied or approved by the purchaser and shall maintain traceable records to document the materials of construction, regardless of PSL.

More NACE Information

Material Classes DD, EE, FF and HH require compliance to NACE MR0175/ISO 15156 and responsibility for the choice rests with the purchaser.

Examples of Designations:

Class FF-1.5 means:

- Material class FF
- Rated at 1.5 psia H₂S maximum allowable partial pressure

Class DD means:

- Where no limit of H₂S is defined by NACE, no partial pressure shall be marked.

Product Specification Levels (PSL)

The minimum PSL required for material class and rated working pressure combinations shall conform to Table 5.

Note: Annex B provides guidelines (not requirements) for selecting an acceptable PSL.

For crossover connectors, the PSL shall be based on the higher pressure rating and material class. For mandrel hangers, the PSL should be based on the pressure rating and material class of the spool or tubing head adapter placed over the suspended hanger.

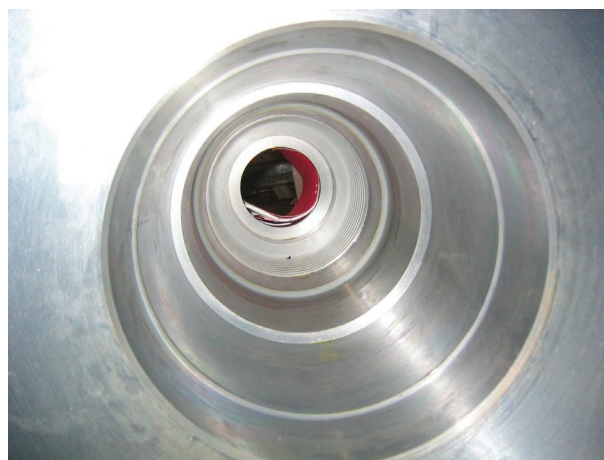


API 6A, Table 5—Minimum PSL

Material Class	Rated Working Pressure					
	13.8 MPa (2000 psi)	20.7 MPa (3000 psi)	34.5 MPa (5000 psi)	69.0 MPa (10,000 psi)	103.5 MPa (15,000 psi)	138.0 MPa (20,000 psi)
AA, BB, CC	PSL 1	PSL 1	PSL 1	PSL 2	PSL 2	PSL 3
DD, EE, FF	PSL 1	PSL 1	PSL 1	PSL 2	PSL 3	PSL 3
HH, ZZ	PSL 3	PSL 3	PSL 3	PSL 3	PSL 3	PSL 4

API 6A, Table 4—Applicability of Product Specification Levels

Equipment Category and Type (Reference Section)	Applicable PSLs	Equipment Category and Type (Reference Section)	Applicable PSLs
Plugs, Connectors, Gaskets		Valves and Chokes	
Flanges (blind, test) ^a (see 14.1)	1, 2, 3, 4	Valves (gate, plug, ball) (see 14.11)	1, 2, 3 ^e , 4
Ring gaskets ^b (see 10.4.5 and 14.2)	NA	Valves (prepared for/and actuated) (see 14.11)	1, 2, 3 ^e , 4
Threaded connectors ^a (see 14.3)	1, 2, 3, 4	Check valves (see 14.11)	1, 2, 3 ^e , 4
Tees and crosses (see 14.4)	1, 2, 3 ^e , 4	Back-pressure valves ^b (see 14.12)	NA
Bullplugs ^b (see 14.5)	NA	SSVs and USVs ^c (see 14.17)	2, 3 ^e , 4
Valve-removal plugs ^b (see 14.6)	NA	BDSVs ^d (see 14.17)	3 ^e , 4
Top connectors (see 14.7)	1, 2, 3 ^e , 4	Chokes (adjustable and positive) (see 14.15)	1, 2, 3 ^e , 4
Crossover connectors (see 14.8)	1, 2, 3 ^e , 4	Casing and Tubing Heads	
Other end connectors ^a (see 14.9)	1, 2, 3, 4	Housings (see 14.14)	1, 2, 3 ^e , 4
Spools (adapter, spacer) (see 14.10)	1, 2, 3 ^e , 4	Adapters (see 14.14)	1, 2, 3 ^e , 4
Weld-neck flanges ^a (see J.1)	1, 2, 3, 4	Other Equipment	
Segmented flanges ^a (see L.1)	1, 2, 3, 4	Actuators ^b (see 14.16)	NA
Nonintegral metal seals ^a (see 10.4.5)	1, 2, 3, 4	Tree assemblies ^b (see 14.18)	NA
Casing and Tubing Hangers		Packing mechanisms ^b (see 9.1)	NA
Slip-type ^a (see 14.13)	1, 2, 3, 4	Pressure boundary penetrations ^b (see 9.2)	NA
Mandrel-type ^a (see 14.13)	1, 2, 3, 4	Test and gauge ports ^b (see 9.3)	NA
Footnotes: <i>a Gas testing is not required, so PSL 3G designation is not applicable.</i> <i>b There is only one level of requirements for these products, so PSLs are not applicable.</i> <i>c PSL 1 is not applicable to SSVs and USVs.</i> <i>d PSL 1 and PSL 2 are not applicable to BDSVs.</i> <i>e For products eligible for gas testing, PSL 3G designation and marking may apply.</i>			



