

其他要求和说明:

Other Requirements and Notes:

1 一般要求 / General requirements

1.1 除注明外, 所有尺寸均以英制为准。括号内标注来制尺寸作为参考

Unless otherwise specified, all dimensions shall be in US customary unit as primary unit and metric unit shown in bracket for reference

1.2 除非另有说明, 法兰螺栓孔应跨中设备中心线或其平行线

Unless otherwise indicated, all bolt holes of flange shall straddle the center line or parallel line of the equipment

1.4 除特殊注明外, 所有承压密封面粗糙度要求为Ra3.2-Ra6.4

Facing for pressure connections shall be 125-250 AARH unless otherwise specified on the drawing

2 材料/Materials

2.1 承压元件和与承压元件相焊的非承压元件材料应符合ASME Section II项目文件SPEC-ENG-MQ042, AS8K-PP-000-500530-A和MPS文件

Material of pressure and welded with pressure retaining parts shall be in accordance with ASME Section II, Project specification SPEC-ENG-MQ042, AS8K-PP-000-500530-A and Material Purchasing Specification

2.2 所有材料应提供EN10204中3.1类证书, 且需按照项目规范SPEC-ENG-MQ042的附录A进行复验

All materials shall be delivered with Certificates 3.1 acc to EN 10204 and it shall be subjected to retesting per Appendix A of SPEC-ENG-MQ042

2.3 材料按照项目文件AS8K-PP-000-500512-A进行PMI

PMI shall be performed in accordance with specification AS8K-PP-000-500512-A

2.4 所有换热管应为无缝管, 并不得拼接

All tubes shall be one piece without circumferential & Longitudinal weld seams

2.5 板材应真空脱气处理, 全镇静, 并要夹余物形状控制

Plate shall be vacuum degassed and fully killed. Inclusion shape control is required

2.6 所有板材和成形的封头应在正火或淬火+回火状态下供货。除非另有批准, 正火温度应为1650°F±25°F。正火应作为单独的热处理进行

All plates and formed heads shall be furnished in the normalized or quenched and tempered condition. The normalizing temperature shall be 1650°F ± 25°F, unless otherwise approved by Buyer

Normalizing shall be carried out as a separate heat treatment

2.7 HIC板材磷含量应不大于0.010%, 硫含量应不大于0.002%

HIC Plate material phosphorus content shall be 0.010% maximum, sulfur content shall be 0.002% maximum

2.8 板材中有意加入微量元素Co、V、Ti是不允许的。最大含量不应超过如下范围: Co-0.015%; V-0.008%; Ti-0.020%; Nb-0.020%; Niobium: 0.01%; Boron: 0.0005%

Equipment plates with deliberate additions of microalloying elements (Co, V, and Ti) are not permitted. Limits shall be: Co-0.015%; V-0.008%; Ti-0.020%; Nb-0.020%; Niobium: 0.01%; Boron: 0.0005%

2.9 附件材料的硫含量应不大于0.30%

Carbon content of forgings for equipment shall be limited to 0.30% maximum

2.10 所有承压按照ASME SA-578进行100%UT检测, 合格要求按照补充要求S1中C级

Each plate shall be 100% ultrasonically examined in accordance with ASME SA-578, supplementary requirements S1 with level C acceptance standards

2.11 碳钢焊缝及热影响区在热处理后的硬度应不超过200 HBW

The hardness of weld metal and heat-affected zones of carbon steel after stress relief shall not exceed 200 HBW

2.12 相应板材应按照项目规范AS8K-PP-000-500532-A Rev 0B中A.4.2条要求进行HIC试验

The plate shall be tested for resistance to HIC according to A.4.2 in project specification AS8K-PP-000-500532-A Rev 0B

2.13 所有SA-106 Gr.B, SA-105H, SA-266 Gr.2H 材料应正火+细晶粒状态供货

The all material of SA-106 Gr.B, SA-105H, SA-266 Gr.2H shall be supply with normalized and Fine grain practice

