CDU&VDU FURNACE DRYOUT SCHEME

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				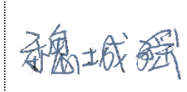	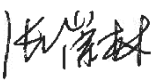
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Hengyi Industries Sdn Bhd
恒逸实业（文莱）有限公司

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CDU&VDU Furnace Dryout Scheme

常减压装置加热炉烘炉方案

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Contents 目录

1. Organization and Responsibilities 组织机构及职责

Group leader: Zhang Chong Lin

组　长：张崇林

Deputy leader: Wei Cheng Yao, Song Yu Long

副组长：魏城瑶、宋玉龙

Process Team: Responsible person is Wei Cheng Yao. The team members include: Cao Qiang, Li Hou Liang, Zhao Jie, Wo Lun Yue, Li Xue Qiang, Zhang Cheng. Mainly responsible for the preparation of the furnace Dryout scheme, the organization of staff training on the furnace Dryout scheme and undergo assessment regarding the furnace during scheme. The relevant work on furnace Dryout is divided. The team is organized to complete relevant works on the furnace Dryout and solutions to the problems that could exist when undergoing furnace Dryout is also proposed. Relevant responsible person is urged to implement the solutions.

工艺组：由魏城瑶负责。组员包括：曹强、李厚亮、赵杰、沃轮跃、李学强、张诚。主要负责编制烘炉方案，组织员工对烘炉方案的培训，并对员工进行考试。烘炉的相关工作进行分工，组织班组完成烘炉的相关工作内容，并对烘炉过程中存在的问题提出解决方案，并督促相关责任人落实。

Equipment Team: Responsible person is Song Yu Long. The team members include: He Jian Gang, Qian Zhen, Zhao Jie, Wo Lun Yue, Li Xue Qiang, Zhang Cheng. Mainly responsible for the equipment inspection and maintenance, transportation system and to be responsible in establishing an inventory on equipment, must be equipped with special tools and have spare parts for certain equipment. Must also train team members on the operation of the equipment. There must be implementation of temporary measures while must resolve equipment failures and problems during furnace Dryout. Organize the construction team to work with the process team to complete relevant works of furnace Dryout.

设备组：由宋玉龙负责。组员包括：何建刚、钱震、赵杰、沃轮跃、李学强、张诚。主要负责建立设备检维修、保运体系，负责建立设备台帐，配备专用工具和落实设备备品备件；对班组员工开展设备操作的培训；落实烘炉期间的临时措施；解决烘炉过程中出现的设备故障与问题；组织施工力量配合工艺组完成烘炉相关工作。

HSE Team: Responsible person is Lin Jun. The team members include: Zhao Jie, Wo Lun Yue, Li Xue Qiang, Zhang Cheng. Mainly responsible for establishing the guarantee system in HSE, organizing the implementation of safety, fire protection and occupational health protection facilities. Organize a risk assessment on furnace Dryout and establish an inventory of personal protective equipment. Organize inspection and acceptance of pressure vessels, safety accessories, fire alarm, occupational health and other safety facilities. Responsible for the safety

during furnace dryout, responsible for the safety, security of personnel and material during furnace dryout as well as HSE works.
HSE 组：由蔺君负责。组员包括：赵杰、沃轮跃、李学强、张诚。主要负责建立烘炉 HSE 保证体系，组织落实安全、消防、职业卫生防护设施；组织烘炉的风险评估；建立安全技术台帐，配备劳动保护用品；组织检查验收压力容器、安全附件、火灾报警、职业卫生以及其它安全设施，负责烘炉的装置安全、现场烘炉人员和物质物料的安全保卫工作，对烘炉过程的 HSE 工作负责任。

2. Purpose and Conditions of Furnace Dryout 烘炉的目的及条件

2.1. Purpose of Furnace Dryout 烘炉的目的

2.1.1. The lining inside the newly-built furnace, the refractory bricks, brazier, etc. contain a large amount of water. The moisture accumulated in the masonry process of the furnace wall can be slowly removed through furnace dryout and the refractory mortar can also be fully dehydrated and sintered. If the moisture is not removed, the furnace temperature will rise rapidly during start-up and the moisture will evaporate rapidly, causing the expansion of brick joints and cracks, which in severe cases can cause the collapse of the furnace wall. Hence a newly built or overhauled furnace must undergo furnace dryout.
新建的加热炉的炉体内衬里，耐火砖，火盆等含有大量水。经过烘炉可缓慢地除去炉墙在砌筑过程中积存的水分，并使耐火胶泥得到充分脱水和烧结。如果这些水分不去掉，开工时炉温上升很快，水分急剧蒸发，造成砖缝膨胀，产生裂缝，严重时会造成炉墙倒塌，所以刚建成或大修的炉子必须要进行烘炉。
2.1.2. Carry out thermal load test on process pipelines, equipment and automatic control system such as fuel gas system, fuel oil system and steam system.
对燃料气系统、燃料油系统、蒸汽系统等工艺管线、设备及自动控制系统进行热负荷试运。
2.1.3. Check the effects of all the oil and fuel gas burner nozzles of the furnace.
考核全部加热炉油火嘴，燃料气火嘴的使用效果。
2.1.4. Assess the performance of the furnace's body components under heating.
考核炉体各部件在受热状态下的性能。

2.2. Conditions for Furnace Dryout 烘炉应具备的条件

2.2.1. The construction quality should be strictly checked and accepted. The furnace components, equipment belonging to the air preheater system, and process pipelines and instruments should also be completely checked and accepted.
对施工质量进行严格验收，加热炉的零部件、燃料系统所属设备、空气预热器系统所属设备、工艺管线和仪表等全面验收合格。

2.2.2. Fuel gas enters the unit, fuel gas pipeline is unblocked, nitrogen displacement fuel gas system, oxygen content ≯0.5%.

