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对二甲苯工程及整体公用配套工程

DAC PX Complex Project

加氢裂化装置

高压钢管采购规格书

Specification For High Pressure Service Pipe

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目 录

1 总则 GENERAL

1.1 适用范围 SCOPE

本规格书是关于高压钢管的最低要求，除此以外还应满足相关标准的其他要求。

This specification is the basic technical requirement for steel pipes. Manufacturer shall comply with relative standards except this.

1.2 主要规范和标准（最新版本） STANDARDS AND CODES

除非特殊说明，应使用下列标准的最新版本。

The latest edition of the following standards and codes shall be applied unless otherwise noted.

ASTM A312 《无缝和焊接奥氏体不锈钢管 (P)》

Seamless and welded austenitic stainless steel pipes

ASTM A335 《高温用无缝铁素体合金钢管 (P)》

Seamless ferritic alloy-steel pipe for high-temperature service

ASTM A106 《高温用无缝碳钢管(P)》

Seamless carbon steel pipe for high-temperature service

ASTM A312 《无缝和焊接奥氏体/铁素体不锈钢管》

Seamless and welded ferritic/austenitic stainless steel pipe

ASTM B619 《镍铁铬钼铜合金无缝管和焊管》

Nickel-Iron-Chromium-Molybdenum-Copper Alloy Seamless Pipe and Tube

ASTM A530 《专门用途碳钢和合金钢管通用要求》

General requirements for specialized carbon and alloy steel pipe

ASTM A370 《钢制品力学性能试验方法和定义标准》

Standard test methods and definitions for mechanical testing of steel products

ANSI B31.3 《工艺管道》

Process piping

ANSI B36.10 《焊接和无缝锻钢钢管》

Welded and seamless wrought steel pipes

ANSI B36.19 《不锈钢管》

Stainless steel pipe

MSS-SP-25 《阀门、管件、法兰和活接头的标准标记系统》

Standard Marking System for Valves, Fittings, Flanges and Unions

1.3 说明 EXPLAINING

本规格书以中文版为主，英文版仅供参考。

The Chinese version of specification has precedence to their English translation which is only for reference.

2 制造 MANUFACTURE

2.1 冶炼过程由制造厂完成。钢应采用电炉＋AOD(氩氧炉精炼)或VOD(真空炉外精炼)。

Refining process shall be carried out by manufacturer. Steel shall be refined with electric furnace +AOD or VOD.

2.2 每炉都必须进行熔炼分析化学成分满足如下要求：

The heat analysis must be carried out for each furnace, chemical composition shall conform to the requirements of the following

Material	C	S	P	N	其它成份 Other chemical
321,316	0.04~0.08%	≤0.02%	≤0.03%	N/A	其他成份满足相应ASTM标准规定要求 as per relevant ASTM standards
304L	≤0.03%	≤0.02%	≤0.03%	N/A	
A106 Gr.B	≤0.25%	≤0.02%	≤0.03%	N/A	
P11	0.05~0.15%	≤0.02%	≤0.012%	N/A	
P22	0.05~0.15%	≤0.02%	≤0.02%	N/A	
2205	≤0.03%	≤0.02%	≤0.02%	0.145~0.2%	

2.3 所有钢管应为无缝钢管，并进行热加工。

Steel pipes shall be seamless and hot finished.

2.4 每根钢管长度最小为6m，且供货长度应比料单中的实际长度至少长1米。

The length required for each pipe is 6 metres minimum, furthermore the supplied length shall be 1 metre more than actual length in bill of material at least.

2.5 钢管表面的瑕点应通过修磨清除而不能用焊接修补。

The surface imperfection shall be removed with grinding and no any repair welding.

[redacted]

下表加工。

If the end of pipe is PLAIN ENDS, it shall be in accordance with ASTM A530; the [redacted] The bevel ends of pipe shall be machined according to the following table.

thickness	bevel ends
t≤22mm	ASME B16.25 Fig.2(A)
22mm<t<60mm	ASME B16.25 Fig.3(A)

2.7 钢管以热处理状态供货。奥氏体不锈钢钢管要求用酸洗、钝化处理。

Steel pipes shall be delivered after the heat treatment. Pickling and passivation are required for Austenitic Stainless Steel.