3 制造与检验/Fabrication and inspection

3.1 设备的制造与检验应符合项目规范AS8K-PP-000-500530-A的要求

Fabrication and inspection shall confirm to the requirements of ASME code and Project specification AS8K-PP-000-500530-A

3.2 设备的制造公差应按照ASME VIII-1, API-660 和 TEMA R级中严格的执行。对于外压设备筒体的椭圆度应按照ASME VIII-1 UG-80执行

Most Stringent tolerances out of ASME Sec VIII Div.1, API-660 and TEMA Class-R shall be applicable and followed. The out-of-roundness of shell with external pressure shall be inspected according to UG-80

3.3 开孔和附件: 包括补强板和垫板, 到焊缝的间隔应至少2英寸。经买方批准, 如果无法满足以上要求, 则在接管或附件焊接至换热器之前, 应将焊缝打磨平整, 并对开孔两侧4英寸的距离或附件覆盖的全长加上两侧4英寸的距离进行RT检测

Openings and attachments (including reinforcing and support pads) shall clear weld seams by at least 2 inches. Subject to approval of the purchaser, if this construction is not possible, the seam weld shall be ground flush and radiographed for a distance of 4 inches on either side of the opening or for the full length covered by an attachment plus 4 inches on both sides prior to welding the nozzle or attachment to the exchanger

3.4 碳钢椭圆封头应整板冷成形, 成形后进行正火处理。正火处理周期和温度应严格按照EN207122-03-WCE-0002 热处理程序。椭圆封头形状偏差还应满足UG-81 b) 的要求, 最大的成型偏差为3.1mm

The ellip head shall be of clad-formed by one piece, and to be normalized after clad-forming. Normalizing cycle and temperature detail for PFHT process shall be as per EN207122-03-WCE-0002 Heat Treatment Procedure. The forming shape tolerance of ellipsoidal head shall meet the requirement of UG-81 b), the maximum permissible deviation e of ellip head is 3.1mm

3.5 除非已表明, 接管应与容器内表面轮廓齐平, 其接管端部应打磨呈最小5mm的圆角

Unless specified otherwise, nozzles shall finish flush with the internal contour of the vessel. All inside edges of nozzle shall be radiused to 5 mm minimum

3.6 补强圈应至少有一个NPT 1/8英寸的试验孔, 位于距离换热管轴至少45度的位置。本要求适用于每个补强圈或补强圈的每一部分。在对换热管进行压力测试之前, 应对每个补强圈或补强圈的每一部分的焊缝应通入15psi的压缩空气进行空气和肥皂泡试验。试验孔应保持打开状态, 以便在压力试验期间用作信号孔

Reinforcing pads shall have at least 1 test hole, tapped 1/8 inch minimum pipe thread, located at least 45 degrees off the longitudinal axis of the exchanger. This requirement applies to each pad or segment thereof. The welds of each pad or segment shall be tested pneumatically to 15psi air-and-soap solution test before pressure testing the exchanger. Test holes shall be left open for use as tell tale holes during the pressure test

3.7 所有承压紧固件上紧应按照项目文件4WPI-670210进行

All tightening of pressure fastener shall be according to the specification 4WPI-670210