燃料气引入装置，燃料气管线畅通，氮气置换燃料气系统，含氧量≯0.5%。

2.2.3. Introduce 1.0MPa and 0.5MPa steam into the unit.

1.0MPa、0.5MPa 蒸汽引入装置。

2.2.4. Tools and fire-fighting facilities are prepared.

工具及消防器材准备好。

2.2.5. The feed process flow of F-301 and F-401 is changed, the spectacle blind plate at the F-301 and F-401 furnace tube outlets are in their blind state, and the furnace tube protection steam is switched to silencer for venting.

F-301、F-401 进料流程改好，F-301、F-401 炉管出口 8 字盲板调成为盲状态，炉管保护蒸汽改至消音器放空。

2.2.6. The measuring instrument is installed well and is qualified.

检测仪表安装良好检测合格。

2.2.7. Furnace dryout curve is on the wall, the ignition tools are prepared, and the site is clean and free of debris.

烘炉曲线上墙，点火工具准备好，现场清洁无杂物。

2.2.8. Operating personnel passed the training and examination for furnace Dryout scheme.

操作人员烘炉方案培训考试合格。

2.3. Inspection Before Furnace Dryout 烘炉前的检查

2.3.1. Ensure all the manholes are closed.

人孔是否都已封闭。

2.3.2. Furnace tubes, nozzles, relevant valves and lining are in good condition.

炉管、火嘴、相关阀门、衬里完好。

2.3. 3. The debris inside, outside and around the furnace have been removed.

炉内、外及周围的杂物已清除。

2.3. 4. Installation accessories of furnace body: manhole, observation hole, air damper, flue damper opening and closing are flexible and easily used.

炉体的安装附件：人孔、看火孔、风门、烟道挡板开关灵活好用。

2.3.5. All flexible support and bracket bolts have been removed and the installation is qualified, flexible and easily used.

所有弹簧吊架、支架插销已拔除且确认安装合格、灵活好用。

2.3. 6. Ensure the flue damper and air duct butterfly valve are flexible and easily used. Mark the direction of the switch on site.

烟道挡板、风道蝶阀是否灵活好用，并在现场标清开关方向。

2.3. 7. Ensure the burner inside the furnace is completely and can be easily used.

炉内燃烧器是否齐全完整好用。

2.3. 8. Ensure that electricity is sent to the air blower and induced draft fan, add lube oil to rotate shaft and circulating water is doing well.

鼓、引风机送电、盘车加油，给上循环水做好备用工作。

2.3. 9. The installation position of each measuring instrument is accurate.

各检测仪表安装完毕位置准确。

Table 1: Furnace Inspection Table

表一 加热炉检查表

No. 序号	Name 名称	Inspection Content 检查内容	Current Problem 存在问题	Inspector 检查人	Inspection Time 检查日期
1	Furnace Tubes 加热炉管	No defects or cracks; Installation is qualified; upper and lower flanges as well as flange bolts are complete; No defects such as empty welding or missing welding 无缺损、裂纹；安装合格；上下法兰、法兰螺栓齐全；无虚焊或漏焊等缺陷			
2	Furnace Tube Flexible Support 加热炉管弹簧吊架	The support is vertical; Displacement pointer and nameplate should be clear and definite; Remove all the flexible support bolts; Installation is complete and correct 吊杆垂直；位移指针、标示牌清楚明确；所有弹簧吊架插销拔除；安装完好无误			

Table 1: Furnace Inspection Table (Continued)

表一 加热炉检查表

No. 序号	Name 名称	Inspection Content 检查内容	Current Problem 存在问题	Inspector 检查人	Inspection Time 检查日期
3	Furnace Wall 加热炉墙	The furnace wall is smooth; No defects or crack; Sealing is intact 炉墙平整；无缺损、裂纹；密封完好			
4	Furnace Flue Duct 加热炉烟道	No defect or crack; Sealing is intact 无缺损、裂纹；密封完好			
5	Furnace Nozzle 加热炉火嘴	Installation is correct; Flexible valves and dampers 安装正确；阀门、风门灵活			
6	Furnace Manhole 加热炉人孔	Sealed tight; Heat insulation is qualified 密封严密；绝热合格			
7	Furnace Observation Hole 加热炉看火孔	The opening and closing is flexible and convenient; Sealed tight; No air leakage 开关灵活方便；密封严密；无漏风			
8	Furnace Explosion-Proof Door 加热炉防爆门	Sealed tight; heat insulation is qualified; installation is qualified 密封严密；绝热合格；安装合格			
8	Others 其他	No debris inside, outside and around the furnace 炉内、外及周围无杂物			

Table 2: Furnace Dryout Materials and Tools

表二 烘炉物料及工具

Tools and Appliances 工器具	
Name 名称	Amount 数量
Adjustable wrench 活动扳手	4 (pc) 4（把）
Pipe wrench 管钳	2 (pc) 2（把）
Ignition torch 点火火把	2 (pc) 2（把）
Kerosene 煤油	20 (kg) 20（公斤）

Materials 物料	
Fuel gas 燃料气	2t/h (average) 2t/h（平均）
0.5MPa Steam 0.5MPa 蒸汽	3.2t/h (average) 3.2t/h（平均）
1.0 MPa Steam 1.0MPa 蒸汽	73t/h (average) 73t/h（平均）

