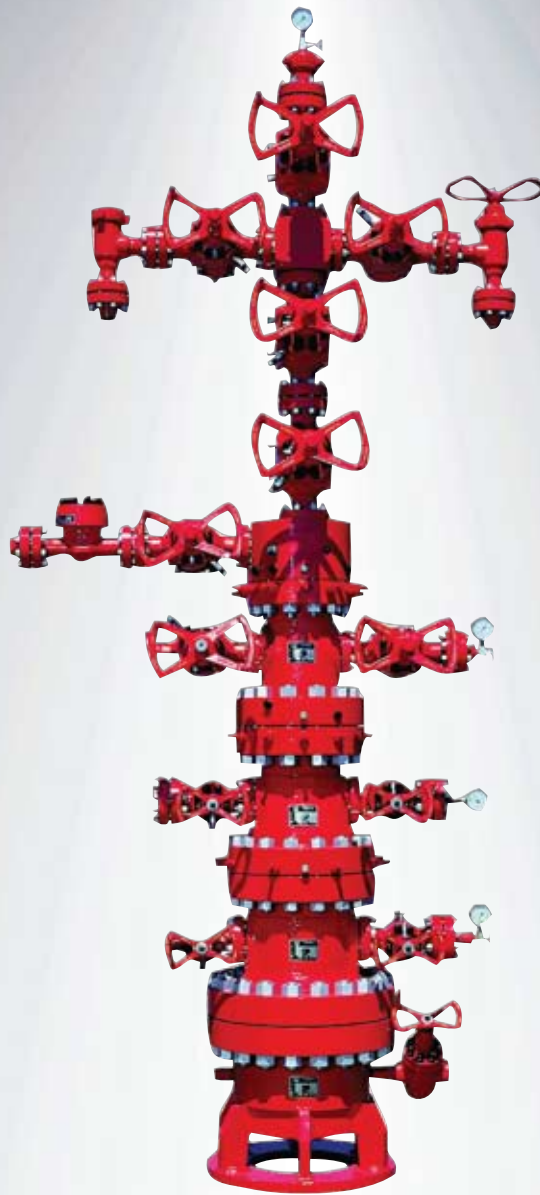




**Purchasing Guide
for Wellhead & Christmas Tree Equipment**



With Reference to API 6A, 19th Edition, Including Changes
in NACE MR0175, ISO 15156, Latest Edition.

OUR COMPANY

Stream-Flo Industries Ltd. is a privately owned and operated Canadian manufacturer of wellhead and christmas tree equipment, gate valves, ESD's and check valves. Founded in 1962, the company has grown to be one of the largest manufacturers of its kind in Canada and is continually expanding its export activities. Our commitment to core values of unceasingly improving and investing in technology and striving for high standards in our people has made Stream-Flo the successful company it is today.

With this success, we are better equipped to provide excellent and consistent customer service. This customer service translates to improved quality, reduced cost of the finished product, and shorter delivery schedules. Further improvements are achieved through close partnering with material suppliers and subcontractors.

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Canadian Head Office and Manufacturing Facility, Edmonton, Alberta, Canada



United States Wellhead and Check Valve Business Units, Houston, Texas, USA

When coupled with Stream-Flo processes, API provisions, and applicable customer requirements, this booklet is intended to provide a common fundamental approach to quality management for the petroleum, petrochemical and natural gas industry.

Message from the Corporate Quality Manager/Senior Metallurgist



“There are times when I ask myself, What makes us a better choice than the other guy?”

First of all, at Stream-Flo, we have a strong desire to service the customer. We find out our customer’s needs and get it delivered in the best condition as quickly as possible.

Second, when I look at our corporate manufacturing operations, I see the commitment toward quality. We have a strong passion to make sure the customer is always satisfied, recognizing the value-added advantage of dealing with Stream-Flo Industries Ltd.

Third, we monogram all our products, thereby reinforcing our conformance to API 6A and 6D, as applicable. Stream-Flo has stable operation, quality, marketing, and engineering organizations. With three metallurgists on staff, we provide comprehensive expertise to our customers: material selection, heat treatment, corrosion, welding, and solving metallurgical and welding problems.

As Corporate Quality Manager and Senior Metallurgist over the past 25 years, I have seen the changes that have taken place within Stream-Flo’s systems and processes. Operations and management are committed to maturing and comprehensive quality, engineering, and materials program with documented procedures complying to API Q1 and ISO 9001.