Casting Specification Level (CSL) Requirements

Casting Specification Level (CSL) is now required and will be determined by PSL (see Table 2). CSL is outlined by API 20A and Stream-Flo castings shall meet these outlined requirements based off PSL. Previously API 6A 20th Edition did not outline any requirements to be met regarding CSL. This requires qualifications of castings prior to production pieces on a vendor basis as well as additional volumetric NDE on production castings. There are additional surface NDE requirements on wetted surfaces. Also, material and weight of the casting will drive different qualification categories.

API 6A, Table 19—Casting Specification Level Cross-Reference to PSL	
API 6A	API 20A
PSL 1	CSL 2
PSL 2	CSL 3
PSL 3	CSL 3
PSL 4	NA

Bolting Specification Level (BSL) Closure Bolting Requirements

Closure bolting is a threaded fastener used to assemble well bore pressure-containing parts or join end or outlet connectors, such as studs, nuts, bolts and capscrews. The naming convention is now identified as “closure bolting” and no longer “studs and nuts” as stated in API 6A 20th Edition.

With the addition of this Bolting Specification Level (BSL) we shall now qualify closure bolting and it shall be manufactured in accordance with API 20E and API 20F.

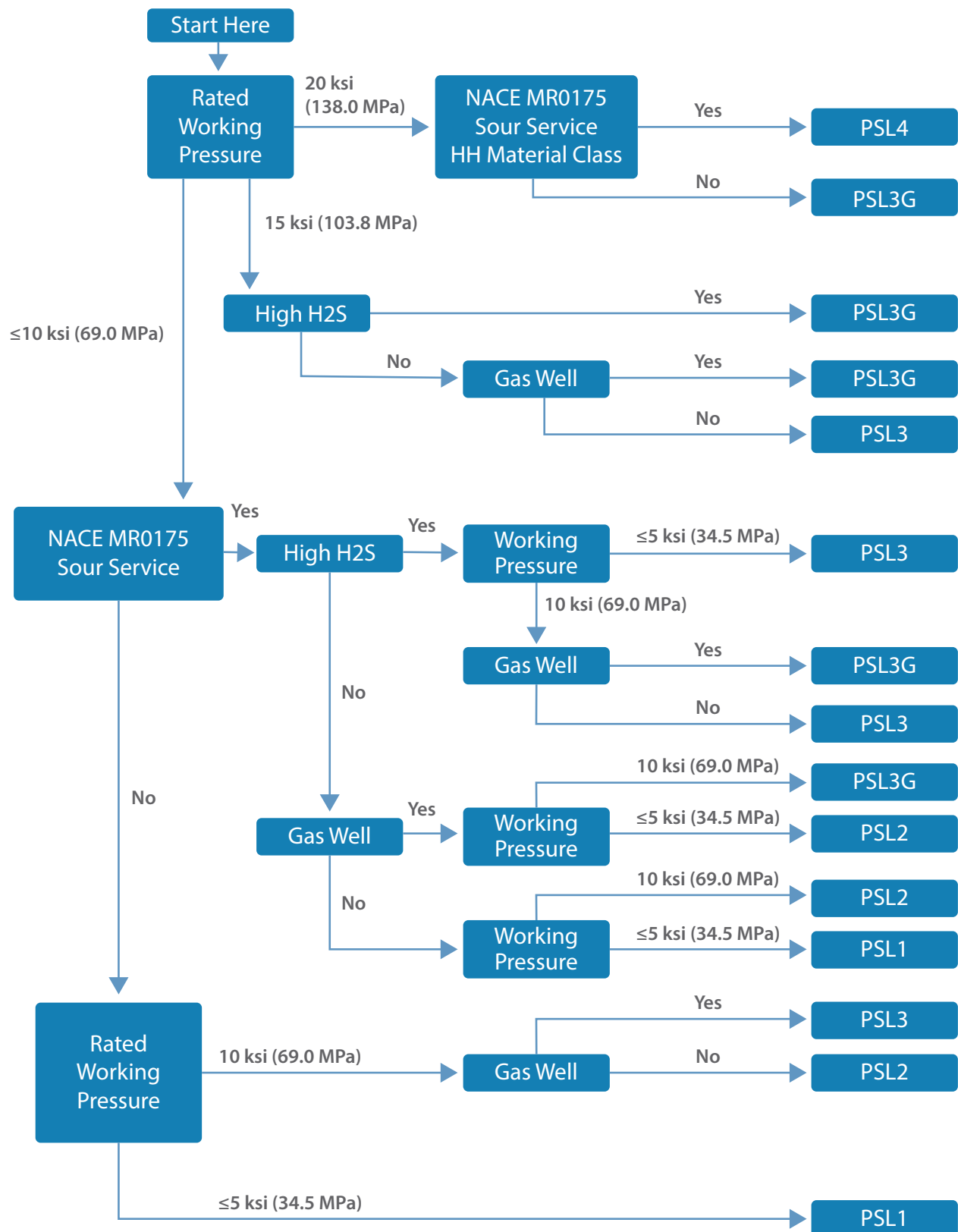
BSL will be determined based on PSL, as specified in Table 15. Stream-Flo will comply with this action by giving closure bolting a BSL rating, based on PSL.