3. Furnace Dryout Procedure 烘炉操作

3.1. Furnace Dryout Process Flow 烘炉流程：

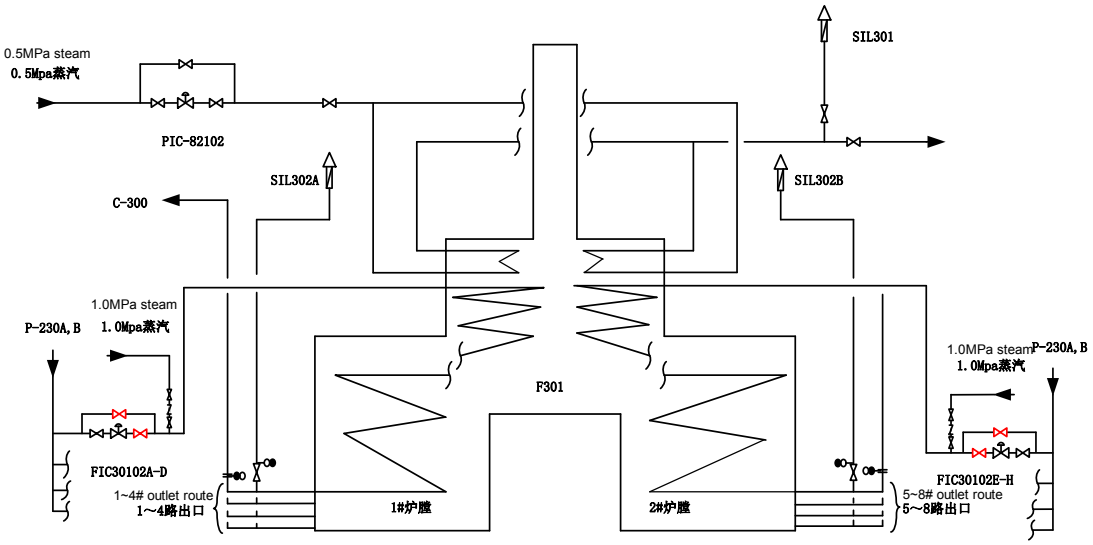

Figure 1: Furnace Dryout for Atm. Furnace Process Flow

图 1 常压炉烘炉流程

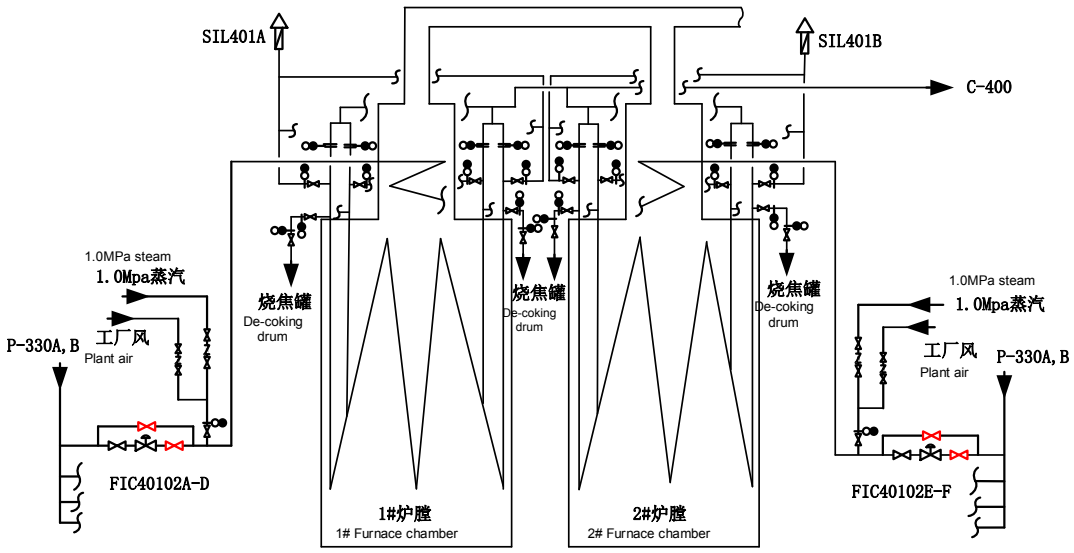

Figure 2: Furnace Dryout for Vacuum Furnace Process Flow

图 2 减压炉烘炉流程

Figure 3: 1.0MPa Steam Process Flow

图 3 引 1.0Mpa 蒸汽流程

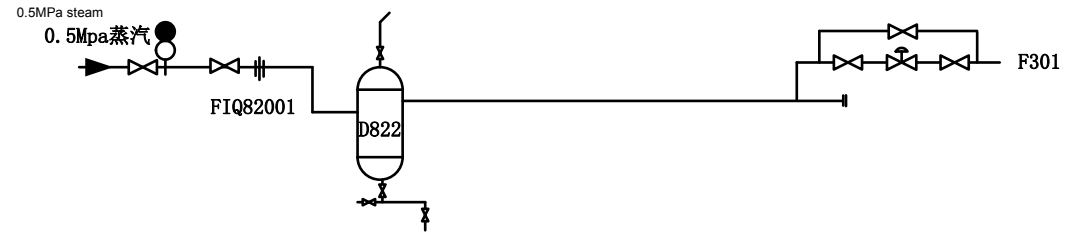

Figure 4: 0.5MPa Steam Process Flow

图 4 引 0.5Mpa 蒸汽流程

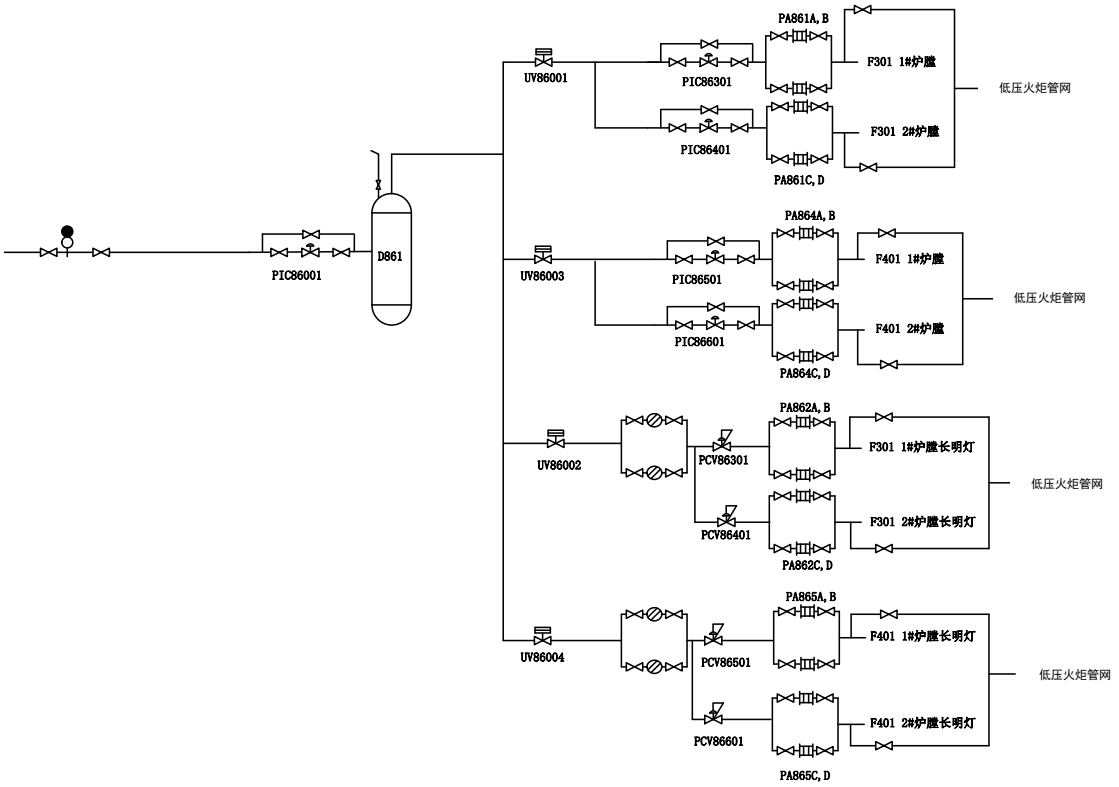

Figure 5: High Pressure Fuel Gas Process Flow

图 5 引高压燃料气流程

3.2. Steps for Establishing Furnace Dryout Process 建立烘炉流程的步骤

3.2.1 Ensure the blind plate is in blind state for the outlet of eight routes from F-301 to C-300. The blind plate going to the silencer should be in its open state and the outlet valve to silencer should be opened.

将 F-301 八路出口管线至 C-300 盲板调整为“盲”状态，至消音器盲板调整为“通”状态，打开出口至消音器阀门。

3.2.2 Ensure the blind plate is in blind state for the outlet of eight routes from F-401 to C-400. The blind plate going to the silencer should be in its open state and the outlet valve to silencer should be opened.

将 F-401 八路出口管线至 C-400 盲板调整为“盲”状态，至消音器盲板调整为“通”状态，打开出口至消音器阀门。

3.2.3 Introduce 1.0MPa steam to F-301 and F-401

引 1.0MPa 蒸汽至 F-301、F-401。

3.2.4 Close the F-301 front valve and bypass valve of feed control valve FIC30102A-H. Supply steam after the valve and vent it to the outlet of the silencer

关闭 F-301 进料控制阀 FIC30102A-H 前手阀及副线阀，阀后给汽至出口消音器放空。

3.2.5 Close the F-401 front valve and bypass valve of feed control valve FIC40102A-H. Supply steam after the valve and vent it to the outlet of the silencer

关闭 F-401 进料控制阀 FIC40102A-H 前手阀及副线阀，阀后给汽至出口消音器放空。