[redacted]

2.8 壁厚偏差见材审: Tolerance for wall thickness see Diff of material.

除特殊注明外，如：0～+25%，钢管的壁厚偏差应为-12.5%～+12.5%。

Unless otherwise noted, for example: 0～+25%, the wall thickness tolerance for all other pipe shall be -12.5%～+12.5%。

2.9 321S.S 的钛含量应不少于 5 倍碳含量且不大于 0.7%。

For austenitic stainless steel 321S.S, titanium content shall not less than 5 times carbon content and not more than 0.7%.

2.10 对2205双相不锈钢，其点蚀当量PREN应不低于34（PREN=%Cr+3.3%Mo+16%N）。

For duplex stainless steel 2205, PREN should not less than 34 (PREN=%Cr +3.3%Mo+16%N).

3 热处理 HEAT TREATMENT

3.1 碳钢要求正火处理，Cr-Mo 钢要求正火+回火或要求完全退火。

Normalizing heat treatment is required for carbon steel (A106B), Normalizing and tempering or full annealing are required for all Chrome-Molybdenum pipe.

3.2 321 不锈钢管加工完成后应进行固溶和稳定化热处理，稳定化温度 900℃±10℃，每 25mm 壁厚保温 2 小时（4.7min/mm），空冷。

Solution and stabilizing heat treatment are required after processing for

[redacted]

preservation of 2 hours per 25mm wall thickness (4.7min/mm), and air cooling.

3.3 双相钢应按 ASTM A790 进行固溶处理。

Solution heat treatment is required for Duplex S.S. per ASTM A790

3.4 凡热处理的部件应予以纪录并有热处理报告。

Heat treatment shall be recorded and its report is required

[redacted]

4 检查和试验 INSPECTION AND TESTING

4.1 根据 ASTM 标准，需对碳钢、合金钢和奥氏体不锈钢钢管进行成品分析。

[redacted]

Product analysis is required for Carbon Steel, Alloy Steel and Austenitic Stainless Steel according to ASTM standard.

4.2 每炉、每种钢管规格、每一热处理炉次的钢管需进行一次拉伸试验。

Tensile test shall be performed per each pipe size, heat of steel and heat treatment batch.

4.3 直径小于 2"的钢管需进行弯曲试验，直径不小于 2"的钢管需进行压扁试验。每炉、每种规格、每一热处理炉次的每种钢材必须从钢管两端取样。

[redacted]

Bending test is required for pipe smaller than NPS 2", and flattening test is required for pipes NPS 2" and larger. Specimen must be taken from both ends of pipe as per each material size, heat of steel and heat treatment batch.

[redacted]

4.4 根据 ASTM E381 规定，需对碳钢、合金钢和不锈钢钢管进行浸蚀试验。每种钢管分别按材料、规格、壁厚抽查 5%。

Carbon steel, Alloy steel and stainless steel pipe are required to be tested according to ASTM E381 etching. Etching tests shall show sound and reasonably uniform material free of injurious laminations, cracks, and similar objectionable defects. Random 5% random inspection of each material, size and wall thickness shall be performed.

[redacted]

锈钢钢管非金属夹杂物A≤1.5级、B≤2.0级、C≤2.0级、D≤1.5级且A+B+C+D≤5级。

Nonmetallic inclusions shall be spot examined at two pipes for each batch per ASTM E45: For carbon and alloy steel, nonmetallic inclusion A,B,C,D ≤ level 2.5 respectively furthermore A+B+C+D≤level 8.5; For stainless steel, nonmetallic inclusion A

[redacted]

5.

[redacted]

For austentic stainless steel and austentic/ferritic stainlss steel pipes, intergranular corrosion tests are required respectively according to ASTM A262 practice E and ASTM A923 practice C as per each lot of heat treatment, and testing is required on the sensitized condition.

