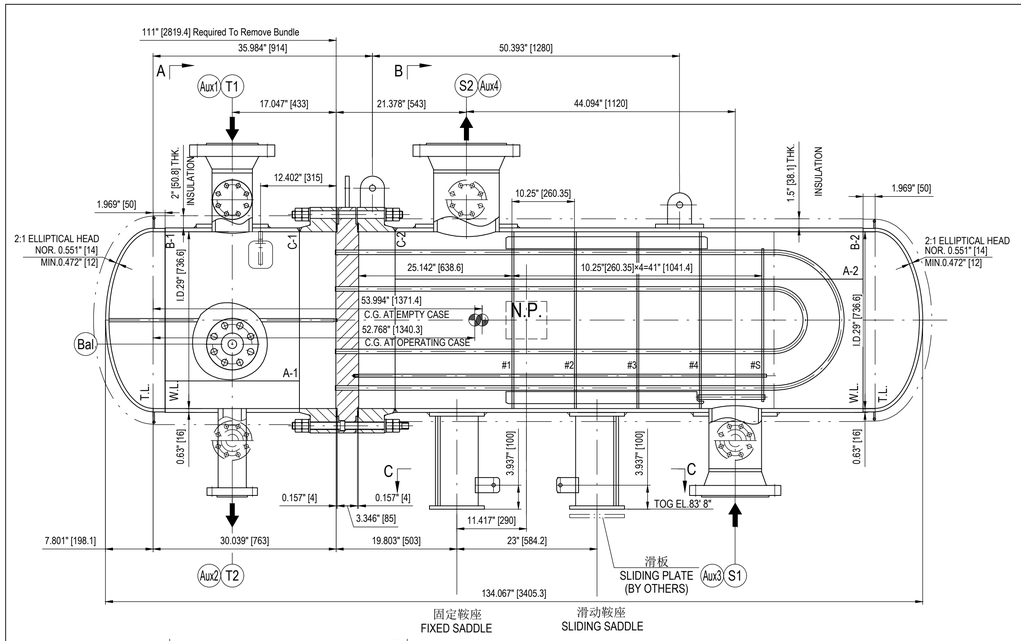
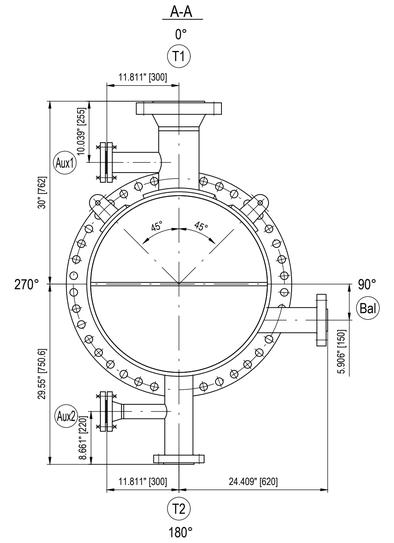
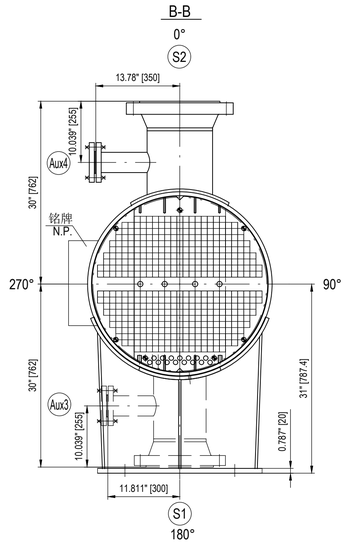
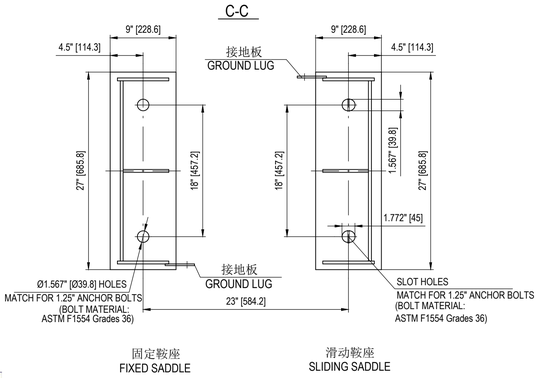
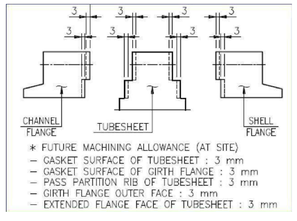
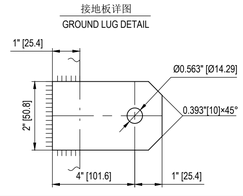












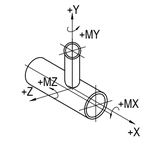
设计,制造,检验与验收数据表
DATA SHEET OF DESIGN,FABRICATION,INSPECTION & ACCEPTANCE