3.2.6 Close the superheated steam valve to C-300 and C-301. Open the valve of superheated steam to the silencer and lead 0.5MPa steam to F-301 superheated silencer for venting.

关过热蒸汽至 C-300、C-301 阀，开过热蒸汽至消音器阀，引 0.5MPa 蒸汽至 F-301 过热蒸汽消音器放空。

Note: When introducing steam, slowly warm the pipe to avoid water hammer. Steam shall be introduced to the main pipe and then to the branch pipe. During the introduction of utilities process, the expansion of the pipeline must be checked. Steam shall be introduced to the furnace tubes slowly, one route by one route. Steam shall be supplied through all the way in one route and then to the next route. The temperature shall be measured by the thermocouple at the outlet of the eight routes to determine whether it is blocked. After the furnace tubes are all unblocked, furnace flue damper must be opened by 1/3, butterfly valve of the air duct should be opened by ½ and should not be closed.

注意事项：引蒸汽时要缓慢暖管避免管线水击，先主管后支路引入蒸汽，引入过程中要检查管线膨胀情况，炉管给汽，注意缓慢，一路一路的给，通一路再给下一路，通过炉八路出口热电偶测量温度来判断是否畅通，炉管全通后，炉子烟道挡板开 1/3，风道蝶阀开 1/2 不得关死。

3.3. Fire Ignition and the Temperature Control of Furnace Dryout 点火及加热炉温度控制

3.3.1 Introducing fuel gas 引燃料气

3.3.1.1 Open the OVHD of D-861 for venting and dismantle the soft fuel gas hoses of F-301 and F-401. Open the end of the fuel gas enclosing the pipeline for venting. Steam is introduced through the pipeline at the battery limit. Close the vent system for pressure test and leak detection test. After the pressure test, stop the steam venting and depressurize the system until the pressure reaches 0.4MPa. When pressure is at that level, nitrogen is introduced from the battery limit to displace the steam. After displacing for 30 minutes, contact quality inspection department for sampling and analysis. If O2≯0.5%, stop nitrogen displacement.