3.8 换热管孔板槽应去除毛刺的90度直角, 并与管孔保持同轴

TUBE HOLE GROOVES SHALL BE SQUARE EDGED, CONCENTRIC AND FREE FROM BURRS

3.9 换热管的强度减薄率应按照API 660 表8, 不得超过3%

MAXIMUM ALLOWABLE TUBE WALL THICKNESS REDUCTION SHALL BE 8% AS PER TABLE 8 OF API-660

3.10 所有换热管孔均按管板上相等的台阶应不小于1.5mm

DISTANCE BETWEEN EDGE OF TUBE HOLES AND EDGE OF ALL GASKET GROOVES (INCLUDING PP GROOVES) SHALL NOT BE LESS THAN 1.5 MM

3.11 所有U形管弯制后, 压扁率不得超过换热管外径的10%

FLATTENING TOLERANCES AFTER BENDING OF U-TUBES SHALL NOT EXCEED 10 % OF THE TUBE OUTSIDE DIAMETER

3.12 所有双相U形管管段应在圆滑过渡处处理。热处理应采用电加热的方式。其工艺程序须经交业主批准。加热炉加热的方式是不允许的

Tube U-bends for duplex SS shall receive post bend solution annealing heat treatment. Heat treatment shall use electric resistance methods, and the procedure shall be submitted to Buyer for approval. Furnace heat treatments are not allowed

4 焊接/Welding

4.1 设备的焊接程序和焊工资质应符合ASME IX以及项目文件AS8K-PP-000-500550-A和4WEC-1051的要求

Welding procedure qualification and welders' performance qualifications shall confirm to the requirements of Section IX of the ASME Code and Project specification AS8K-PP-000-500550-A and 4WEC-1051

4.2 所有承压焊接接头及应采用全截面焊接接头形式

All holding pressure welding joints shall be full penetration weld

4.3 对接焊缝应在背面清根后再进行焊接, 不能清根时应采用氩弧焊打底

All butt welded joints shall be back chipped and welded. Wherever back chipping is not possible root run shall be welded by GTAW

4.4 未注角焊缝焊脚高度为较薄板厚度

The fillet weld height not dimensioned shall be equal to the thickness of thinner plate

4.5 除特别说明外, 所有焊缝均为连续焊

Unless specified, all welds shall be continuous

4.6 禁止使用不可拆卸的焊接背部垫板

Non-removable welding backing strips or rings are prohibited

4.7 换热管与管板的焊接应满足项目规范AS8K-PP-000-500530-A Rev 0中7.0条要求

The article 7.0 of the Project specification AS8K-PP-000-500530-A Rev 0 shall apply to tube-to-tubesheet welding

4.8 换热管与管板之间的焊接应采用GTAW工艺, 并添填充金属。焊喉, 最小焊喉厚度, 不得小于换热管壁厚

Tube-to-tubesheet welds shall be made using the GTAW process with the addition of filler metal. The weld throats (minimum leak paths) shall not be less than the thickness of the tube wall

4.9 换热管与管板开两道焊缝, 第二道焊缝的起焊点应错开180°, 焊接完成后应对焊接接头进行100%PT检测, 合格后再进行底接。底接完成后应进行100%PT检测

Tube-to-tubesheet joints shall be welded in two welding layers, the start arc welding point for layer shall be staggered 180 degrees, and the final layer shall be examined by 100% PT. After the test, expansion should be performed. 100% PT shall be performed after expansion

4.10 所有焊接接头表面均应按照Magne-Gage或Fischer Ferite进行铁素体检测, 按照AWS A4.2进行校准。每1.7m 5英尺, 长度最少检测3个点。每条焊接接头铁素体含量的平均值应为30%至70%

The ferrite content of all accessible completed external surfaces of production welds shall be checked using either a Magne-Gage or Fischer Ferite Scope calibrated in accordance with AWS A4.2. A minimum of three tests shall be made on each 1.7 m (5 feet) of weld. The average value of the tests on each weld shall be 30-70% ferrite

4.11 设备制造完成后, 对每种焊接工艺的焊缝应进行至少一组硬度检测。每组检测应包含焊缝两侧母材、热影响区及焊缝金属5个点。检测点焊缝余高应磨平。硬度检测必须用HV10方法。其余硬度检测的要求应符合AS8K-PP-000-500550-A Rev 0B中11.2条

On the finished vessel a minimum of one hardness test set is required per weld procedure. A set of hardness readings shall consist of at least five measurements including measurements of 1) the base metal on both sides of the weld, 2) the heat-affected zone (HAZ) on both sides of the weld, and 3) the weld metal. The weld profile shall be ground flat across the weld to perform the tests. The hardness must be measured using theHV10 method. The other requirement of hardness test shall comply the item 11.2 of AS8K-PP-000-500550-A Rev 0B