Martin Ishkanian



API Specification 6A

API Specification 6A (ISO 10423) is the recognized industry standard for wellhead and christmas tree equipment that was formulated to provide for the availability of safe, dimensionally and functionally interchangeable wellhead and christmas tree equipment. This specification includes detailed requirements for the manufacture of tubular suspension equipment, valves, and fittings used at the location of oil and gas wells to contain and control pressure and fluid flows.

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.















Since API Specification 18th Edition was withdrawn, this booklet covers the 19th Edition with references to the 17th Edition.

Abbreviated Terms

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

API 6A Applicable Equipment

API Specification 6A covers wellhead and christmas tree equipment as follows:

API 6A Applicable Equipment					
Wellhead Equipment	Connectors and Fittings	Casing and Tubing Hangers	Valves and Chokes	Loose Connectors ¹	Other Equipment
casing head housings	cross-over connectors	mandrel hangers	single valves	weld neck connections	actuators
casing head spools	tubing head adaptors	slip hangers	multiple valves	blind connectors	hubs
tubing head spools	top connectors		actuated valves	threaded connectors	pressure boundary penetrations
cross-over spools	tees and crosses		valves prepared for actuators	adaptor and spacer connections	ring gaskets
multi-stage head housings and spools	fluid sampling devices		check valves	bull plugs	running and testing tools (in Annex H)
	adaptor and spacer spools		chokes	valves removal plugs	wear bushings (in Annex H)
			surface and underwater safety valves and actuators		
		back-pressure valves			
					

¹ Flanged, threaded, other end connectors (OEC) and welded.

Note: This international standard defines service conditions in terms of pressure, temperature and material class for the well-bore constituents and operating conditions.

Significant Differences Between API 17 and 19 Editions

Due to the significant differences between current and previous API standards, much equipment commonly used in the field may have to be replaced to comply with new API requirements.

Valve Removal Plugs and Threads Added Valve removal plugs and threads were previously the responsibility of the manufacturer. The specified threads for $\leq 10,000$ psi are Charpy V tubing threads from the 1946 edition of API 5B. The LP plug previously used will engage an outlet with either LP or Charpy V threads. The new Charpy V plug will not fit into an outlet with LP threads. The specified connections for 15,000 and 20,000 psi is a stub ACME with a metal-to-metal seal.

Top Connection Assemblies Shall Be Equipped with a Bleeder Plug Bleeder plugs must now be shipped with bottom hole test adapters. A needle valve which is normally shipped with BHTA will meet this requirement.

Recommended Design for Top Connectors Added An optional annex has been added that shows dimensional information for bottom hole test adapters.

NACE MR0175/ISO 15156-1 Many necessary changes were made to API 6A to reflect the new NACE standard. One significant change concerning wellhead equipment is the limit of 0.5 psi partial pressure of H_2S for 17-4 PH.

Temperature Class N Added As NACE now restricts a maximum temperature rating of 140° F, the temperature Class N -50° F to 140° F (-46° C to 60° C) was added to accommodate austenitic stainless steels (e.g. 316).

Partial Pressure Stamping for Sour Service Added The maximum allowable partial pressure of H_2S will be stamped immediately after the material class. Where no limit is defined, NL will be stamped.

New PSL-3G Added A new PSL with gas testing required has been added with the designation PSL-3G.

Running Tools, Test Tools and Wear Bushings Added Running tools, test tools and wear bushings may now be monogrammed. There are no dimensions specified. Design and material requirements are identified.

Repair and Remanufacture Annex Added Annex Q has been added to API 6A. This annex defines the requirements for repair and remanufacture of user/purchaser-owned equipment originally manufactured in accordance with API 6A. Repaired or remanufactured equipment is not eligible for licensing under the API Monogram Program.

Back Pressure Valves Added Back pressure valves may now be monogrammed. There are no dimensions specified; however, design and performance requirements are identified.

Bull Plugs Added Bull plugs are now included and may now be monogrammed. Materials and dimensions are specified.

Material Class ZZ Added Material Class ZZ allows materials outside of NACE MR0175 limits for sour service applications.

Test Pressure Refer to API Table 19, *Hydrostatic Body Test Pressure*.