打开 D-861 顶部放空,拆下 F-301、F-401 燃烧器燃料气软管，打开燃料气围炉管线末端放空,界区给蒸汽贯通管线，管线贯通后关闭放空系统试压查漏，试压结束后系统停蒸汽放空撤压，压力撤至 0.4MPa 时从界区给氮气置换，置换 30 分钟后联系质检部采样分析，O_2≯0.5%停止置换。

3.3.1.2 Close all the venting points in the system after nitrogen displacement and ensure the system pressure is at 0.7MPa to undergo gas sealing.

氮气置换结束后关闭系统各放空点，保持系统压力 0.7MPa 系统进行气密检查。

3.3.1.3 Contact the dispatcher to introduce fuel gas. Open the fuel gas enclosing the pipeline to flare for fuel gas displacement. After displacing for 30 minutes, contact quality inspection department for sampling and analysis. Stop fuel gas displacement when the fuel gas components are qualified.

联系调度引入燃料气，打开燃料气围炉管线至火炬阀进行置换，置换 30 分钟后联系质管采样分析，燃料气组分合格后停止置换。

Note: When purging and to line up the process flow, each of the soft fuel gas hoses of the combustors must be dismantled for steam breakthrough

注意事项：吹扫贯通时每个燃烧器的燃料气软管必须拆下贯通见汽。

3.3.2 Fire Ignition of furnace 加热炉点火

3.3.2.1 Contact the quality inspection department to collect gas from F-301 and F-401 chambers for analysis. After analysis is qualified, furnace will be ready for ignition.

联系质检部采 F-301、F-401 炉膛气分析，化验分析合格后加热炉准备点火。

Table 2: Lab Analysis Before Furnace Dryout

表二烘炉前的化验分析

Name 名称	Project indication 项目指标	Actual Value 实际值	Signature of confirmer 确认人签字
Fuel Gas 燃料气	O_2≯0.5%		
Furnace chamber gas 炉膛气	O_2 > 20%		
	Hydrocarbon <1% 烃 < 1%		

3.3.2.2 Open the flue damper, open the fire-fighting steam of the furnace. Ignite fire 10 minutes after steam is seen in the chimney.

打开烟道挡板，开炉膛消防蒸汽，烟囱见汽后 10 分钟点火。

3.3.2.3 Turn down the flue damper and let the furnace be in a natural ventilation mode. First, ignite the fuel gas pilot light nozzle, after that ignite the main fuel gas nozzle. The ignition should not be too large to prevent temperature from rising too fast. The ignition should be symmetrical and not biased.

关小烟道挡板，加热炉自然通风，先点燃料气长明灯火嘴，后点主燃料气火嘴，点火不能太大，防止升温过快，点火要对称，不能烧偏。

3.3.2.3 After fuel gas is ignited, increase the temperature according to the furnace Dryout curves. Increase the amount of fuel gas nozzles.

燃料气点火后，根据烘炉曲线升温，增点燃料气火嘴。

3.3.2.4 Try to ignite as much fuel gas nozzle as possible. The flame is short, neat and bright. The standby fire nozzles are switched on a regular basis.

火嘴尽量多点，火焰短齐明亮，备用火嘴定期切换使用。

3.3.2.5 After fire ignition, start the air preheater to dry the hot and cold ducts.

点火嘴后开空气预热器，烘冷热风道。

Note: The nozzles should be switched in time and should not affect the temperature and the constant temperature curves. It is required for all the nozzles to be used normally after furnace dryout. According to the requirements of the furnace dryout curves, nozzles should be ignited one by one. During the process of furnace dryout, the temperature of F-301 is based according to the top of the radiation chamber TI86907A-C and TI86908A-C while the temperature of F-401 is based according to the top of the radiation chamber TI86917A-C and TI86918A-C. When igniting, it should be ignited in a diagonal direction. The furnace dryout curve is mainly based on

the actual curve standards of the lining manufacturers and furnace manufacturers. The heating speed shall be subjected to the actual speed supplied by the manufacturer and the furnace manufacturer. Amount of steam, fuel gas amount, air damper and flue damper can be used as means to adjust the furnace temperature. The furnace temperature shall be strictly controlled within 8℃ and shall not fluctuate too much. The outlet temperature of the furnace should not be ≯420℃.

注意事项：火嘴要适时切换，以不影响升温、恒温曲线为原则，要求其烘炉完毕时，所有火嘴均正常使用过，根据烘炉曲线升温及恒温要求，逐一点燃其它火嘴，烘炉过程中 F-301 温度以辐射室顶部 TI86907A-C 和 TI86908A-C，F-401 温度以辐射室顶部 TI86917A-C 和 TI86918A-C 为准，点火时要对角均匀点，烘炉曲线以衬里厂家及加热炉厂家的实际曲线标准为主。升温速度以厂家及加热炉厂家的实际速度为准，蒸汽量、燃料气量、风门和烟道挡板都可做为调节炉膛温度的手段，恒温时严格控制炉膛温度±8℃，不可波动太大，加热炉的出口温度≯420℃。