In addition, API 20E and 20F requires that all closure bolting coatings be under the control of the bolting manufacturer.

API 6A, Table 15—Minimum Requirements for Closure Bolting		
	API 20E	API 20F
PSL 1	BSL-1	BSL-2
PSL 2	BSL-1	BSL-2
PSL 3	BSL-1	BSL-2
PSL 4	BSL-2 (bolt nominal diameter ≤ 2 1/2 in.)	BSL-2 (bolt nominal diameter ≤ 2 1/2 in.)
PSL 4	BSL-3 (bolt nominal diameter > 2 1/2 in.)	BSL-3 (bolt nominal diameter > 2 1/2 in.)
<i>Closure Bolting Minimum Bolting Specification Level Requirements</i>		

PSL Decision Tree

Recommended minimum PSL for primary parts of wellhead and christmas tree equipment.



Guide to Marking Requirements

API 6A, Table 35—Guide to Marking Requirements ^{a,b,c}		
Equipment Type	Nameplate Required?	Marking Requirements
Loose Fittings and Connectors		
• Integral, blind, and test flanges	Optional	14.1.5
• Ring gaskets	Not applicable	14.2.5
• Threaded connectors	Optional	14.3.5
• Tees and crosses	Optional	14.4.5
• Bullplugs	Not applicable	14.5.5
• Valve-removal plugs	Not applicable	14.6.5
• Top connectors	Optional	14.7.5
• Crossover connectors	Optional	14.8.5
• Other end connectors	Not applicable	14.9.5
• Spools (adapter and spacer)	Optional	14.10.5
Valves		
• Complete assemblies	Optional	14.11.5
• Prepared for actuator	Optional	14.11.5
• Back-pressure valves	Not applicable	14.12.5
• Slip-type and mandrel-type hangers	Not applicable	14.13.5
• Casing and tubing heads	Optional	14.14.5
Chokes		
• Choke assemblies, adjustable	Optional	14.15.5
• Choke assemblies, positive (fixed)	Optional	14.15.5
• Choke beans, positive chokes	Not applicable	14.15.5
• Actuators (for valves and chokes)	Optional	14.16.5
Safety Valves		
• Safety valves (SSV, USV, BSDV)	Required	14.17.5
• Safety valves prepared for actuator	Required	14.17.5
• Safety valve actuators (SSV, USV, BSDV)	Required	14.17.5
• Tree assemblies	Optional	14.18.5
Other		
• Fittings/pressure boundary penetrations	Not applicable	Section 9
<p><i>Footnotes:</i></p> <p><i>a Valves that satisfy the requirements of API 6FA can be marked per the requirements therein in addition to the requirements of this section.</i></p> <p><i>b Marking for features that do not exist on a product is not applicable.</i></p> <p><i>c PSL 3 products may be marked PSL 3G when the additional requirements of gas testing have been satisfied.</i></p>		