[redacted]

The grain size value for S.S. pipe as ASTM E112 shall be graded ≥7

人工缺陷深度为壁厚的5%，但不能超过1mm。

All pipe are required to be ultrasonic examined at the proportion of 100% according to ASTM E213, notch shape as Fig.2(B), and notch depth shall be within 5% of wall thickness but not deeper than 1 mm.

钢管两端100mm长内外两侧，对于不锈钢管进行100%液体渗透检验，对于碳钢和合金钢管进行100%磁粉探伤。

Inside and outside of pipe ends for a length of 100mm extension only shall be tested by 100% PT for S.S. and by 100% MT for C.S and A.S.

4.6 所有钢管都要进行水压试验，对于奥氏体不锈钢管，水中的氯离子不应超过25ppm。对于碳钢和合金钢钢管，水压试验引起的管道应力为一般屈服强度的80%，对于奥氏体不锈钢钢管，水压试验引起的管道应力为一般屈服强度的70%。

Hydrostatic test is required for all pipes. For Austenitic Stainless the [redacted] chloride content in water shall be no more than 25 ppm. The stress of pipes caused by testing pressure shall be 80% of the normal yield strength carbon steel and alloy steel, and 70% for Austenitic Stainless Steel.

4.10 材料测试证书(PMI)要求：每炉或每一热处理炉批次的部件5件或少于5件全部测试；6件至200件按照5%比例且不少于5件测试，200件以上按照3%比例且不少于10件测试，若代表性取样中的任一件不合格时，应对该批次的全部组件进行检验。测试应作记录并立即标识“PMIV”。测试元素见下表。

材料	测试元素	材料	测试元素
1 1/4Cr-1/2 Mo	Cr,Mo	2 1/4Cr-1 Mo	Cr,Mo
304L	C*,Cr,Ni,		
321	Cr,Ni,Ti		

* 验证微量元素的适用方法：特殊的实验室仪器，适用的光学辐射分析仪，可追溯的钢厂合格证结合

Lots of 5 pieces or less per heat of steel or heat treat batch. For inspection lots of 5 to 200 pieces, the inspection sample shall be 5% but not less than 5 pieces. For inspection lots greater than 200 pieces, the inspection sample shall be 3% but not less than 10 pieces. If any piece from a representative sample is found to be unacceptable, the remainder of that lot shall be examined 100%. PMI testing shall be recorded and marked “PMIV” immediately.

The alloy elements to be checked are as follow:

Material	Checked Alloy	Material	Checked Alloy
1 1/4Cr-1/2 Mo	Cr,Mo	2 1/4Cr-1 Mo	Cr,Mo
304L	C*,Cr,Ni,		
321	Cr,Ni,Ti		

*

4.11 壁厚大于25mm的碳钢及合金钢管道，每炉材料应进行一组CVN冲击试验，三个试样在0°的平均冲击功不小于18J，其中最小值不小于14J。

For carbon steel and Cr-Mo steel pipe, one set of CVN impact tests is required for each heat of material for wall thicknesses over 1.0″ (25 mm). Impact energies at +32° F (0 C) must average greater than 13 ft-lbf (18 joules) per set of 3 specimens, with a minimum [redacted] value of 10 ft-lbf (14 joules).

4.12 对2205双相不锈钢，按照ASTM E562进行金相检测。铁素体含量应在40-60%。

[redacted] the content of ferrite in duplex 2205 shall be as per ASTM E562 shall be 40-60%.

5 标记和喷漆 MARKING AND PAINTING

5.1 一般规定 GENERAL

5.1.1 所有钢管都应按相应的制造标准进行标记，MSS SP-25 应作为最低导则。

All pipe shall be marked in accordance with the standard to which they are manufactured, and MSS-SP-25 shall be used as the minimum requirement.

5.1.2 用于色标和标记的涂料不得含有任何有害金属或金属盐，如锡、锌、铅、硫、铜或氯化物等在热态时可引起腐蚀的物质，且涂料应能抗盐水、热带环境或类似情况的腐蚀。

[redacted] Paint used for the color coding and marking on components shall not contain a harmful metal, or metal salts, such as tin, zinc, lead, sulfur, copper or chlorines, which cause corrosive attack on heating and shall be resistant to salt water atmosphere, tropical or similar attack.