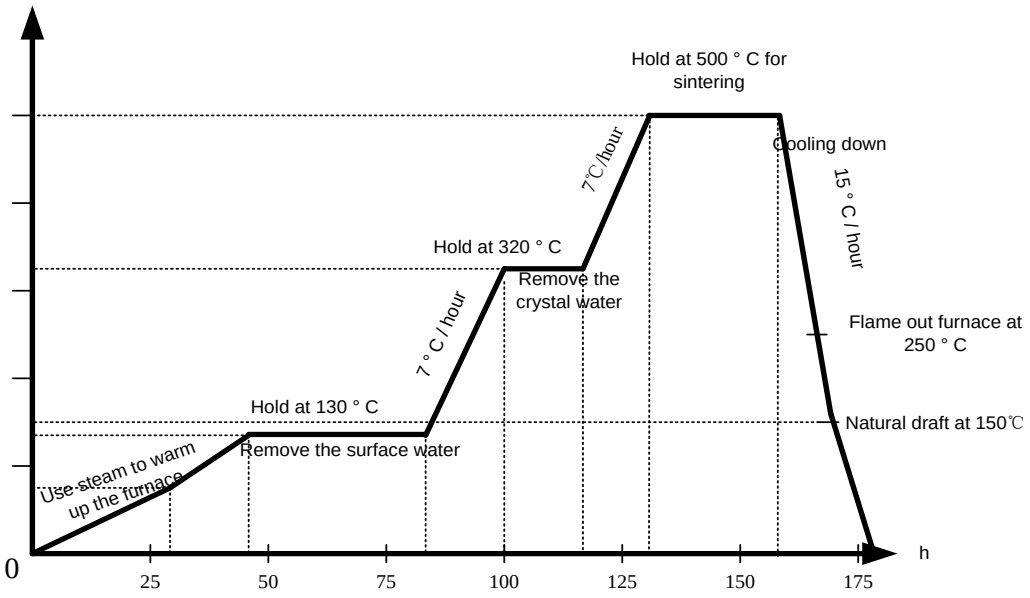

Figure 6 Furnace Dryout Curve of Furnace

图 6 加热炉烘炉曲线

4．Furnace Dryout Quality Inspection 烘炉质量检查

When the furnace chamber temperature drops below 40℃, after the oxygen content and combustible gas in the furnace are analyzed and is qualified, open the manhole and conduct a comprehensive and careful inspection of the following parts; check whether the lining has cracks or is falling off, the steel frame and suspension needs to be checked whether there are any bents, furnace tube needs to be checked for deformation or subsidence and whether the brazier is cracked. The refractory material of the furnace will be analyzed and if the moisture content is lower than 7%, then it is qualified. If there are large cracks to the furnace lining, it should be repaired. Pay attention to whether the steel structure is exposed or not and report immediately if it is exposed.

当炉膛温度降至40℃以下时，在炉膛氧含量和可燃气体分析合格后，打开人孔，对下列各部位进行全面、仔细的检查，检查衬里有无裂缝、脱落、钢架、吊挂有无弯曲，炉管有无变形，有无下沉，火盆有无裂缝，取炉内耐火材料分析水分低于7‰即认为合格，如发现炉内衬里裂缝大，必须进行修补，特别是要检查是否露出钢结构，如露出应立即汇报处理。

Note: Before entering the furnace, the fuel gas pipeline entering the furnace must be purged and displaced. The fuel gas must be isolated by blind plates, the burner fuel gas hose must be removed, and the oxygen content and explosive gas analysis of the furnace chamber gas must be qualified.

注意事项：炉膛进人前，入炉燃料气管线必须吹扫、置换干净，燃料气必须加盲板隔离，燃烧器燃料气软管拆下，炉膛气做氧含量、爆炸气分析必须合格。

5. Furnace Dryout Accident Treatment Scheme 烘炉事故处理预案

5.1. Fuel gas stopped

停燃料气

Treatment: Close the burner fuel gas manual valve, remove the fuel gas hose, stop the air blower, close the flue and air duct damper, and maintain heat of furnace.

处理：关闭燃烧器燃料气手阀，拆下燃料气软管，停鼓引风机、关烟道和风道挡板，焖炉保温。

5.2. Air blower stopped

停鼓风机

Treatment: Open the fast-opening air damper.

处理：打开快开风门。

5.3. Induced draft fan stopped

停引风机

Treatment: Open the air preheater bypass control valve PV86930, open the fast-opening air damper, stop the air blower and switch to natural ventilation.

处理：打开空气预热器旁路控制阀 PV86930，打开快开风门，停鼓风机改自然通风。

5.4. Circulating water stopped

停循环水

Treatment: Open the air preheater bypass control valve PV86930, open the fast-opening air damper, stop the air blower and induced draft fan, and switch to natural ventilation.

处理：打开空气预热器旁路控制阀 PV86930，打开快开风门，停鼓、引风机改自然通风。

5.5. Electricity stopped

停电

Treatment: Open the air preheater bypass control valve PV86930, open the fast-opening air damper and switch to natural ventilation

处理：打开空气预热器旁路控制阀 PV86930，打开快开风门改自然通风。

5.6. Instrument air stopped

停仪表风

Treatment: Close the fuel gas main valve and every burner manual valves of F-301 and F-401 to extinguish fire, stop the air blower and induced draft fan, and remove the fuel gas hose of each burner.

处理：关燃料气总阀以及各燃烧器手阀 F-301、F-401 熄火，停鼓、引风机，拆下各燃烧器燃料气软管。

6. HSE Measures HSE 措施

During furnace Dryout, the furnace area should be isolated and irrelevant personnel should be prohibited from entering, the hot work operation of the unit should be upgraded and blind plates should be installed on the nitrogen pipelines except for fuel gas purging pipelines. The fuel gas pipelines and related pipelines should be marked temporarily with red cloth strips and the combustible gas and hydrogen sulfide alarms in the furnace area related to the fuel gas pipelines and equipment should be put into operation. The shift teams and individuals should be equipped with 4-in-1 alarms. The shift teams and individuals should also be provided with complete personal protection equipment.