设计,制造,检验与验收标准 STANDARDS OF DESIGN,FABRICATION ,INSPECTION & ACCEPTANCE	设计数据 DESIGN DATA		
1. ASME SECTION VIII DIV.1 2021 ED. 2. TEMA Tenth Edition CLASS R 3. API660-2020.	名称 DESIGNATION	壳 程 SHELL SIDE	管 程 TUBE SIDE
	换热器型式 EXCHANGER TYPE(TEMA)	BEU	
	传热面积 HEAT TRANSFER SURFACE AREA ft²[m²]	568.11 [52.78] Effective	
	DESIGN DUTY	6.215 MM Btu/hr	
	设计压力(内压/外压) DESIGN PRESSURE (INT/EXT) psig[barg]	180 [12.41]@330°F 15 [1.034]@300°F	232 [16.0]@430°F 15 [1.034]@400°F
	工作压力(NORMAL) OPERATING PRESSURE psig[barg]	98.5 [6.79]	50.0 [3.45]
	最大允许工作压力 MAWP(INTERNAL) psig[barg]	400.8 [27.62] (Limited by nozzle flange)	477.8 [32.92] (Limited by head)
	最大允许工作压力 MAWP(EXTERNAL) psig[barg]	15 [1.034]	15 [1.034]
	最大允许压力 MAP psig[barg]	594.1 [40.93] (Limited by tubesheet)	594.1 [40.93] (Limited by tubesheet)
	设计温度 DESIGN TEMPERATURE °F[°C]	330 [165.6] 300 [148.9]@-15 PSIG	430 [221.1] 400 [204.4]@-15 PSIG
	工作温度(进/出) OPERATING TEMPERATURE(IN/OUT) °F[°C]	244.6 [181.1]/ 250.1 [121.2]	328.2 [164.6]/ 297.1[147.3]
	最低设计金属温度 MDMT °F[°C]	32 [0] @400.8 PSIG	32 [0] @478.7 PSIG
	工作介质 OPERATING FLUID	Hydrocarbons	MP Steam
	介质特性 VESSEL SERVICE	FLAMMABLE	/
	湿H2S工况 WET H2S SERVICE	NA	NA
	氢工况 HYDROGEN SERVICE	NA	NA
	介质致死工况 FLUID LETHAL SERVICE	非致死/Nonlethal	非致死/Nonlethal
	介质密度 DENSITY OF FLUID lb/ft³[kg/m³]	33.06[529.6] liquid 1.355[21.7] vapour	57.476[920.7] liquid 0.14;32.286] vapour
	腐蚀裕量 CORROSION ALLOWANCE In.[mm]	0.125 [3.175]	0.125 [3.175] (SEE NOTE 1)
	焊接接头系数(筒体/封头) JOINT EFFICIENCY (SHELL/HEAD)	1.0/1.0	0.85/1.0
	容 积 CAPACITY ft³[m³]	23.06 [0.653]	21.33 [0.604]
	冲击试验 IMPACT TEST	不需要/NO	不需要/NO
	程数 NUMBER OF PASSES	1	2
	换热管与管板的连接 TUBE-TO-TUBESHEET JOINT	强度胀+密封焊 Expanded and Seal Welded	
	换热管间距/排列方式/数量 PITCH/PATTERN/NO.	1" [25.4] / 90° / 262U	
	换热管外径/壁厚/直段管长 TUBE O.D./WALL THK./LENGTH	0.75" [19.05] / 0.083"[2.11](MW thk.) / 72" [1828.8](直段)	
	焊后热处理 POST-WELD HEAT TREATMENT	不需要/NO	不需要/NO
	成型后热处理 POST FORMING HEAT TREATMENT	需要/YES 仅对:S/SHELL HEAD ONLY	需要/YES 封头和U型管 CHANNEL HEAD & U-BEND
	保温类型/厚度 INSULATION TYPE/THK In.[mm]	IH/1.5[38.1]	IH/2.0[50.8]
	防火类型/厚度 FIREPROOF MATERIAL/THK In.[mm]	NA	NA
	油漆系统号 PAINT SYSTEM CODE	6	6

NB REGISTRATION	YES
ASME CERTIFICATE	YES (With U Designator)

Note 1: 1/4" (6.35mm) on tubesheet, 0 on tubes

管口载荷表 NOZZLES LOADS LIST



NOZZLE	NPS	FORCES (UNIT: Lbf)			MOMENTS (UNIT: Lbf-ft)		
		FY	FX	FZ	MX	MZ	MY
S1	8 " (2×150#)	2080	2600	2600	5160	6560	8340
S2	10 " (2×150#)	2580	3240	3240	8020	10180	12960
T1	6 " (2×300#)	2800	3500	3500	5340	6760	8620
T2	3 " (2×300#)	1060	1340	1340	1080	1360	1720
Bal	2 " (2×300#)	720	900	900	500	640	800

FLAMMABLE SERVICE (SHELL SIDE)

SADDLE	FIXED	SLIDING	TOTAL
EMPTY WEIGHT (lbf)	6621	1459	8080
OPERATING WEIGHT (lbf)	8771	1279	10050
TEST WEIGHT(FIELD) (lbf)	8631	2194	10825
TEST WEIGHT(SHOP) (lbf)	8532	2168	10700

MAXIMUM FOUNDATION LOADING DATA (ASD)