4.12 低合金钢焊缝金属和热影响区热处理后硬度应不超过230HB

The hardness of weld metal and heat-affected zones of low-alloy steels after stress relief shall not exceed 230 Brinell hardness

4.16 内衬焊缝表面应尽量磨平以减少应力集中, 并进行湿荧光磁粉检测

The inside weld surfaces of pressure equipment shall have the weld reinforcement as smooth and as nearly flush as possible to reduce stress risers, and to facilitate Wet Fluorescent Magnetic Particle Testing (WFMT)

4.17 所有内部附件焊缝应为至少两道的全焊缝对接焊缝。所有外部附件焊缝若不是全焊缝的, 应设置排气孔

All internal attachment welds shall be full penetration butt welds with a minimum of two passes. All external attachment welds that are not full penetration shall be vented

5 无损检测/Nondestructive examination

5.1 所有NDE应满足项目文件AS8K-PP-000-500550-A的要求第10条的要求

NDE requirements shall meet the article 10 of Project specification AS8K-PP-000-500550-A

5.2 设备主体的无损检测要求见“无损检测表”

The NDE requirement of main parts according to table "NONDESTRUCTIVE EXAMINATION"

5.3 所有无损检测 NDE: 应满足以下要求: a) 焊接后至少48小时内不得进行 (a); b) 焊后热处理 PWHT: 后进行

All nondestructive examination (NDE) shall: a) Not be performed until at least 48 hours after welding and b) Be performed after postweld heat treatment (PWHT)

5.4 所有板材制成的接管及管件, 其焊缝应进行100%RT检测

Welded fittings (nozzles, etc.) made from plate shall be 100% RT examined at the fitting fabricator's shop

5.5 应在焊后热处理前对高应力附件 (如吊耳) 进行射线照相或超声波检查, 焊后热处理后应进行磁粉或渗透检测 (不允许有裂纹)

Highly-stressed attachments, such as lifting lugs, shall be radiographed or ultrasonically checked before post-weld heat treatment and magnetic particle inspection after post-weld heat treatment. No crack indication is allowed

5.6 设备焊制完成后, 其上所有形式的焊接接头均应进行100%PT检测

All accessible completed production welds shall be examined by PT. PT examination (100%) is required of butt, seal, fillet, socket, weldolet and branch welds and at all pipe support connection welds

5.7 壳程的所有碳钢焊接接头内表面应进行100%湿荧光磁粉检测

For shell side, all internal welds surfaces (including Process Nozzle, Auxiliary nozzle attached to process nozzle) of carbon steel shall be 100%WFMT (Wet Fluorescent Magnetic Particle Testing) examined

6 试验/Testing

6.1 在压力试验期间, 工艺管口使用的垫片可由供应商选择通用类型, 但对于人孔或带法兰盖的管口, 垫片应与正式垫片的类型相同。试验后, 当接头因任何原因被拆开后, 应更换新的正式垫片并重新水压试验

The gaskets used during pressure testing for process piping connections may be of a generic type, but for the connections that service gasket is supplied, shall be the same type as the service gaskets. When equipment is dismantled for any cause, it shall be reassembled with the new gaskets of the same type & material and re-hydrotested

6.2 用于水压试验的水应为淡水, 软化水或可溶氯化物含量小于50ppm。按设计和工艺的使用水

Water used for hydrostatic testing shall be condensate, demineralized, or potable with a soluble chloride content of less than 50ppm by volume

6.3 水压试验用水温度应为62.6°F (17 °C) 到118.4°F (48 °C) 之间

The minimum temperature of the fluid used for hydrostatic test shall be 62.6 °F (17 °C) to 118.4 °F (48 °C)

6.4 所有补强圈上的焊缝应在水压试验前进行气密试验

The welds of each reinforcing pad shall be given an air-and-soap solution test before pressure testing the exchanger