烘炉期间对加热炉区域进行隔离、禁止无关人员进入，装置动火作业升级，氮气管线除燃料气吹扫外的管线加装盲板盲断，燃料气管线以及相关管线用红色布条间断标识，投用加热炉区域以及涉及燃料气管线、设备周边的可燃气、硫化氢报警仪，班组及个人配备四合一报警仪，班组及个人劳动保护配发齐全。

7. Patrol Inspection Content and Route during Furnace Dryout of Unit 烘炉期间装置巡检内容及路线图

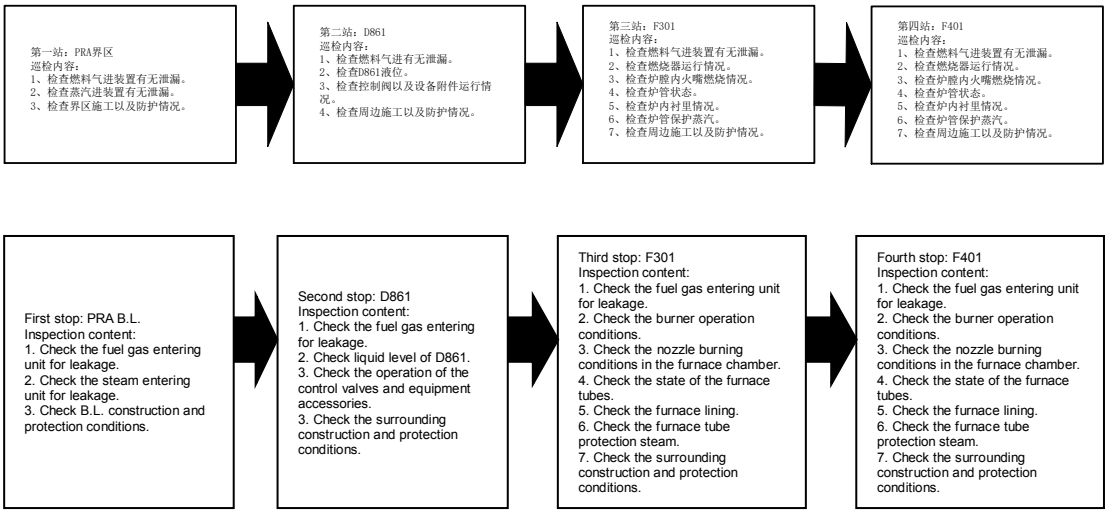

Figure 7 Patrol Inspection Content during Furnace Dryout

图 7 烘炉期间巡检内容

8. Tables and Drawings Attachment 附表及附图

Attachment 1 Furnace Tube Inspection Table

附表 1 加热炉管检查表

No. 序号	Furnace Tube No. 炉管编号	Current problem 存在问题	Treatment Suggestions 处理意见	Inspector 检查人	Inspection Time 检查日期
1	1—1				
2	1—2				
3	1—3				
4	1—4				
5	1—5				
6	1—6				
7	1—7				
8	1—8				
9	1—9				
10	1—10				

Attachment 2 Furnace Tube Hanger Inspection Table

附表 2 加热炉管吊架检查表

No. 序号	Furnace Tube Hanger No. 炉管吊架编号	Current problem 存在问题	Treatment Suggestions 处理意见	Inspector 检查人	Inspection Time 检查日期
1	1—1				
2	1—2				
3	1—3				
4	1—4				

Attachment 3 Furnace Nozzle Inspection Table

附表 3 加热炉火嘴检查表

No. 序号	Nozzle No. 火嘴编号	Current problem 存在问题	Treatment Suggestions 处理意见	Inspector 检查人	Inspection Time 检查日期
1	1—1				
2	1—2				
3	1—3				
4	1—4				
5	1—5				
6	1—6				

Attachment 4 Observation Hole Inspection Table

附表 4 看火孔检查表

No. 序号	Observation Hole No. 看火孔号	Current problem 存在问题	Treatment Suggestions 处理意见	Inspector 检查人	Inspection Time 检查日期
1	Ground Floor East-1 1 层东—1				
2	Ground Floor East-2 1 层东—2				
3	Ground Floor East-3 1 层东—3				
4	Ground Floor East-4 1 层东—4				
5	Ground Floor East-5 1 层东—5				
6	Ground Floor West-1 1 层西—1				
7	Ground Floor West-2 1 层西—2				

Attachment 5 Explosion-Proof Door Converter Inspection Table

附表 5 转化炉防爆门检查表

No. 序号	Explosion-Proof Door No. 防爆门编号	Current problem 存在问题	Treatment Suggestions 处理意见	Inspector 检查人	Inspection Time 检查日期
1	East-1 东—1				
2	East-2 东—2				
3	East-3 东—3				
4	East-4 东—4				
5	East-5 东—5				

Attachment 6 CDU&VDU Furnace Dryout Operation Permit

附表 6 常减压蒸馏装置加热炉烘炉操作票

_____**Operation Permit** _____操作票
Start Time 开始时间:____年____月____日____时_____分 End Time 结束时间:____年____月____日____时_____分
Executor 执 行 人:_____
Examiner 检 查 人:_____
Executive Team 执行班组:_____ Monitor 班长:_____

No. 序号	Operation content 操作内容	Confirmation 确认 (√)	Implementation 实施
1-Preparatory Work 准备工作			
1	Contact dispatch to prepare for the supply of high pressure gas into the unit 联系调度准备引高压燃料气进装置		
2	Prepare ignition tools and ensure furnace area has complete fire-fighting equipment and should be under standby condition 准备好点火工具，确认炉区消防器材齐全、处于备用状态		
3	Steam pressure test for the furnace tubes are completed 加热炉管蒸汽贯通试压完毕		
4	Ensure the H.P. Fuel Gas process is not blocked, dismantle the blind plate and change the process to prepare the introduction of fuel gas 确认高压燃料气流程是否畅通，拆除盲板改通流程准备引燃料气		