Quality Requirements Bull Plug, Valve Removal Plug, and Back Pressure Valve		
Material (bull plugs)	60K psi	¹ Hardness testing is not required for those materials that have no hardness restrictions specified by NACE MR0175 or are not heat treated to obtain a minimum specified strength level. ² 100% valve sealing mechanism for back pressure valves. ³ 100% assembly for back pressure valves.
Material (valve removal plugs and back pressure valves)	60K psi 2,000 - 10,000 75K psi 15,000 - 20,000	
Tensile Testing	Preheat	
Impact Testing	Preheat	
Hardness Test ¹	Sampling	
NACE MR0175 ²	100%	
Dimensional	Sampling	
Traceability	Job Lot	
Chemical Analysis	Preheat	
Visual Examination	Sampling	
Hydrostatic Test ³	-	

API Table 19

Hydrostatic Body Test Pressure						
Working Pressure Rating MPa (psi)	End and Outlet Connections					
	Nominal Flange Size 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 - 273.1 (4 ¹ / ₂ - 10 ³ / ₄) MPa (psi)	298.5 - 338.7 (11 ³ / ₄ - 13 ³ / ₈) MPa (psi)	406.5 - 508.0 (16 - 22) MPa (psi)
13.8 (2,000)	27.6 (4,000)	20.7 (3,000)	27.6 (4,000)	27.6 (4,000)	27.6 (4,000)	15.5 (2,250)
20.7 (3,000)	41.5 (6,000)	31.0 (4,500)	41.5 (6,000)	41.5 (6,000)	31.0 (4,500)	-
34.5 (5,000)	51.7 (7,500)	51.7 (7,500)	51.7 (7,500)	51.7 (7,500)	-	-
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)	-	-	-	-	-

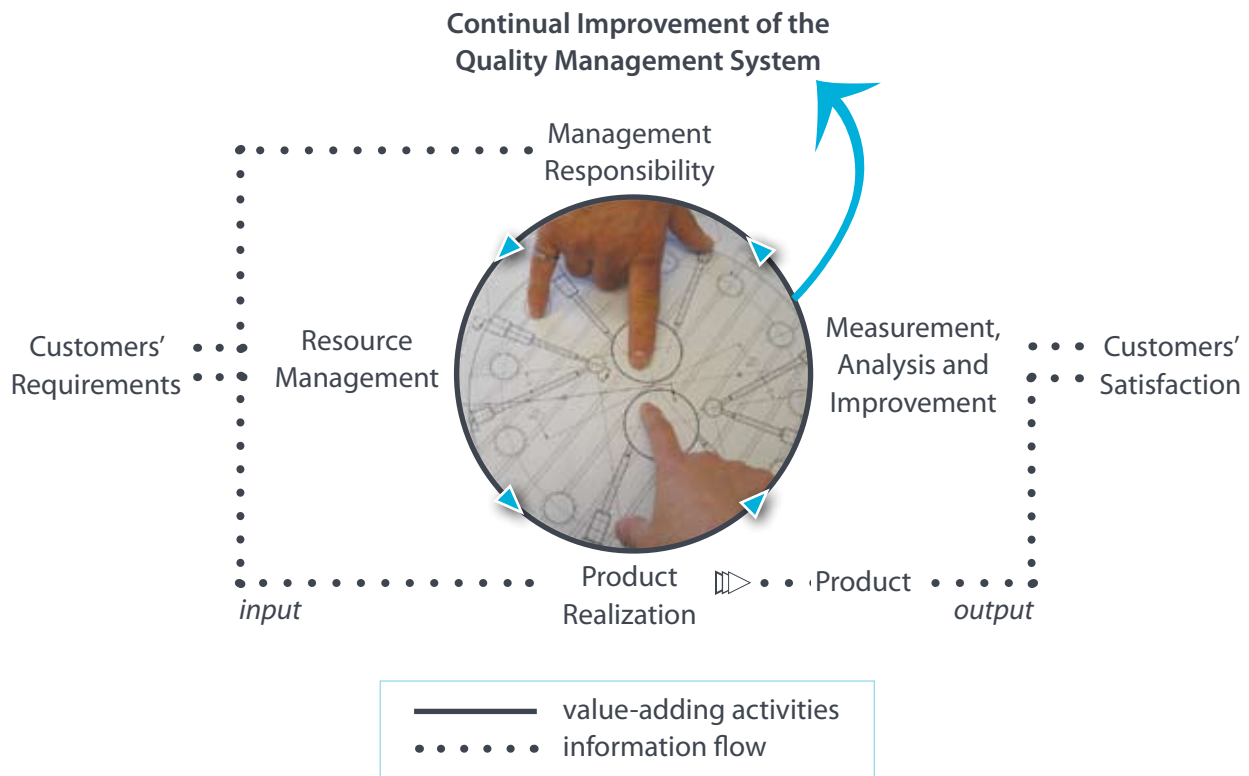


Plan-Do-Check-Act

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

The Plan-Do-Check-Act (**PDCA**) 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** Take actions to continually improve the process performance.