Thread Markings

The thread type marking in accordance with ISO 11960 shall be as follows:

STC	Casing: short thread
LC	Casing: long thread
BC	Casing: buttress
XL	Casing: extreme line
LP	Line pipe
NU	Tubing: non-upset
EU	Tubing: external upset



API 6A, Table 30

Applicability of Factory Acceptance Testing

Pressure-tested Equipment Factory acceptance testing (FAT) requirements identified in this specification	Nonpressure-tested Equipment No factory acceptance testing (FAT) requirements identified in this specification
<ul style="list-style-type: none"> Valves (<i>flowline</i>) <ul style="list-style-type: none"> Gate, plug, and ball valves SSVs, USVs, BDSVs Check valves 	<ul style="list-style-type: none"> Loose connectors <ul style="list-style-type: none"> Blind, test, and weld-neck flanges Blind, test, and weld-neck OECs
<ul style="list-style-type: none"> Back-pressure valves Fittings/pressure boundary penetrations (<i>installed in assembled equipment</i>) Chokes 	<ul style="list-style-type: none"> Bullplugs Valve-removal plugs Loose fittings (<i>and other pressure boundary penetrations</i>)
<ul style="list-style-type: none"> Actuators (<i>for valves or chokes</i>) <ul style="list-style-type: none"> Hydraulic actuators Pneumatic actuators Electric actuators 	<ul style="list-style-type: none"> Casing and tubing hangers <ul style="list-style-type: none"> Mandrel-type hangers Slip-type hangers
<ul style="list-style-type: none"> Casing and tubing heads (<i> housings and adapters</i>) Adapter and spacer spools Tees and crosses 	<ul style="list-style-type: none"> Ring gaskets Other metal seals Packing mechanisms for lock screws, alignment pins, and retainer screws
<ul style="list-style-type: none"> Crossover connectors Top connectors Tree assemblies 	<ul style="list-style-type: none"> Replacement parts <ul style="list-style-type: none"> Stems Lock screws Valve bore sealing mechanisms (<i>gates, seats, plugs, balls, etc.</i>) Choke trim

API 6A, Table 31

Summary of Factory Acceptance Testing Requirements by Equipment Type and PSL

Equipment Type	Hydrostatic Testing (PSL)			Gas Testing (PSL)			Drift Test (PSL)
	Shell Test	Seat Test	Function Test	Body ^c Test	Valve Seat Test	Backseat Test	
Valves (flowline)	1, 2, 3, 4	1, 2, 3, 4	2, 3, 4	3G, 4	3G, 4	3G ^d , 4	1, 2, 3, 4
Chokes	1, 2, 3, 4	—	—	3G, 4	—	—	—
Tree assemblies	1, 2, 3, 4 ^b	—	—	3G, 4	—	—	1, 2, 3, 4
Casing and tubing heads, housings, and adapters	1, 2, 3, 4	—	—	3G, 4	—	—	—
Adapter and spacer spools, Tees and crosses, Crossover connectors, Top connectors	1, 2, 3, 4	—	—	3G, 4	—	—	—
Actuators ^{a,e}	✓	✓	✓	—	—	—	—
Back-pressure valves ^a	—	✓	—	—	—	—	—
Footnotes: ^a PSLs are not applicable to this equipment. ^b See 11.2.3.3 for test pressure requirements. ^c Body test pressure = rated working pressure.				^d Optional. ^e See 14.16.4 for factory acceptance testing requirements. ✓ = Test applies/PSL does not apply.			

Relative Corrosivity

There are many factors that contribute to the corrosivity of a system. The most prominent of these are:

- Temperature
- H_2S (Partial Pressure)
- pH
- Chloride ion concentration
- Water production and composition
- Types and relative amounts of produced hydrocarbons
- Oxygen levels
- CO_2 levels (Partial Pressure)



Finally, the purchaser should consider future service of the well when selecting a material class. This should not be limited to anticipated changes in the produced fluids or increased water production with or without increased chloride content, but also should include consideration of operations such as acidification or other well treatments.