		FIXED SADDLE		SLIDING SADDLE	
		EMPTY	OPERATING	EMPTY	OPERATING
WIND LOAD	TRANSVERSE SHEAR (lbf)	194.04	194.04	194.04	194.04
	TRANSVERSE BENDING (lbf-ft)	501.27	501.27	501.27	501.27
	LONGITUDINAL SHEAR (lbf)	276.03	276.03	276.03	276.03
	LONGITUDINAL BENDING (lbf-ft)	713.08	713.08	713.08	713.08
EARTHQUAKE	TRANSVERSE SHEAR (lbf)	-	4751.9	-	692.6
	TRANSVERSE BENDING (lbf-ft)	-	12275.7	-	1789.2
	LONGITUDINAL SHEAR (lbf)	-	5444.5	-	5444.5
	LONGITUDINAL BENDING (lbf-ft)	-	14065	-	14065
Bundle pull out: @150% bundle weight		5202	/05		/05

图纸汇总表 DRAWING SUMMARY					
名称 TITLE	图号 DWG. NO.	张数 SHEET NO.	名称 TITLE	图号 DWG. NO.	张数 SHEET NO.
管口详图 NOZZLE DETAIL DRAWING	WXCE6713-03	1/1	水压工装图 TEST RING DETAIL DRAWING	WXCE6713-08	1/1
管束详图 BUNDLE DETAIL DRAWING	WXCE6713-02	1/1	运输及吊装图 SHIPPING AND LIFTING DETAIL DRAWING	WXCE6713-07	1/1
壳体图 SHELL DETAIL DRAWING	WXCE6713-01	1/1	保温支撑图 INSULATION SUPPORT DETAIL DRAWING	WXCE6713-06	1/1
装配图 II GENERAL ASSEMBLY DRAWING II	WXCE6713-00	2/2	铭牌图 NAMEPLATE DETAIL DRAWING	WXCE6713-05	1/1
装配图 I GENERAL ASSEMBLY DRAWING I	WXCE6713-00	1/2	鞍座及吊耳详图 SADDLE AND LIFTING LUG DETAIL DRAWING	WXCE6713-04	1/1

扭矩表 TORQUE TABLE		
部件 PART	螺栓规格 BOLT SIZE	扭矩(lbf-ft) TORQUE
CHANNEL FLANGE AND SHELL FLANGE TO TUBESHEET	1-1/8"	1003
NOZZLE Aux1-4	5/8"	90

MATERIAL				
CHANNEL		SKID BARS/RAILS		SA-516 Gr.70N
CHANNEL HEAD	SA-516 Gr.70N	IMPINGEMENT RODS		SA-36
CHANNEL FLANGE	SA-266 Gr.2N	SPACERS		SA-179
CHANNEL SHELL	SA-516 Gr.70N	EXTERNAL ATTACHMENTS		SA-516 Gr.70N
NOZZLE NECK	SA-106 Gr.B	EXTERNAL BOLTING/ NUT		SA-193 Gr.B7/ SA-194 Gr.2H
NOZZLE FLANGE	SA-105N	INTERNAL BOLTING/ NUT		-/SA-194 Gr.4
PASS PARTITION	SA-516 Gr.70N	SUPPORTS		SA-516 Gr.70N
SHELL		SLIDING PLATE		NA
SHELL AND SHELL HEAD	SA-516 Gr.70N	ANCHOR BOLTS		ASTM F1554 Gr.36 (by others)
SHELL FLANGE	SA-266 Gr.2N	SHELLSIDE GASKET		SEE NOTE 1
NOZZLE NECK	SA-106 Gr.B	TUBESIDE GASKET		SEE NOTE 1
NOZZLE FLANGE	SA-105N	EARTHING LUG		SS.304
TUBE BUNDLE		NAMEPLATE		SS.304
TUBES	SA-179 (Seamless)	NAMEPLATE BRACKET		SA-516 Gr.70N
TUBESHEETS	SA-266 Gr.2N	COLLAR BOLTS (INTEGRAL):		SA-193 Gr.B7
BAFFLES	SA-516 Gr.70N	JACK SCREW / DOWEL PIN		SS.304
TIE / SEAL RODS:	SA-36	NOTE1: KAMMPROFILE TYPE (GROOVED SS316L) METAL GASKET WITH GRAPHITE FACING.		
SLID. RAIL	SA-516 Gr.70N			

PROJECT SPECIFICATION			
NO.	DOC. NO.	DESCRIPTIONS	Rev
1	A8KM-PP-000-200001-A	Plant Site Data Sheet	0B
2	A8KM-PP-000-400002-A	Structural Data for Mechanical Equipment General	0
3	A8KM-PP-000-500005-A	Design of Lifting Component for Mechanical Equipment	0
4	A8KM-PP-000-500510-A	Hot Insulation	0C
5	A8KM-PP-000-500520-A	Painting	0D
6	A8KM-PP-000-500512-A	Positive Material Identification - PMI	0
7	A8KM-PP-000-500550-A	Welding-NDE Requirements for Equipment	0B
8	A8KM-PP-000-50720-A	Shell and Tube Heat Exchangers	0
9	A8KM-PP-000-530400-D	Expanded Metal Personnel Protection Details for Shell and Tube Exchangers	B
10	SPEC-MED-DOC001	Design Basis for Mechanical Equipment	0
11	4WPI-670210	Bolt-Up Procedure for Flanged Connections	5
12	Form 8232	Flanged Joint Assembly Record and Tightening Sequence	
13	SPEC-ENG-DOC001	Supplier-Designed, Shop-Fabricated Pressure Equipment	0
14	SPEC-ENG-DOC002	Shell & Tube Heat Exchanger	0
15	SPEC-ENG-MQ057	Mechanical Equipment Gaskets	1
16	4WGN-10001	Shipment and Packing Specification for Equipment and Materials being Exported Directly by Vendors	6
17	4WEQ-1051	Welding of HyCO Plant Equipment	0
18	SPEC-ENG-MQ042	Material Certification and Retesting Requirements	0