5.1.3 印记应使用低应力凿印模，且印模应有至少 0.25mm 半径的圆头。

Marking by stamp shall be applied with low-stress hard-die stamping and a low-stress stamp [redacted] shall be round nosed with a radius of 0.25mm minimum.

5.1.4 标记必须清楚且不易毁坏。

Marking shall be clearly indicated and shall not be easily erased.

5.1.5 色标和标记绝不能用于下列部位：

Color coding and marking shall absolutely not be applied to the following locations:

钢管的内表面	Inside of pipe
螺纹	Threads
焊缝和坡口	Weld Seam and Bevels

密封面 Gasket Contact Surfaces

5.2 标记 MARKING

5.2.1 一般来说，标记应包括下列各项,且容易识别的符号。

Marking shall be carried out in general with regard to the following items using easily identifiable symbols.

[redacted]

壁厚(表号) Wall Thickness (Schedule Number)

[redacted]

材料标准和级别 Material Specification and Grade

[redacted]

[redacted]

装料号或炉号 Charge/Heat No.

[redacted]

5.2.2 其它 Others

[redacted]

Identification marks other than those listed in this Specification shall be in accordance with the individual applicable specifications and standard.

[redacted]

Small bore items which would be difficult to mark shall have stainless steel labels attached by stainless steel wire.

6 包装和运输 PACKING AND SHIPPING

[redacted]

机械损伤和海水大气腐蚀。

After inspection and test, pipe shall be completely free of water, dried and prepared for shipment. Adequate protection shall be provided against mechanical damage and atmospheric corrosion in transit.

[redacted]

closures in order to avoid damage.

6.3 运输中钢管不能有任何损坏（包括碰伤、压扁、弯曲等）。

For all pipe, no damage can be made during shipments (No bending, colliding, pressing, etc).

6.4 包装由生产厂负责。

6.5 碳钢、合金钢和不锈钢管要分开装运，不得混装。

steel (A.S) pipes, and packed respectively.

7 附表 1

料单中的缩写词

BC	bolted cover	螺栓连接的阀帽
BLE	bevel large end	大端坡口
BW	butt welding	对焊
C.A.	corrosion allowance	腐蚀裕度
CALC	calculation	计算(壁厚)
COMM. CODE	commodity code	编码
CON	concentric	同心
CS	carbon steel	碳钢
DN	nominal diameter	公称直径
DSAW	double submerged arc weld	双面埋弧焊
ECC	eccentric	偏心
EFW	electric fusion welding	电熔焊
FE	female face	凹面
FLG	flange	法兰
GRAF	graphite	石墨
GR	grade	等级
HEX	hexagonal	六角
IR	inner ring	内定位环
LR	long radius	长半径
ME	male face	凸面
NPT	national standard taper pipe thread	60° 锥管内螺纹
OCR	octagonal ring gasket	八角环形垫片
O.D.	outside diameter	外径
ID		控制内径
OR	outer ring	外定位环

OR	outer ring	外定位环
OS&Y	outside screw and yoke	明杆支架型
PBE	plain both ends	两端平口
PE	plain end	平口
PPL	Polyphenyl	对位聚苯
PSB	pressure seal bonnet	压力密封阀盖
PSE	plain small end	小端平端
R_2	55° taper pipe external thread	55° 锥管外螺纹
RF	raised face	突面
TBE	threaded both ends	两端螺纹
TEMP	temperature	温度
TFWT	tolerance for wall thickness	壁厚偏差
THR	thread	螺纹
TOE	threaded one end	一端螺纹
TRI-ECC	TRI-eccentric	三偏心
SAW	submerged arc weld	埋弧焊
SMLS	seamless	无缝的
SO	slip-on	平焊
SR	short radius	短半径
STL	stellite	司太立合金
SS	stainless steel	不锈钢
SW	socket welding	承插焊
WN	welding neck	对焊