中国石化工程建设公司
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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

高压管件、法兰采购规格书

SPECIFICATION OF HIGH PRESSURE FITTINGS

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1 总则 GENERAL

1.1 请购范围 SCOPE

本规格书是关于美标管件、法兰的最低技术要求，除应满足以下要求外，还应满足相应 ASTM 标准的其他要求。

This specification is the basic technical requirement for Fittings and Flanges. Manufacturer shall comply with relative standards except this.

1.2 规范和标准 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.

ASME B31.3	Process piping 工艺管道
ASME B36.10M	Welded and seamless wrought steel pipes 焊接和无缝锻钢钢管
ASME B36.19M	Stainless steel pipe 不锈钢钢管
API 590	American Petroleum Institute Steel Line Blanks 美国石油学会钢制管线盲板
ASME B16.5	Pipe Flanges and Flanged Fitting 管法兰与法兰配件
ASME B16.9	Factory-Made Wrought Steel Buttwelding , Fittings. 工厂制造的对焊管件
ASME B16.11	Forged Fittings, Socket-Welding and Treaded. 锻钢制承插焊和螺纹管件
ASME B16.28	Wrought Steel Butt-welding Short Radius Elbows and Returns 锻钢制对焊短半径 90° 弯头和 180° 回弯头
ASME B16.47	Large Diameter Steel Flanges 大直径钢法兰
MSS-SP-25	Standard Marking, System for Valves, Fittings, Flanges and Unions 阀门、管件、法兰和活接头的标准标记系统
MSS SP-83	Steel Pipe Unions, Socket-Welding and Threaded 承插焊和螺纹活接头

MSS SP-95	Swage(d) Nipples and Bull Plugs 异径短节和管塞
MSS SP-97	Integrally Reinforced Forged Branch Outlet Fittings - Socket Welding,Threaded and Buttwelding Ends 承插焊、螺纹和对焊加强管接头（支管台）
ASTM A106	Seamless Carbon Steel Pipe for High-Temperature Service 高温用无缝碳钢管 (P)
ASTM A335	Seamless ferritic alloy-steel pipe for high-temperature service 高温用无缝铁素体合金钢管 (P)
ASTM A312	Seamless and welded austenitic stainless steel pipes 无缝和焊接奥氏体不锈钢管 (P)
ASTM A388	Ultrasonic Examination of Heavy Steel Forgings 大型锻件超声波检验
ASTM A530	General requirements for specialized carbon and alloy-steel pipe 专门用途碳钢和合金钢公称管通用要求
ASTM A691	Carbon and Alloy Steel Pipe, Electric-Fusion-Welded for High-Pressure Service at High Temperature 高温、高压用碳素钢和合金钢电熔化焊钢管 (P)
ASTM A358	Electric-Fusion-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High-Temperature Service 高温用电熔化焊奥氏体铬-镍合金钢管 (P)
ASTM A105	Carbon Steel Forgings for Piping Applications 管道元件用碳钢锻件
ASTM A182	Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service 高温用锻制或轧制合金钢管道法兰、锻制管配件、阀门和零件
ASTM A234	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 中、高温用锻制碳钢和合金钢管道配件
ASTM A403	Wrought Austenitic Stainless Steel Piping Fittings 锻制奥氏体不锈钢管配件
ASTM A815	Wrought Ferritic, Ferritic/Austenitic, and Martensitic

Stainless Steel Piping Fittings
铁素体、铁素体-奥氏体和马氏体不锈钢管配件

ASTM B564 Nickel Alloy Forgings
镍基和金锻件

ASTM B366 Factory-Made Wrought Nickel and Nickel Alloy Fittings
工厂制锻制镍和镍合金配件

NACE MR0175 Petroleum and natural gas industries—Materials for use in H_2S-containing Environments in oil and gas production

ASTM E213 金属钢管和管子超声波检验实用规程

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 translations that are only for reference.

2 母材要求 REQUIREMENTS OF RAW MATERIAL

2.1 作为母材的钢管应采用电炉+VOD(真空吹氧脱碳精炼)或AOD(氩氧脱碳精炼)冶炼，碳钢管也可采用电炉+VD(真空脱气)。

The pipes as raw material for fittings shall be refined with electric furnace +AOD or VOD, Carbon Steel pipes can be with electric furnace + AD.

2.2 母材的化学成份应符合下表要求。

Chemical composition of raw material 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 按标准 ASTM A370 的试验方法每批钢管在两根钢管上各取一个试样进行抗拉试验，试验结果满足相应的 ASTM 标准。

Tensile test shall be performed at two pipes for each batch per ASTM A370.

2.4 每炉、每种规格、每一热处理炉次必须任选两根钢管从端部各取一个试样。直径小于 2”的管子需进行弯曲试验，直径不小于 2”的钢管需根据 ASTM A530 要求进行压扁试验。

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.