Standard Material Applications Bodies, Bonnets, and End and Outlet Connections						
Pressure Ratings MPa (psi)						
Part	13.8 (2,000)	20.7 (3,000)	34.5 (5,000)	69.0 (10,000)	103.5 (15,000)	138.0 (20,000)
Body ^a , Bonnet	36K, 45K, 60K, 75K, NS ^b	36K, 45K, 60K, 75K, NS	36K, 45K, 60K, 75K, NS	36K, 45K, 60K, 75K, NS	45K, 60K, 75K, NS	45K, 60K, 75K, NS
Integral End Connection	flange	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS
	threaded	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS
	other ^c	c	c	c	c	c
Loose Connection	welding neck	45K	45K	45K	60K, 75K, NS	75K, NS
	blind	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	75K, NS
	threaded	60K, 75K, NS	60K, 75K, NS	60K, 75K, NS	NA	NA
	other ^c	c	c	c	c	c

^a If end connections are of the material designation indicated, welding is in accordance with Clause 6 and design is in accordance with Clause 4.

^b NS indicates nonstandard materials.

^c As specified by manufacturer.

Standard Material Property Requirements Bodies, Bonnets, and End and Outlet Connections				
Material Designation	0.2% 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 requirements
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

Charpy V Notch Impact Requirements (10 mm x 10 mm)				
Temperature		Minimum Average Impact Value Traverse Direction J (ft lb)		
Temp Class	Test Temp °C (°F)	PSL 1	PSL 2	PSL 3 and PSL 4
K	-60 (-75)	20 (15)	20 (15)	20 (15)
L	-46 (-50)	20 (15)	20 (15)	20 (15)
N	-46 (-50)	20 (15)	20 (15)	20 (15)
P	-29 (-20)	-	20 (15)	20 (15)
R	-18 (0)	-	-	20 (15)
S	-18 (0)	-	-	20 (15)
T	-18 (0)	-	-	20 (15)
U	-18 (0)	-	-	20 (15)
V	-18 (0)	-	-	20 (15)



Temperature Ratings

Temperature Classification	Operating Range					
	(min)	°C	(max)	(min)	°F	(max)
K	-60		82	-75		180
L	-46		82	-50		180
N	-46		60	-50		140
P	-29		82	-20		180
R	room temperature			room temperature		
S	-18		60	0		140
T	-18		82	0		180
U	-18		121	0		250
V	2		121	35		250
X ¹	-18		180	0		350
Y ¹	-18		345	0		650

¹ Reference Annex G for details of design and temperature rating of equipment for use at elevated temperatures.

Note: Annex G is not intended as a material selection guide for high temperature use. Some alloys are embrittled after repeated or prolonged exposure to elevated temperatures. Care should be used in selection of alloys for these ratings. If plated or coated materials are used at temperatures greater than 180° C (350° F), cracking potential can be increased.

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

Pressure Rating for Class K to U	De-rated Pressure	
	MPa (psi)	Class X MPa (psi)
13.8 (2,000)	13.1 (1,905)	9.9 (1,430)
20.7 (3,000)	19.7 (2,860)	14.8 (2,145)
34.5 (5,000)	32.8 (4,765)	24.7 (3,575)

Material Classes

Material Class	Minimum Material Requirements	
	Body, Bonnet, End & Outlet Connections	Pressure-Controlling Parts, Stems & Mandrel Hangers
AA - General Service	Carbon or Low-alloy Steel	Carbon or Low-alloy Steel
BB - General Service	Carbon or Low-alloy Steel	Stainless Steel
CC - General Service	Stainless Steel	Stainless Steel
DD - Sour Service ^a	Carbon or Low-alloy Steel ^b	Carbon or Low-alloy Steel ^b
EE - Sour Service ^a	Carbon or Low alloy Steel ^b	Stainless Steel ^b
FF - Sour Service ^a	Stainless Steel	Stainless Steel ^b
HH - Sour Service ^a	CRA ^s ^{bcd}	CRA ^s ^{bcd}
ZZ - Sour Service	User Defined	User Defined

^a As defined by NACE MR0175/ISO 15156 in compliance with NACE MR0175/ISO 15156.

^b In compliance with NACE MR0175/ISO 15156.

^c CRA required on retained fluid wetted surfaces only. CRA cladding of low alloy or stainless steel is permitted.

^d CRA as defined in Clause 3 of this International Standard. NACE MR0175/ISO 15156 definition of CRA does not apply.