管口表 NOZZLE SCHEDULE

符号 MARK	数量 QTY.	公称尺寸 NPS	壁厚等级 SCH /THK	补强圈外径x厚度 REIN. PAD O.D.X THK	公称压力 RATING	连接标准,法兰型式/密封面 CONNECTING STD./ TYPE	法兰密封面到设备中心线长度 PROJECTION FROM VESSEL C.L. TO FLANGE FACE	用途或名称 SERVICE	备 注 REMARKS
S1	1	8 "	0.5" [12.7]	Ø13.78"×0.63" [Ø350×16]	CL300	ASME B16.5-2017 WN/RF	30" [762]	SS INLET	
S2	1	10 "	0.594" [15.09]	Ø16.732"×0.63" [Ø425×16]	CL300	ASME B16.5-2017 WN/RF	30" [762]	SS OUTLET	
T1	1	6 "	0.562" [14.27]	Ø11.811"×0.63" [Ø300×16]	CL600	ASME B16.5-2017 WN/RF	30" [762]	TS INLET	
T2	1	3 "	0.803" [20.4]	--	CL600	ASME B16.5-2017 LWN/RF	29.55" [750.6]	TS OUTLET	
Bal	1	2 "	1.067" [27.1]	--	CL900	ASME B16.5-2017 LWN/RF	見图/SEE DWG	PRESS. BAL	
Aux1 Aux3-4	3	2 "	0.654" [16.6]	--	CL300	ASME B16.5-2017 LWN/RF	見图/SEE DWG	AUXILIARY	With BF & Gasket & Bolt &Nut & Washer
Aux2	1	2 "	0.218" [5.54]	--	CL300	ASME B16.5-2017 WN/RF	見图/SEE DWG	AUXILIARY	With BF & Gasket & Bolt &Nut & Washer

无损检验 NONDESTRUCTIVE EXAMINATION

焊接接头型式或焊缝编号 JOINT TYPE OR WELD SEAM NO		焊接接头系数 JOINT EFFICIENCY	射线探伤 R.T 检测比例 EXAM. RATE	射线探伤 R.T 合格级别 CLASS OF ACC	超声波探伤 U.T	磁粉探伤 M.T	着色探伤 P.T	备 注 REMARKS
A,B类 CATEGORY A,B	壳程 SHELL SIDE	1.0	FULL	UW-51	/	100%	/	
	管程 TUBE SIDE	0.85	SPOT	UW-52	/	100%	/	
C类/CAT. C	壳程 SHELL SIDE 设备法兰与壳体 GIRTH FLANGE TO SHELL	1.0	FULL	UW-51	/	100%	/	
	壳程 SHELL SIDE 接管与法兰 NOZZLE TO FLANGE	/	/	/	/	100%	/	
	壳程 SHELL SIDE 接管与法兰(S2) NOZZLE TO FLANGE	/	FULL	UW-51	/	100%	/	
	管程 TUBE SIDE 设备法兰与壳体 GIRTH FLANGE TO SHELL	0.85	SPOT	UW-52	/	100%	/	
	管程 TUBE SIDE 接管与法兰 NOZZLE TO FLANGE	/	/	/	/	100%	/	
D类 TYPE D		/	/	/	/	100%	/	
吊耳焊缝 LIFTING LUG WELDS		/	/	/	100%	100%	/	
鞍座焊缝 SADDLES WELDS		/	/	/	/	100%	/	
换热管与管板的连接接头 TUBE TO TUBESHEET JOINT		/	/	/	/	/	100%	

注/NOTE:
1.应在焊后热处理前对吊耳进行超声波检查，焊后热处理后应进行磁粉检测。
Lifting lugs shall be ultrasonically checked before post-weld heat treatment and magnetic particle inspection after post-weld heat treatment.
2.无损检测要求见"其他要求和说明第5条"
For requirements of NDT, see clause 5 of "Other Requirements and Notes"

AIR PRODUCTS　FLUOR

Air Products Project Number	EN207120	Fluor Project Number	A8KM
Project Name	World Energy Renewables Project	RFQ No.	A8KM-4-403-RQ
Purchase Order Number	4505600574	PO/Contract No	A8KM-4-403-PO-2
Air Products Open Text document number	EN207120-WUXI-9V3-00029	Project Area	PRU
Client	WORLD ENERGY PARAMOUNT	Client Doc No:	

REV.	版次说明/DESCRIPTION	设计/PREPARED	审核/REVIEWED	批准/APPROVED	日期/DATE
05	供批准/ ISSUED FOR APPROVAL	Jialing Huang	Shengfang Zhao	Kevin Yang	14-Mar-23
04	供批准/ ISSUED FOR APPROVAL	Jialing Huang	Shengfang Zhao	Kevin Yang	16-Jan-23
03	供批准/ ISSUED FOR APPROVAL	Jialing Huang	Shengfang Zhao	Kevin Yang	21-Oct-22
02	供批准/ ISSUED FOR APPROVAL	Jialing Huang	Shengfang Zhao	Kevin Yang	19-Aug-22