2.5 用作管件原料的管子、钢板或锻件的质量证明文件中应有超声波检测结果，否则应根据 ASTM E213/A388 标准 100%超声波检查，槽断面形状如 ASTM E213 图 2（B），人工缺陷深度是壁厚的 8%，且不大于 1.5mm。

The pipes, plates, or forgings used as raw material for fittings, shall have ultrasonic result in quality files, otherwise , shall be ultrasonic tested according to ASTM E213/A388, notch shape as Fig.2(B)Butters in the depth of 8% of wall thickness but not deeper than one(1.5) mm.

2.6 每批在两根钢管上各取一个试样进行非金属夹杂物检验：碳钢、合金钢钢管的非金属夹杂物按 ASTM E45 评级，其 A、B、C、D 类非金属夹杂物级别按其中最严重者判定，分别不大于 2.5 级，总共不超过 8.5 级；不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 ≤level 1.0,B≤level 2.0,C≤level 2.0,D≤level 1.5, furthermore A+B+C+D≤level 5.

2.7 用作母材的钢管都应经过热处理。碳钢要求正火处理； Cr-Mo 钢要求正火+回火或要求完全退火；不锈钢固溶处理。

The Heat Treatment is required for the pipes used as raw material for fittings as follows: Normalizing heat treatment is required for carbon steel (A106B), Normalizing and tempering or full annealing are required for all

Chrome-Molybdenum pipes, Solution is required for stainless steel.

2.8 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 制造 MANUFACTURE

3.1 所有碳钢部件应使用镇静碳钢。

All carbon parts shall be killed carbon steel.

3.2 所有部件表面的瑕点应通过修磨清除而不应进行补焊。

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

3.3 所有部件以热处理状态供货。奥氏体不锈钢要求进行酸洗、钝化处理，对于经过机加工的部件可以不经过酸洗只作钝化处理。

Fittings shall be delivered after the heat treatment.Pickling and passivation are required for Austenitic Stainless Steel, but machined parts can be delivered without pickling.

3.5 4 除特殊要求外，例如： XXS(min)，注明(min)的壁厚允许偏差为 0～+25%，一般管件壁厚的允许偏差为-12.5%～+2.5%。

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

3.5 管件端部要求为坡口形式,一般应符合 ASME B16.9 的要求;承插焊管件端部加工按 ASME B16.11 要求。

End of butt-weld fittings shall be finished in accordance with ANSI B16.9. The socket weld ends as per ANSI B16.11.

4 热处理 HEAT TREATMENT

4.1 对锻制、冷成型以及最终成型温度低于 750℃的碳钢管件应进行正火处理。

Normalizing heat treatment is required for forged、cold-formed Fittings or Carbon Steel Fittings which final forming temperature bellowing 750℃.

4.2 Cr-Mo 钢要求正火+回火或要求完全退火。

Normalizing and tempering or full annealing are required for all Chrome-Molybdenum fittings.

4.3 321、347、347H 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；304L,316 不锈钢管加工完成后应进行固溶热处理。

Solution and stabilizing heat treatment are required after processing for 321s.s, 347s.s, 347Hs.s Fittings. Stabilizing heat treatment shall be at a temperature 900±10℃, heat preservation of 2 hours per 25mm wall thickness（4.7min/mm）, and air cooling. Solution heat treatment is required for 304L,316 S.S.

4.4 双相钢应按 ASTM A790 进行固熔处理。

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

4.5 凡热处理的管件、法兰应予以纪录并有热处理报告。

Heat treatment shall be recorded and its report is required

5 检查和试验 INSPECTION AND TESTING

5.1 管件、法兰应逐件进行外观检查,表面不得有裂纹、伤痕等缺陷，外观应光滑，无氧化皮。

All Fittings shall be examined visually one by one. Cracks, scabs and other defects are not allowed on surface of the components.

5.2 根据 ASTM A262 方法 E 及 ASTM A923 方法 C，分别对同一热处理炉次的奥氏体不锈钢及双相不锈钢钢管在敏化状态下进行晶间腐蚀试验。

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.

5.3 按 ASTM E112 平均晶粒度测定方法，对于不锈钢管件要求晶粒度为 5～7 级。

The grain size value for S.S. pipe as ASTM E112 shall be grade5～7.

5.4 大于等于 CL1500 法兰及不小于 6”的所有管件均应按 ASTM A388 进行 100%超声波检查，槽断面形状如 ASTM E213 图 2（B），人工缺陷深度是壁厚的 8%，且不大于 1.5mm。

100% ultrasonic inspection according to ASTM A338 on flange (≥CL1500) and fittings not less than 6”,notch shape as ASTM E213 Fig.2(B) Butters in the depth of 5% of wall thickness but not deeper than 1.5 mm.