API 6A Annex O: Material Class ZZ

NACE MR0175/ISO 15156 includes provisions for the qualification of materials for a specific sour service application which is outside the parameters defined in that standard by means of testing or documented field history. This can include MR0175/ISO 15156 or the use of materials not addressed in MR0175/ISO 15156. For such sour service applications, equipment may be described and marked as Material Class ZZ.

It is 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 NL means:

- where no H₂S limit is defined by NACE, NL shall be used for marking (i.e. DD-NL).

Product Specification Levels (PSL)

API Specification 6A (ISO 10423) recommends product specification levels (PSLs) for equipment with quality control requirements for various service conditions. PSLs apply to primary equipment:

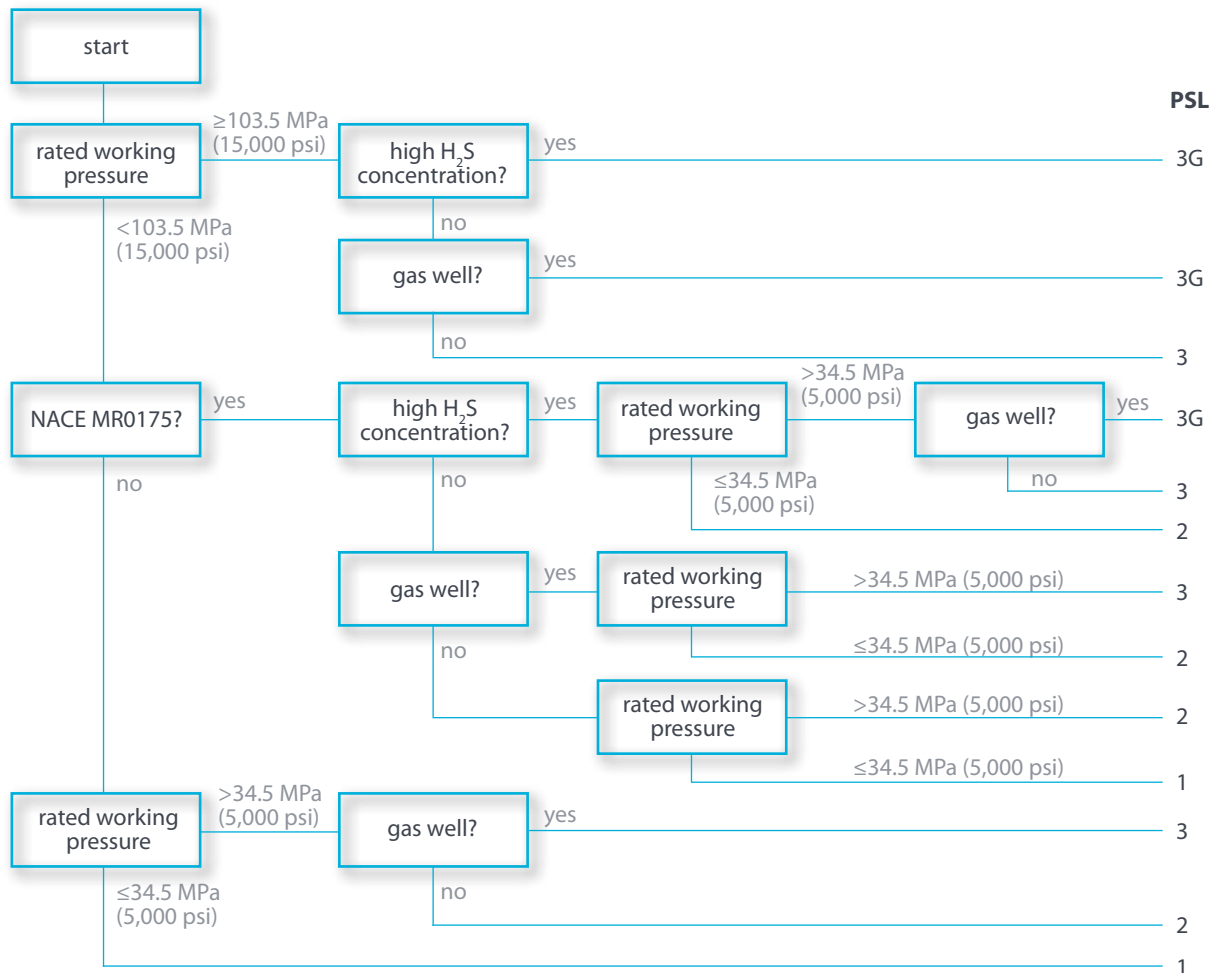
- tubing heads
- tubing hangers, hanger couplings
- tubing head adapters
- lower master valves

All other wellhead parts are classified as secondary. The PSL for secondary equipment may be the same or less than the PSL for primary equipment.