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设计项目 DESIGN ITEM	World Energy Renewables Project		
设计阶段 DESIGN PHASE	详细设计 Detail Design		
设计 PREPARED		DEBUTANIZER REBOILER GENERAL ASSEMBLY DRAWING I	设备位号 ITEM NO. 18-X-381
审核 REVIEWED			图号 DWG. NO. WXCE6713-00
批准 APPROVED		比例: SCALE 1:1	版次: REV. 05
			第 1 页 共 2 页 PAGE 1 OF 2

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，括号外为英制尺寸，括号内为米制尺寸。
All dimensions shall be in US customary unit as primary unit and metric unit shown in bracket, unless otherwise specified.
1.2 法兰的螺栓孔应跨换热器自然中心线。
Flange bolt holes shall straddle the natural centerlines of exchanger.
1.3 公差应符合ASME第八卷第1部分、API-660和TEMA-R的要求，除非图纸另有规定，否则应采用最严格的公差。
Tolerance shall be accordance with ASME SEC VIII Div-1, API-660 & TEMA-R and most stringent shall be applied unless otherwise specified on the drawing.

2.材料/Materials
2.1受压元件和非受压元件材料应符合ASME Section II, Part A,项目文件SPEC-ENG-MQ042 和批准的MPS文件，文件编号：EN207120-MPS。
Material of pressure and non pressure retaining parts shall be in accordance with ASME Section II, Part A and Project specification SPEC-ENG-MQ042，and approved Material Purchasing Specification，Document No：EN207120-MPS
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A8KM-PP-000-500512-A及WCE的程序EN207120-WCE-0010进行PMI。
PMI shall be performed in accordance with specification A8KM-PP-000-500512-A and WCE's PMI PROCEDURE EN207120-WCE-0010.
2.4所有换热管不得拼接，所有换热管不得有纵焊缝
All tubes shall be one piece without circumferential weld seams ， All tubes shall be also without longitudinal weld seams.
2.5 垫片硬度应低于法兰接触面硬度
Hardness of gasket shall be lower than that of flange contact surface
2.6 垫片应满足项目规范SPEC - ENG - MQ057的要求
Gaskets shall comply with the requirements of SPEC - ENG - MQ057
2.7.U型管弯制后其弯管部分加150mm长直管段应进行消应力热处理。
Tube u-bends shall receive post bend Stress relief heat treatment.
2.8所有承压部件的厚度应通过超声波检测进行测量，并记录在最终档案中并可追溯到部件。包括（但不限于）所有壳体板材、封头、锻件、接管和管件。
(1)相同厚度的板材、管子仅在一个位置进行测量；
(2)对于不同厚度的锻件，应针对每个直径测量一次（比如自增强式锻管将有两次测量-一次在锻管大端厚度测量，一次在颈部测量）；
(3)标准管件应在焊接端测厚；
(4)标准法兰应在焊接端口及法兰盘处测厚.
(5)对于换热器管，制造商应测量每批的5%（每根管一个位置）
Thickness of all pressure-containing components shall be measured by UT and logged in the final dossier and traceable to the component. This includes (but is not limited to) all shell plates, dished ends, forgings, pipes & fittings.
(1)Items of consistent thickness (i.e. plates, pipe) shall be measured in one location only.
(2)Forgings with varying thicknesses shall be measured once for each diameter (i.e. SRN nozzle forging would have two measurements - one at barrel and one at neck).
(3) Standard fittings (e.g. ASME B16.9) shall be checked at the weld prep end.
(4)Standard flanges (e.g. ASME B16.5/47) shall be checked at the weld prep end and flange.
（5）For heat exchanger tubes, 5% of each lot shall be measured by the fabricator (one location per tube).