6.5 底接完成后, 水压试验前, 应对换热管与管板连接头进行氦检漏试验。试验时壳程通入低压氦气, 壳程与管板压差至少为1bar。最大允许泄漏率为1x10⁻⁵ bar cm³/s

Helium leak test of tube-to-tubesheet joint integrity after final expansion of the tubes before pressure test. The shell side of the exchanger shall be pressurized with low pressure helium. The pressure difference between the pressurized shell side and tube side of the exchanger shall be at least 1 bar. The maximum allowable leak rate of helium or halogen shall be 1x10⁻⁵ standard cubic centimeters per second (0.76x10⁻⁵ for liters per second) at a minimum pressure difference of 1 bar

6.7 试验后, 应彻底干燥换热器。不允许通过蒸发进行热空气烘干

Exchangers shall be thoroughly dried after testing. Hot air drying by evaporation is not permitted

7 表面处理/Surface treatment

7.1 设备的表面处理按照项目文件AS8K-PP-000-500520-A 和油漆工艺

Surface preparation and painting shall be carried out per Air Products specification AS8K-PP-000-500520-A and Painting procedure

7.2 装运前, 热交换器应无异物。每个换热器的内部和外部均应彻底清洗, 且应无油脂、焊飞溅物、氧化皮、熔渣、铁锈和其他异物

Heat exchanger shall be free of foreign matter prior to shipment. Each exchanger shall be thoroughly cleaned inside and outside, and shall be free of grease, weld spatter, scale, slag, rust, and other foreign matter

7.3 所有紧固件螺栓应涂金属基防水润滑油, 以防止试验、运输、储存过程中应腐蚀

Threads of bolts including exposed parts shall be coated with a metallic base waterproof lubricant to prevent aqueous corrosion during testing, shipping, and storage

7.4 删除 DELETE

8 包装、标记和运输/Packing, Marking & Shipping

8.1 设备、备件和松散件的运输准备应符合项目文件4WCH-10001 的相关要求

Preparation for shipping of equipment, spares, and any loose items shall be in accordance with Air Products specifications 4WCH-10001

8.2 所有补强圈上试验孔及其它板板上通气孔, 应在压力试验后, 运输前用油漆封堵

All test holes on reinforcing pad and vent on other pad shall be filled with grease after pressure test and prior to shipment

8.3 换热器应使用0.34 barg (5 psig) 干燥无油空气或氮气, 露点为-40°C或更低, 且含氧量<5mg/m³。开口应正式垫片及全螺栓连接进行密封, 以保持运输压力

Vessels shall be pressurized with 0.34 barg (5 psig) of dry, oil-free air or nitrogen, with a dew point of -40°C or lower and a total oil content (aerosol, liquid, vapor) < 5mg/m³. Openings shall be fully bolted in conjunction with service gaskets, to hold the shipping pressure

8.4 充氮的设备应在每个盲板连接处贴上警告通知, 清楚地表明该装置是用空气或氮气加压的

Equipment that has been pressurized for shipping shall carry a warning notice at each blinded connection clearly indicating that the unit is pressurized with either air or nitrogen

8.5 所有临时盲板和螺栓应涂上发光黄色RAL 1026或类似涂料

All temporary shipping plugs, metal or plywood cover plates and bolting shall be painted luminous yellow RAL 1026 or similar

8.6 运输时, 临时垫片是不允许的

Temporary shipping Gaskets are prohibited

9 其它/Others

9.1 建造、调试和开车备品备件

-垫片: 200%

-容器法兰及带法兰盖的管口用螺栓/螺母/垫圈: 10% 至少2套

-Spare parts for construction, commissioning, and start-up

-Gaskets for girth flanges and blinded nozzles: 200%

-Stud bolts/nuts for girth flanges and blinded nozzles: 10% (min 2 sets)