PSL Decision Tree

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



API Marking Requirements and Locations						
Marking	Location					
	Wellhead Equipment	Connectors and Fittings	Casting and Tubing Hangers	Loose Connectors	Valves and Chokes	Actuators
ISO 10423	nameplate and/or body	nameplate and/or body	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body
temperature class or rating (4.2.2)	nameplate and/or body	nameplate and/or body	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body (actuators containing retained fluid)
material class (4.2.3)	nameplate and/or body	nameplate and/or body	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body (actuators containing retained fluid)
product specification level (1.4)	nameplate and/or body	nameplate and/or body	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body (actuators containing retained fluid)
performance requirement level (4.1)	nameplate and/or body	-	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body
nominal size (bore if required)	nameplate or body, and connector OD	nameplate or body, and connector OD	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body
thread size (threaded products only)	nameplate or body, and/or near each thread	nameplate or body, and/or near each thread	nameplate and/or near each connector	OD of connector	nameplate or body, and/or near each thread	-
end and outlet connector size	nameplate or body, and each connector OD	nameplate or body, and each connector OD	-	OD of connector	nameplate and/or body	-
rated working pressure (4.2.1)	nameplate or body, and each connector OD	nameplate or body, and each connector OD	-	OD of connector	nameplate or body, and each connector OD	-
ring gasket type and number	near each connector	near each connector	-	OD of connector	near each connector	-
date of manufacture	nameplate and/or body	nameplate and/or body	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body
manufacturer's name or mark	nameplate and/or body	nameplate and/or body	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body
serial number (if applicable)	nameplate and/or body	nameplate and/or body	nameplate and/or body	OD of connector	nameplate and/or body	nameplate and/or body
hardness test values (if applicable)	adjacent to test location	adjacent to test location	adjacent to test location	adjacent to test location	adjacent to test location	adjacent to test location



Quality Control Requirements Bodies, Bonnets, End and Outlet Connections, and Hub End Connectors				
Parameter	Subclause Reference			
	PSL 1	PSL 2	PSL 3/3G	PSL 4
Tensile Testing	7.4.2.1.1	7.4.2.2.1	7.4.2.2.1	7.4.2.2.1
Impact Testing	7.4.2.1.2	7.4.2.2.2	7.4.2.3.2	7.4.2.3.2
Hardness Testing	7.4.2.1.3	7.4.2.2.3	7.4.2.3.3	7.4.2.3.3
NACE MR0175	7.4.1.5	7.4.1.5	7.4.1.5	7.4.1.5
Dimensional Verification	7.4.2.1.4	7.4.2.1.4	7.4.2.3.4	7.4.2.3.4
Traceability	-	7.4.2.2.5	7.4.2.3.5	7.4.2.3.5
Chemical Analysis	-	7.4.2.2.6	7.4.2.2.6	7.4.2.2.6
Visual Examination	7.4.2.1.5	7.4.2.1.5 7.4.2.2.7	-	-
Surface NDE	-	7.4.2.2.8 7.4.2.2.9	7.4.2.3.8	7.4.2.3.8
Weld NDE				No welding permitted except for weld overlays (see 7.4.2.4.9)
General Examination Visual	7.4.2.1.6	7.4.2.1.6	7.4.2.1.6	
NDE Surface	-	7.4.2.2.11	7.4.2.3.10	
Repair Welds	-	7.4.2.2.12	7.4.2.2.12	
NDE Volumetric	-	7.4.2.2.13	7.4.2.3.11	
Hardness Testing	-	7.4.2.2.14	7.4.2.2.13	
Serialization	-	-	7.4.2.3.12	7.4.2.3.13
Volumetric NDE	-	-	7.4.2.3.14	7.4.2.3.14
	-	-	7.4.2.3.15	7.4.2.4.11

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



Quality Control Requirements for Welding					
Weld Type	Stages	PSL 1	PSL 2	PSL 3/3G	Preparation
Pressure containing	Preparation	-	-	a	no welding permitted
	Completion	-	a, b and (c or d)	a, b, (c or d), and e	
Non-pressure containing	Preparation	-	-	a	no welding permitted
	Completion	-	a	a and e	
Repair	Preparation	-	h	h	no welding permitted
	Completion	-	a, b, and (f or g)	a, b, e and (f or g)	
Weld metal overlay (ring grooves, stems, valve-bore sealing mechanisms and choke trim)	Preparation	-	-	b	b
	Completion	-	b	b	b
Weld metal corrosive resistant alloy overlay (bodies, bonnets and end and outlet connections)	Preparation	a	a	a	a
	Completion	a,b	a,b	a, b, i	a, b, i