3.制造与检验/Fabrication and inspection
3.1 法兰密封面粗糙度 Ra3.2~6.3μm;
The finish of the gasket contact surface of flange facing shall be Ra125~250in;
3.2 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.
3.3 加工完后的法兰面应有充分的保护防止受损伤和污染,并涂上防锈油,需要热处理时应涂上易去除的涂层保护.。
Finished flange facings shall be adequately protected to prevent any deterioration, daub suitable rust inhibitor, for heat treatment conditions, protection shall be achieved by applying easily removable coatings.
3.4补强圈应至少有一个NPT 1/8英寸的试验孔，位于距离换热器纵轴至少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。在对换热器进行压力测试之前，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。压力试验后和装运前，应在试验孔中填充润滑脂
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. Test holes shall be filled with grease after pressure test and prior to shipment.
3.5 椭圆封头应冷成形，成形后进行消应力处理,并按护批号准备试板,试板应进行与封头相同的热处理,然后取样进行机械性能试验; 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e为3.5mm。
The ellip.head shall be of Clod-formed , and to be Stress relief after Clod-forming.Test specimens shall be extracted from the same heat as the head, and subjected to the same heat treatments done on the head, and then a mechanical test shall be carried out on it； The forming shape tolerance of ellipsoidal head shall meet the requirement of UG-81(b), the maximum permissible deviation e is 3.5mm.
3.6 管子与管板的连接应采用全强度胀，带两个凹槽，胀接长度按管束图；
Tube-to tube-sheet connection shall be full strength expansion ， with two grooves and The expansion length shall be in accordance with the bundle drawing ；
3.7 卧式容器的焊缝不得鞍座相碰。相邻纵焊缝之间的距离应大于钢板厚度的5倍或150 mm（6 in）
Weld joints in horizontal vessels shall not be located coincident with or across saddle supports. Longitudinal seam offset shall be the greater of five times the plate thickness or 150 mm (6 in).
3.8开孔和附件（包括补强板和垫板）到焊缝的间隙应至少2英寸。经买方批准，如果无法满足以上要求，则在将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.
3.9 通过气刨或热切割移除的制造辅助工具、临时支撑等，与表面的距离不得小于1/8英寸（3.2 mm）。剩余材料应与母材磨平；附件区域不得导致减薄至规定壁厚以下,焊接处应打磨光滑,并采用100%MT进行表面裂纹检测。Fabrication aids, temporary supporting lugs, etc., that are removed by gouging or thermal cutting shall not be reduced less than 1/8 inch (3.2 mm) from the surface. The remaining material shall be ground flush with the base metal; the ground area shall not result in thinning below the specified wall thickness ， the surfaces shall be ground and subjected to a surface crack examination by 100%MT after their removal.
3.10 1.5"及以上的螺栓使用液压拉伸器上紧，螺栓应具有足够的间隙和长度，以便使用液压螺栓张紧器
At and above 1.5" diameter, bolting shall be suitable for hydraulic tensioning. bolting shall have adequate clearance and length for use of hydraulic bolt tensioner
3.11 所有螺栓螺母垫圈按照项目文件4WPI-670210指定的PTFE干膜润滑剂进行润滑。
All stud bolts and nuts and waster shall be lubricated with PTFE dry film lubricant as per 4WPI-670210.
3.12 非管法兰的垫片接触面的平面度按照API 660-2020 表5的要求。
The flatness tolerances on peripheral gasket contact surfaces other than nozzle flange facings shall be measured in accordance with table 5 of API 660-2020.
3.13 螺柱每端应提供两（2）个螺母和硬化垫圈（即4个螺母和2个垫圈）
Two (2) nuts and hardened washer shall be provided for each end of the stud (i.e. 4 nuts and 2 washers)
3.14 包括外露部件在内的螺栓螺纹应涂上金属基防水润滑剂，以防止在试验、运输和储存期间发生水腐蚀
Threads of bolts including exposed parts shall be coated with a metallic base waterproof lubricant to prevent aqueous corrosion during testing, shipping, and storage
3.15 小于等于12"的接管应该是无缝的，大于12"的接管可以用板卷，板卷接管焊缝应100% RT检测；
Nozzle necks up to 12 NPS made from pipe material shall be seamless for Nozzle greater than 12 NPS made from plate & Longitudinal weld seams will be full radiographed.

4.焊接/Welding
4.1 设备的焊接规程和焊工资质应符合ASME IX以及项目文件A8KM-PP-000-500550-A 及4WEQ-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 A8KM-PP-000-500550-A and 4WEQ-1051；
4.2 承压对接焊接接头,应采用全截面焊透接头形式；接管连接焊缝、吊耳焊缝应为全熔透焊缝，非承压件与承压件之间的焊缝将是全焊透
Holding pressure butt welded joints shall be full penetration weld. Nozzle attachment welds, Lifting lug welds shall be full penetration weld. non-pressure-attachment welds to pressure parts shall use full penetration welds：
4.3 对接焊缝应在背面清根，并对清根区域进行PT检测，合格证明没有裂纹或其他缺陷后再进行焊接，不能清根时应采用氩弧焊打底。
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换热器上的所有焊接应由合格焊工根据适用的国家和地区规范进行
All welding performed on the exchanger shall be performed by qualified welders in accordance with the applicable national and regional code(s).
4.8焊接前，应目视检查接头：清洁度、正确的坡口配置、对齐和根部间隙状况、定位焊缝（如有）、预热（如有规定）和待使用的填充金属。它们应符合WPS的要求。
Prior to welding, joints shall be visually inspected for: cleanliness, correct groove configuration, alignment and root gap conditions, condition of tack welds if present, preheat if specified, and filler metal to be used. They shall be in accordance with the WPS.
4.9 待焊接表面应在外径和内径的焊缝两侧清洁1 1/2英寸（38 mm）。表面应无油漆、油、污垢、氧化皮、氧化物和其他对焊缝有害的异物。
Surfaces to be welded shall be cleaned 1 1/2 inch (38 mm) on either side of the weld on the OD and ID. Surfaces shall be free from paint, oil, dirt, scale, oxides, and other foreign material detrimental to the weld

5.预热及焊后热处理/Preheat and PWHT
5.1 预热要求应满足项目文件A8KM-PP-000-500550-A的要求第9条及4WEQ-1051及WCE的热处理程序EN207120-WCE-0002的要求
Preheating and heat treatment requirements shall meet the article 9 of Project specification A8KM-PP-000-500550-A and 4WEQ-1051 and WCE's Heat Treatment Procedure EN207120-WCE-0002
5.2 DELETE
5.3 DELETE
5.4 DELETE
5.5 DELETE
5.6 DELETE
5.7 DELETE