Relative Corrosiveness of Retained Fluids as Indicated by CO_2 Partial Pressure			
Retained Fluids	Retained Fluids	Retained Fluids Mpa	Retained Fluids (psia)
General service	Noncorrosive	<0.05	(<7)
General service	Slightly corrosive	0.05 to 0.21	(7 to 30)
General service	Moderately to highly corrosive	>0.21	(>30)
Sour service	Noncorrosive	<0.05	(<7)
Sour service	Slightly corrosive	0.05 to 0.21	(7 to 30)
Sour service	Moderately to highly corrosive	>0.21	(>30)

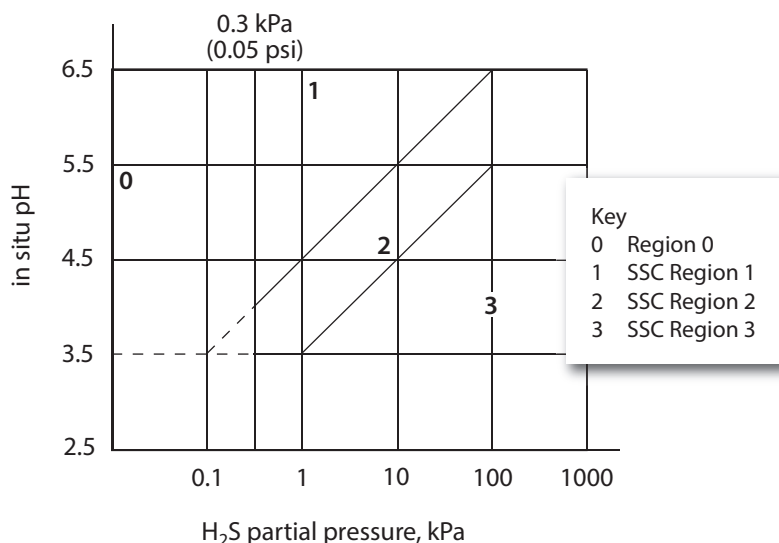
Factors Affecting Behaviour in H_2S Containing Environments

The behaviour of carbon and low alloy steels in H_2S containing environments is affected by complex interactions of parameters, including:

- Chemical composition, method of manufacture, product form, strength, hardness of the material and its local variations, amount of cold work, heat treatment condition, microstructure, microstructural uniformity, grain size and cleanliness of the material
- H_2S partial pressure or equivalent concentration in the water phase
- Chloride ion concentration in the water phase
- Acidity (pH) of the water phase
- Presence of sulphur or other oxidants
- Exposure to production fluid

Severity of Sour Environment

Determined in accordance with NACE MR0175/ISO 15156-1 with respect to SSC of a carbon or low alloy steel.



In defining the severity of the H₂S containing environment, the possibility of exposure to unbuffered condensed aqueous phases of low pH during upset operating conditions or downtime, or to acids used for well stimulation and/or the back flow of stimulation acid after reaction should be considered.

Note 1: The discontinuities in the figure above which are lower than 0.3 kPa (0.05 psi) and higher than 1 MPa (150 psi) partial pressure H₂S reflect uncertainty with respect to the measurement of H₂S partial pressure (low H₂S) and steel's performance outside these limits (both low and high H₂S).

Note 2: Guidance on the calculation of H₂S partial pressure is given in Annex C.

Note 3: Guidance on the calculation of pH is given in Annex D.

The cracking behaviour of CRAs and other alloys in H₂S-containing environments can be affected by complex interactions of parameters, including:

- Chemical composition, strength, heat treatment, microstructure, method of manufacture and finished condition of the materials
- H₂S partial pressure or equivalent dissolved concentration in the water phase
- Acidity (in situ pH) of the water phase
- Chloride or other halide ion concentration
- Presence of oxygen, sulphur or other oxidants
- Exposure temperature
- Pitting resistance of the material in the service environment
- Galvanic effects
- Total tensile stress (applied plus residual)
- Exposure time

These factors shall be considered when using this part of NACE MR0175/ISO 15156 for the selection of materials suitable for environments containing H₂S in oil and gas production systems.



The API Monogram

To receive the authorization for applying the API monogram, Stream-Flo facilities and our quality management system are audited, approved, and licensed by the American Petroleum Institute. The API monogram and license number are our customers' assurance that Stream-Flo complies with all applicable API requirements, and it signifies to our customers that they are receiving high quality products and services.