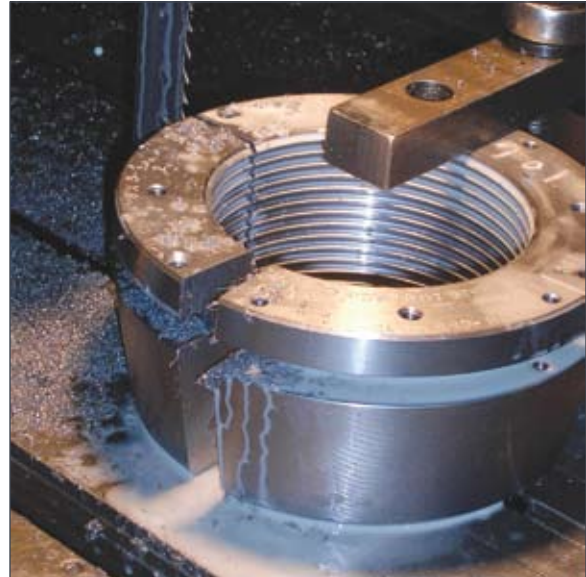
a Visual examination.
b Penetrant testing inspection for non-ferromagnetic materials and magnetic particle testing for ferromagnetic material.
c Radiation (radiography or imaging) examination.
d Ultrasonic examination.
e Hardness test (weld).
f Ultrasonic examination only if weld is greater than 25% of wall thickness or 25 mm (1 in), whichever is less.
g Radiation (radiography or imaging) examination only if weld is greater than 25% or wall thickness for PSL 2 or 20% of wall thickness for PSL 3, or 25 mm (1 in), whichever is less.
h Penetrant or magnetic particle as applicable for material defects only.
i Measurement of overlay thickness, testing of bond integrity and volumetric examination shall be according to the manufacturer's specifications. If the overlay is considered part of the manufacturer's design criteria or of the design criteria of API 6A, volumetric examinations shall be in accordance with the methods and acceptance criteria of 7.4.2.3.15.

Note: preparation = surface preparation, joint preparation, fit up and preheat
 completion = after all welding, post-weld heat treat and machining

Relative Corrosivity

The minimum partial pressure of carbon dioxide required to initiate corrosion and the relative effect of increasing partial pressures on the corrosion rate are strongly influenced by other environmental factors:

- temperature
- H₂S level
- pH
- chloride ion concentration
- sand production
- water production and composition
- types and relative amounts of produced hydrocarbons



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 acid gas partial pressures for production 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	<0.5	(<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)

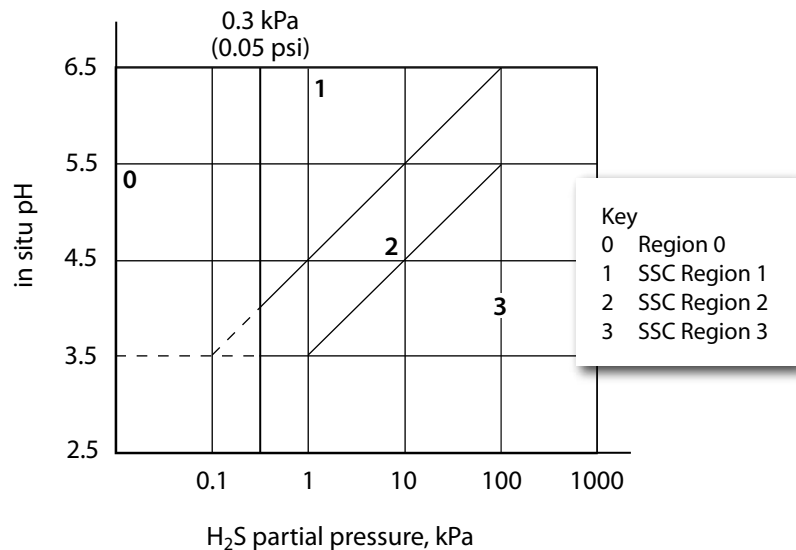
Factors Affecting Behavior in H₂S Containing Environments

The behavior of carbon and low alloy steels in H₂S containing environments is affected by complex interactions of parameters, including the following:

- 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
- H₂S partial pressure or equivalent concentration in the water phase
- chloride ion concentration in the water phase
- acidity (pH) of the water phase
- presence of sulfur 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 below 0.3 kPa (0.05 psi) and above 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 behavior of CRAs and other alloys in H₂S containing environments can be affected by complex interactions of parameters, including the following:

- 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, sulfur or other oxidants
- exposure temperature
- pitting resistance of the material in the service environment
- galvanic effects
- total tensile stress (applied plus residual)
- exposure

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

In order to receive the authorization for applying the API monogram, Stream-Flo's facilities and our Quality Manual are audited, approved and licensed by the American Petroleum Institute. The API monogram and license number are our customers' assurance that Stream-Flo is in compliance with all the applicable API requirements, and it signifies to our customers that they are receiving good quality products and services.