5.5 不锈钢管件(法兰除外)应按 E165 进行 100%液体渗透试验，碳钢和铬钼钢管件(法兰除外)应按 ASTM E709 进行 100%磁粉检查,检测结果均以Ⅰ级为合格。

100% liquid penetrant test according to ASTM E165 method B on stainless steel fittings whereas 100% magnetic examination for carbon steel and Cr-Mo steel fittings are required according to ASTM E709.

5.6 所有大于等于 CL1500 碳钢和铬钼钢法兰需按 ASTM A2750 进行 100%磁粉检查。所有大于等于 CL1500 不锈钢法兰需按 E165 进行 100%液体渗透检查。检测结果均以Ⅰ级为合格。

100% liquid penetrant test according to ASTM E165 method B on stainless steel Flange (≥ CL1500) whereas 100% magnetic examination for carbon steel and Cr-Mo steel flanges (≥CL1500) are required according to ASTM E165.

5.7 对碳钢管件每批应抽 3%且不小于 2 件作硬度检查，结果如不合格应加倍检验，如仍有不合格应逐件检查；对合金钢逐件作硬度检查。结果分别满足 ASTM A105、ASTM A234 的要求。

Hardness inspection for carbon steel fittings, 3% of each batch but not less than 2 pieces, shall be spot tested. If the result is not qualified, re-spot shall be made by double. There is any unqualified, test shall be made by piece; hardness test is required for all Cr-Mo steel fittings. Hardness test result shall conform to ASTM A105、ASTM A234.

5.8 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”。供货时应提供检测报告。测试元素见下表。

The inspection sample shall be 100% for inspection 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:

材料	测试元素	材料	测试元素
1 1/4Cr-1/2 Mo	Cr,Mo	321	Cr,Ni,Ti
5Cr-1/2Mo	Cr,Mo	316	Cr,Ni,Mo
9Cr-1Mo	Cr,Mo	316L	C*,Cr,Ni,Mo
304L	C*,Cr,Ni	347	Cr,Ni,Nb
304	Cr,Ni	347H	C*,Cr,Ni,Nb

* 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使用地测量敏感度的化学分析。

Suitable methods for identifying minor elements include: specialized laboratory instruments, suitable optical emission analyzers or a combination of traceable mill certificates and chemical analysis using lower measurement sensitivity.

5.9 壁厚大于 25mm 的碳钢及合金钢管件，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。试样应来自同一热处理炉。

For carbon steel and Cr-Mo steel Fittings, 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 value of 10 ft-lhf (14 joules).Specimen shall from same lot of heat treatment。

5.10 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%。试样应来自同一热处理炉。

The content of ferritic of duplex 2205 pipe as per ASTM E562 shall be 40~60%. Specimen shall from same lot of heat treatment。

6 标记 MARKING

6.1 一般规定 GENERAL

6.1.1 除本规范规定的以外,其它标识应按照相应的标准规范执行，并以 MSS SP-25 应作为最低导则。

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

6.1.2 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。

Painting material used for the color coding and stencil marking on components shall not contain an harmful metal, or metal salts, such as tin, zinc, lead, sulfur, copper or chlorides, which cause corrosive attack on heating and shall be resistant to salt water atmosphere, tropical or similar attack.

6.1.3 印记应使用低应力硬印模, 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 shall be round nosed with a radius of 0.25mm minimum.

6.1.4 标记必须清楚且不易毁坏。

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

6.1.5 色标和标记不能用于管件的内表面、螺纹、焊缝和坡口以及密封面等部位。

6.2 标记 MARKING

6.2.1 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.

公称直径	Nominal Size
壁厚（表号）	Wall Thickness (Schedule Number)
材料标准和级别	Material Specification and Grade
厂家或商标	Manufacturer's Name or Trade Mark
装料号或炉号	Charge/Heat No.
订单上的编码	Commodity Code as stated on Purchase Order

6.2.2 对难以标记的小尺寸物件,应用不锈钢丝拴不锈钢标牌的方法来标记。

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

7 包装和运输 PACKING AND SHIPPING

7.1 管件在检验和试验之后应放净水，使其干燥。应提供足够的保护措施以防止运输中的机械损伤和海水大气腐蚀。

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

7.2 管件端部处应用坚实的木头、金属或塑料档板盖上或塞住，以防损坏。

Bevel ends shall be covered or plugged with substantial wood, metal or plastic closures in order to avoid damage.

7.3 运输中管件不能有任何损坏（包括碰伤、压扁、弯曲等）。

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

7.4 包装由生产厂负责。

Packing shall be the responsibility of the manufacturer.

7.5 合金钢和不锈钢管件要分开装运，不得混装。

All stainless steel (S.S) fittings shall be kept away from alloy steel (A.S) fittings, and packed respectively.

8 附表

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
GALV	galvanized	镀锌的
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
R_C	55° taper pipe internal thread	55° 锥管内螺纹
RED	reduced	异径的
RF	raised face	突面
RJ	ring joint face	环连接面
TB	threaded bonnet	螺纹连接的阀盖
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