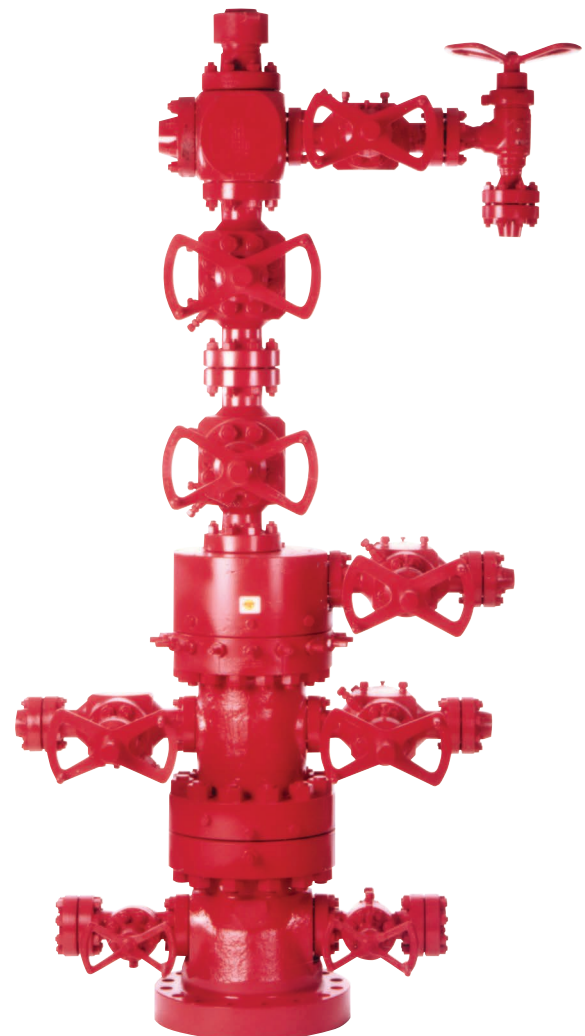


Performance Validation

The performance requirements apply to all products being manufactured and delivered for service. The performance verification procedures are to be applied to designs of products, including design changes. Verification testing specified is intended to be performed on prototypes or production models.

Per API 6A 21st Edition, there are three different performance requirement designations: PR1, PR2 and PR2F, with PR2F being applied to equipment passing the requirements of API 6A Annex F.

A design that undergoes a substantive change becomes a new design requiring performance verification. A substantive change is a change identified by the manufacturer which affects the performance of the product in the intended service condition. This may include changes in fit, form, function, or material.



Criteria for Ordering, 21st Edition

Pressure Class API holds user responsible for choosing class

Temperature Class API holds user responsible for choosing class

Material Class API holds user responsible for choosing class

PSL (Product Specification Level) API recommends PSLs to the user

PR (Performance Requirement) API requires cycle testing of designs

When ordering, please use this wellhead equipment data sheet.

Wellhead Equipment Data Sheet—General

Well name(s) and location(s): _____

Maximum operating pressure: _____

Anticipated wellhead shut-in pressure: _____

Temperature ranges anticipated: _____

Minimum ambient temperature: _____

Maximum flowing fluid temperature at wellhead: _____

Anticipated composition of produced fluids: CO₂ _____ (mg) _____ Chlorides _____

(mg) _____ H₂S _____ (mg) _____ Other _____

Water or brine pH: _____

Does NACE MR0175/ISO 15156 apply? _____

Anticipated production rates: _____ m³/d oil/condensate

_____ m³/d gas

_____ m³/d S&W ^a

Will erosion be a concern? Cause: _____

Will scale, paraffin, corrosion, or other types of inhibitors be used? _____

Inhibitor type: _____ Inhibitor carrier: _____ Batch or continuous inhibition? _____

Will acidification be performed? _____ Type of acid: _____

External coating? Yes, type _____ No _____

Internal coating? Yes, type _____ No _____

Delivery requirements: _____

Special shipping, packing, and storage instructions: _____

Casing program	Top Joint in String					
	Size (OD)	kg/m (lb/ft)	Grade	Connection	Max./Min. Casing Load daN (lb)	Bit Size
Conductor	_____	_____	_____	_____	_____	_____
Surface casing	_____	_____	_____	_____	_____	_____
Protective casing	_____	_____	_____	_____	_____	_____
Production casing	_____	_____	_____	_____	_____	_____
Tubing	_____	_____	_____	_____	_____	_____
Type of completion: single or multiple	_____	_____	_____	_____	_____	_____

Footnote:

^a Sand and water.



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