Performance Verification

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.

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, 19th 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 PSL's to the user

PR (Performance Requirement) API requires cycle testing of designs

When ordering, please use this wellhead equipment data sheet.

Well names and location(s): _____

Maximum operating pressure: _____

Anticipated wellhead shut-in pressure: _____

Temperature ranges anticipated: _____

Maximum flowing fluid temperature at wellhead _____

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

(mg) _____ H₂S _____ (mg) _____ other _____

Anticipated completion or future workover or recovery operations which would affect pressure, temperature or fluid content: _____

New values: _____

Are there any government regulations that apply or must be met by this equipment? _____

If so, which one(s): _____

Water or brine pH: _____

Does NACE MR0175 apply? _____

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: _____

Anticipated production rates: _____ m³/d oil/condensate

_____ m³/d gas

_____ m³/d sand and water (S&W)

Will erosion be a concern? _____ Cause: _____

External coating? Yes type _____ No

Internal coating? Yes type _____ No

Delivery requirements: _____

Special shipping, packing and storage instructions: _____

Casing Program	Top Joint in String			Total String Hanging WT daN (lbs)	Bit Size mm (in)
	Size (OD)	kg/m (lb/ft)	Grade		
Conductor	_____	_____	_____	_____	_____
Surface Casing	_____	_____	_____	_____	_____
Protective Casing	_____	_____	_____	_____	_____
Production Casing	_____	_____	_____	_____	_____
Tubing	_____	_____	_____	_____	_____
Completion Type: single or multiple	_____	_____	_____	_____	_____

For more information, please contact Stream-Flo at (403) 269-5531 or info@streamflo.com.

Guiding Principles

The Stream-Flo Group of Companies recognizes the importance of developing positive and long lasting partnerships with the following groups:

Customers

We desire our current and future customers to succeed and to view us as their preferred business partner. Our job is complete only when a customer is completely satisfied.

Employees

We treat our employees with fairness and respect, allowing them to develop and grow, and in turn, we earn their commitment and loyalty. Our success is dependent upon the skill, professionalism and "can do" dedication of our workforce.

Suppliers

The key to our success is the ongoing development of solid, long-term supplier relationships built on a framework of mutual benefit and trust.

Communities

The communities within which we work will benefit from our presence. We are committed to being a good corporate citizen and giving back to our communities.

The Stream-Flo Group business decisions and operations are guided by the following principles:

Health, Safety and the Environment

We will not compromise the health and safety of our employees, customers, suppliers or the public. All Company operations are conducted with safety as the top priority and with the objective to safeguard the environment.

Integrity

Every day we work hard to live up to our reputation for being honest, ethical and for doing the right thing. Our word is our commitment - we do what we say.

Quality

Our people, processes and facilities all reflect a unified commitment towards quality. We aim to do things right the first time, and if a problem occurs, we fix it.

Innovation

We lead the way by providing innovative technical solutions, products and services. Our products and services are designed with the customer in mind and are differentiated by outstanding functionality, reliability and value.

Independence

We take pride in our independent and entrepreneurial leadership structure. We chart our own course and are enabled to make the best choices.

Growth

We are committed to growing our business in a strategic and profitable manner. Continued growth leads to the long term benefit of our employees, customers, suppliers, communities and shareholders.

OUR

Stream-Flo Industries Ltd. is committed to provide premium quality products and technical services on a timely and best value basis for the benefit of our customers and employees.

MISSION





Head Office and Manufacturing Facility

4505-74 Avenue
Edmonton, Alberta, T6B 2H5
t 780.468.6789
f 780.469.7724

Canadian Sales and Marketing Office

400 Bow Valley Square One
202 - 6 Avenue SW
Calgary, Alberta, T2P 2R9
t 403.269.5531
f 403.266.3307

Stream-Flo USA
8726 Fallbrook Drive
Houston Texas
USA 77064
t 832.912.1022
f 281.653.1188

Worldwide

Canada United States Indonesia United Arab Emirates United Kingdom Algeria China

www.streamflo.com | info@streamflo.com