6.无损检测/Nondestructive examination
6.1见无损检测表/See Nondestructive examination table
6.2 所有NDE应满足项目文件A8KM-PP-000-500550-A第10条的要求及WCE的NDE程序EN207120-WCE-0004的要求
NDE requirements shall meet the article 10 of Project specification A8KM-PP-000-500550-A and WCE's NDE Procedures EN207120-WCE-0004
6.3 所有NDE应由按照ASNT推荐规程SNT-TC-1A或经买方批准的卖方自己的认证计划认证的人员进行
All NDE shall be performed by personnel certified in accordance with ASNT Recommended Practice SNT-TC-1A or Seller's own certification program that has been approved by Buyer.
6.4无损检测结果的解释应由获得二级或三级认证的人员执行
Interpretation of NDE results shall be performed by personnel certified Level II or III
6.5 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,且； 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).
6.6 所有内部和外部附件上的焊缝应圈焊。应采用液体渗透法或磁粉探伤法检查焊缝。
The welds on all internal and external attachments shall be welded all around. The welds shall be checked by means of liquid-penetrant or magnetic particle methods.
6.7 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检测。不允许有裂纹，吊耳或耳轴附件焊缝的单独试验证书应随船装运
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. A separate test certificate for the lifting lug or trunnion attachments welds shall be shipped with the equipment.
6.8 焊缝的磁粉检测应包括焊缝两侧至少一（1）英寸（25 mm）宽的母材带
MT examination of welds shall include a band of base metal at least one (1) inch (25 mm) wide on each side of the weld.
6.9 焊接坡口边缘超过2英寸范围将执行100% MT检测
Weld bevel edges over 2 inch (50 mm) shall be examined by MT
6.10 如果在磁粉探伤过程中发生电弧烧伤，应清除电弧烧伤，并用磁轭法重新检查该区域。
If arc burns occur during magnetic particle examination, the arc burns shall be removed and the area reexamined by the magnetic yoke method
6.10对于焊后热处理设备，应使用磁轭法
For PWHT'd equipment, the magnetic yoke method shall be used
6.11如果设备焊缝按照UW-52进行局部射线检测，选择检测的焊缝应能代表每种设备上使用的每种WPS的焊缝
If the equipment welds are spot radiographed in accordance with uw-52, spots shall be selected so that examination is made of welds representing each WPS utilized on each type of equipment
6.12 管程筒体与封头的焊缝RT还应满足UW-11(a)(5)(6).
RT examination of the welds between the tube side cylinder and the head shall also meet the requirements of UW-11(a)(5)(6).

7.试验/Testing
7.1 水压试验期间的金属温度应为保持至少高于最低设计金属温度30°F（17°C），但不需要超过120°F（48°C），以将脆性断裂风险降至最低。。
The metal temperature during hydrostatic test be maintained at least 30°F (17°C) above the minimum design metal temperature, but need not exceed 120°F(48°C), to minimize the risk of brittle fracture.
7.2 在压力试验期间，垫片应该与正式垫片的类型及材料相同。当设备因任何原因拆卸时，应使用相同类型和材料的新垫圈重新组装，并重新进行水压试验。
The gaskets used during pressure testing shall be the same type and material 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..
7.3 水压试验时间应保持至少一小时。
Hydraulic test shall be maintained at least 1 hour.
7.4 用于水压试验的水应为冷凝水、软化水或可溶氯化物含量小于50ppm（按体积计）的饮用水。
Water used for hydrostatically testing shall be condensate, demineralized, or potable with a soluble chloride content of less than 50ppm by volume.
7.5当且仅当水压试验水的氯化物含量小于1ppm时，可使用热空气进行干燥。
Hot air may be used for drying if and only if the hydrostatic test water has chloride content of less than 1ppm.
7.6如果压力试验期间使用的螺栓超过设计屈服应力或螺栓1%的验证应力，则应更换螺栓，并随成品容器交付新螺栓
If the bolts used during the pressure test exceed the design yield stress or 1% proof stress of the bolts, the bolts shall be replaced and new bolts shall be delivered with the finished vessel.
7.7 氦泄漏试验应按照质量和认证要求A8KM-4-403-PO-2-Q和CR\U RD进行
Helium leak testing shall be performed as per Quality & Certification Requirement A8KM-4-403-PO-2-Q&CR_RD

8.1 设备的油漆按照项目文件A8KM-PP-000-50520-A 及WCE的油漆工艺EN207120-WCE-0017。
Surface preparation and painting shall be carried out per Air Products specification A8KM-PP-000-50520-A and WCE's Surface Preparation and Painting Procedure EN207120-WCE-0017.
8.2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洁，且应无油脂、焊接飞溅物、氧化皮、熔渣、铁锈和其他异物。试验后，应彻底干燥交换器。不允许通过蒸发进行热空气烘干；压力测试后，不得出现任何水迹。
Heat exchangers 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. Exchangers shall be thoroughly dried after testing. Hot air drying by evaporation is not permitted. no trace of water shall be present after pressure testing