9.2 将来可按API 660 4.11, 7.5.2.5和7.7.15, 对设备法兰及管板密封面进行再次加工

Future Machining allowance shall be provided as specified in API-660 clause nos. 7.4.11, 7.5.2.5 and 7.7.15

9.3 As per API-660 Clause no. 9.1.2, For removable-bundle heat exchangers, the permissible out-of-roundness of a completed shell, after all welding and any required heat treatment, shall allow a metal template to pass through the entire shell length without binding. The template shall consist of two rigid disks (each with a diameter equal to the diameter of the transverse baffle or support plate) rigidly mounted perpendicularly on a shaft and spaced not less than 300 mm (12 in.) apart

9.4 Threads and gasket surfaces shall be suitably protected from excessive oxidation during heat treatment

9.5 A maximum of two complete PWHT cycles is permitted for each weld. Further PWHT cycles shall not be carried out without Buyer's approval

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9.6 The reduced PWHT temperature ranges permitted by Table UCS-56.1 of Section VIII, Div. 1 in Table PW-39.1 in Section I shall not be used unless otherwise approved by Buyer. They shall not be used when PWHT is required for process or service conditions or for Cr-Mo steels

9.7 PWHT Temperature shall be continuously recorded. A chart of the heating, soak and cooldown while at temperature above 500°F (260°C) is required. Time intervals shall be recorded with temperature and time intervals clearly indicated. The chart shall be signed by the operator of the furnace and shall be reviewed by Buyer

9.8 After shell and tube side heat treatment, the hardness of weld metal shall not exceed 200 HBW, and the hardness test requirements shall meet the article 11.2 of Project specification AS8K-PP-000-500550-A Rev 0B

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9.19 PWHT Temperature shall be continuously recorded. A chart of the heating, soak and cooldown while at temperature above 500°F (260°C) is required. Time intervals shall be recorded with temperature and time intervals clearly indicated. The chart shall be signed by the operator of the furnace and shall be reviewed by Buyer

9.20 After shell and tube side heat treatment, the hardness of weld metal shall not exceed 200 HBW, and the hardness test requirements shall meet the article 11.2 of Project specification AS8K-PP-000-500550-A Rev 0B

9.21 As per API-660 Clause no. 9.1.2, For removable-bundle heat exchangers, the permissible out-of-roundness of a completed shell, after all welding and any required heat treatment, shall allow a metal template to pass through the entire shell length without binding. The template shall consist of two rigid disks (each with a diameter equal to the diameter of the transverse baffle or support plate) rigidly mounted perpendicularly on a shaft and spaced not less than 300 mm (12 in.) apart

9.22 Threads and gasket surfaces shall be suitably protected from excessive oxidation during heat treatment

9.23 A maximum of two complete PWHT cycles is permitted for each weld. Further PWHT cycles shall not be carried out without Buyer's approval

9.24 The reduced PWHT temperature ranges permitted by Table UCS-56.1 of Section VIII, Div. 1 in Table PW-39.1 in Section I shall not be used unless otherwise approved by Buyer. They shall not be used when PWHT is required for process or service conditions or for Cr-Mo steels

9.25 PWHT Temperature shall be continuously recorded. A chart of the heating, soak and cooldown while at temperature above 500°F (260°C) is required. Time intervals shall be recorded with temperature and time intervals clearly indicated. The chart shall be signed by the operator of the furnace and shall be reviewed by Buyer

9.26 After shell and tube side heat treatment, the hardness of weld metal shall not exceed 200 HBW, and the hardness test requirements shall meet the article 11.2 of Project specification AS8K-PP-000-500550-A Rev 0B

9.27 As per API-660 Clause no. 9.1.2, For removable-bundle heat exchangers, the permissible out-of-roundness of a completed shell, after all welding and any required heat treatment, shall allow a metal template to pass through the entire shell length without binding. The template shall consist of two rigid disks (each with a diameter equal to the diameter of the transverse baffle or support plate) rigidly mounted perpendicularly on a shaft and spaced not less than 3