9.包装、标记和运输/Packing, Marking & Shipping
9.1 设备、备件和松散件的运输准备应符合项目文件4WGN-10001 的相关要求及WCE的包装运输程序EN207120-WCE-0008。
Preparation for shipping of equipment, spares, and any loose items shall be in accordance with Air Products specifications 4WGN-10001 WCE's Packing/shipping preservation procedure EN207120-WCE-0008
9.2 DELETE
9.3 每个换热器应用100 mm（4 in）高的字母喷涂 Air Products project及位号，对于卧式容器，该识别标志应位于90和270角位置，并位于切线之间的大约中间位置（位于任何重心标记的右侧）
Each Exchanger shall be identified with the Air Products project and vessel tag numbers painted on using 100 mm (4 in) high letters. For horizontal vessels this identification marking shall be at the 90 and the 270 angle positions and located approximately midway between tangent lines (to the right of any centre of gravity marks).
9.4 换热器应使用0.34 bar g（5 psig）干燥无油空气或氮气, 露点为-40C或更低，总油含量（气溶胶、液体、蒸汽<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; 法兰连接禁止使用临时运输垫片
Vessels shall be pressurized with 0.34 bar g (5 psig) of dry, oil-free air or nitrogen. with a dew point of -40C 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. temporary shipping gaskets are prohibited for flanged connections
9.5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.
9.6 所有临时盲板和垫片应符合容器内表面要求的清洁检查和验收要求
All temporary shipping cover plates/blinds and gaskets shall meet the same cleaning inspection and acceptance requirements as that required for the internal surfaces of the vessels
9.7 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.
9.8 在包装系统运行前必须拆除的所有临时装运支架应涂上黄色，以明确标识。此外，必须在操作前用书面说明对其进行标记或标记，以便于在工厂现场拆除。
All temporary shipping supports that must be removed before operation of the packaged system shall be clearly identified by painting them YELLOW. In addition,they must be tagged or labeled with written instructions for their removal at the plant site prior to operation.
9.9 备件应与换热器分开包装。备件包装应清楚地标明内容物和换热器编号。
Spare parts shall be packed separately from the exchanger Spare part packages shall be clearly marked with contents and exchanger number

10.备品备件/Spares
建造，调试和开车
-垫片：200%
-容器法兰、人孔、及带法兰盖的管口用螺栓/螺母/垫圈： 10%（至少2个）
For construction, commissioning, and start-up
-Gaskets for girth flanges, manholes, hand holes and blinded nozzles： 200%
-Stud bolt/nuts for girth ranges, manholes and blinded nozzles ： 10% (min 2 pieces)

11.液压试验后，所有壳程接头（螺栓连接和焊接）、换热管与管板连接接头（无论类型）应按照以下要求进行氦气泄漏试验。热交换器应使用低压卤素或氦气加压。换热器受压壳侧和管侧之间的压差应至少为1 bar（g）。除非另有规定，否则最小压差为1巴时，最大允许泄漏率应为1x10-5标准立方厘米/秒（0.76x10-5托升/秒）。
Following the hydraulic tests, all shell side joints (bolted and welded), and tube end joints(regardless of type) in gas service shall be helium leak-tested as following.Heat exchanger shall be pressurized with Low pressure halogen or helium. The pressure difference between the pressurized shell side and tubeside of the exchanger shall be at least 1 bar(g) .The maximum allowable leak rate, unless otherwise specified shall be 1x10-5 standard cubic centimeters per second (0.76x10-5 Torr liter per second) at a minimum pressure difference of 1 bar.

AIR PRODUCTS　FLUOR

Air Products Project Number	EN207120	Fluor Project Number	A8KM
Project Name	World Energy Renewables Project	RFQ No.	A8KM-4-403-RQ
Purchase Order Number	4505600574	PO/Contract No	A8KM-4-403-PO-2
Air Products Open Text document number	EN207120-WUXI-9V3-00029	Project Area	PRU
Client	WORLD ENERGY PARAMOUNT	Client Doc No	

版次 REV.	版次说明/DESCRIPTION	设计/PREPARED	审核/REVIEWED	批准/APPROVED	日期/DATE
05	供批准/ ISSUED FOR APPROVAL	Jialing Huang	Shengfang Zhao	Kevin Yang	14-Mar-23
04	供批准/ ISSUED FOR APPROVAL	Jialing Huang	Shengfang Zhao	Kevin Yang	16-Jan-23
03	供批准/ ISSUED FOR APPROVAL	Jialing Huang	Shengfang Zhao	Kevin Yang	21-Oct-22
02	供批准/ ISSUED FOR APPROVAL	Jialing Huang	Shengfang Zhao	Kevin Yang	19-Aug-22

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WCE 无锡化工装备股份有限公司 WUXI CHEMICAL EQUIPMENT CO.,LTD.				设计项目 DESIGN ITEM	World Energy Renewables Project
				设计阶段 DESIGN PHASE	详细设计 Detail Design
设 计 PREPARED			DEBUTANIZER REBOILER GENERAL ASSEMBLY DRAWING II	设备位号 ITEM NO.	18-X-381
审 核 REVIEWED				图 号 DWG. NO.	WXCE6713-00
批 准 APPROVED			比 例： SCALE 1:1	版 次： REV. 05	第 2 页 共 2 页 PAGE 2 OF 2