5	Check if the process of H.P. fuel gas is smooth. Dismantle the blind plate and change the process flow to prepare for the supply of H.P. fuel gas 确认高压燃料气流程是否畅通，拆除盲板改通流程准备引燃料气		
6	Check if the flue damper, butterfly valve is flexible and good to use and mark the direction on the switch on site 确认烟道挡板、风道蝶阀灵活好用，并在现场标清开关方向		
7	Check whether the combustor in the furnace is complete and ready to use. Then check using steam purging 确认加热炉内燃烧器齐全完整好用，并用蒸汽吹扫检查		
8	Send electricity to the induced draft fan and air blower, add lube oil during the rotation of shaft and supply cooling water – for preparation work 鼓风机、引风机送电、盘车加油，投用循环水做好备用工作		
9	The installation position of each instrument is completed and accurate, contact instrument personnel and make preparations for putting the furnace into use. 确认各检测仪表安装完毕位置准确，联系仪表做好仪表投用准备工作		
10	Supply steam and discharge all the condensed water 引蒸汽并排尽冷凝水		
11	Replace the fuel gas system with nitrogen, oxygen content ≯0.5% 氮气置换燃料气系统，含氧量≯0.5%		
12	Fuel gas K.O. drum has the conditions to be put into use. Supply fuel gas and remove condensed water 燃料气分液罐具备投用条件，引燃料气并切除凝缩液		
13	Prepare the records and furnace curves during the Dryout of furnace.准备好烘炉记录和烘炉曲		

	线		

14	Ensure the site is clean of litter 现场清扫干净，无杂物		
2-OperatingSteps 操作步骤			
1	Plant air is used to displace water 工厂风顶水		
2	After water has been displaced by plant air, the 8” blind plate of each branch of the furnace tubes should be in a blind state 工厂风顶水完毕后停工厂风，加热炉炉管各分支出口“8”字盲板调整为“盲”状态		
3	Change the flow of each furnace tube to the silencer 改通各炉管至消音器的流程		
4	Change 1.0MPa steam to furnace’s inlet valve and drain off the steam condensate 将 1.0Mpa 蒸汽改到加热炉进料阀处，排净冷凝水		
5	Supply steam to the furnace tubes slowly. Steam should be supplied one by one simultaneously. Once the flow for one route is smooth then continue to give the other route. The temperature is measured at the four outlets to judge whether it is blocked or not 炉管缓慢给汽，一路一路的给，通一路再给下一路，用炉八路出口热电偶温度指示来判断是否畅通		
6	Close the superheated steam valve going to C-300, C-301. Open the superheated steam to silencer valve and introduce 0.5MPa steam to F-301. The superheated steam is then vented through the silencer 关过热蒸汽至 C-300、C-301 阀，开过热蒸汽至消音器阀，引 0.5MPa 蒸汽至 F-301 过热蒸汽消音器放空		
7	After the furnace tubes have been passed through by steam, the flue damper of the furnace should be opened by 1/3, air damper butterfly valve by 1/2 . It is restricted to be fully closed. 炉管用蒸汽全部贯通完毕，加热炉烟道挡板开 1/3，风道蝶阀开 1/2，禁止关死。		

8	After the furnace chamber temperature increases to 130 ℃, keep the temperature constant for 24 hours and then water is removed 当炉膛上部温度升到 130℃后，恒温 24h，脱自然水。		
9	Prepare for ignition and temperature increase. After checking the fuel gas flow and confirming that steam purging and nitrogen displacement is done, supply fuel gas to D-861. After water is discharged, supply fuel gas to each fuel nozzle 准备点火升温。检查高压燃料气流程并确认已经过蒸汽吹扫、氮气置换，将高压燃料气引进 D-861 切液以后引到各火嘴处		
10	After steam purging of furnace chamber, sample the gas at F-301, F-401 furnace chamber, then analyze the total light hydrocarbon content and should be <1% before igniting 蒸汽吹扫炉膛，采集 F-301、F-401 炉膛气体，分析总烃含量，总烃含量 < 1%，允许点火		
11	Open the flue damper and open the fire-fighting steam in the furnace chamber. Once steam is seen at the chimney, ignite the fire after 10 minutes 打开烟道挡板，开炉膛消防蒸汽，烟囱见汽后 10 分钟点火		
12	Close the flue damper smaller, let furnace ventilate naturally. Ignite the pilot gas nozzle first, then ignite the fuel gas main nozzle. The ignition should not be too large to prevent the temperature from rising too fast. The ignition should be symmetrical and not biased. The heating rate is 7℃/h 关小烟道挡板，加热炉自然通风，先点长明灯火嘴，后点燃料气主火嘴，点火不能太大，防止升温过快，点火要对称，不能烧偏。升温速度 7℃/h		
13	After fuel gas is ignited, increase the temperature according to the furnace curves. Add more fuel gas nozzles 燃料气点火后，根据烘炉曲线的升温要求，增加燃料气火嘴		

14	Try to have as many nozzles as possible. Flames should be short, neat and bright. Standby nozzles are regularly switched 火嘴尽量多点，火焰短齐明亮，备用火嘴定期切换使用		
15	Increase the temperature to 250℃, put the air preheater into use and dry the cold and hot air duct. Put the air blower into use first and close the quick-opening damper. Adjust the air distribution of the two chambers 炉膛温度升至 250℃，投用空气预热系统，烘冷热风道。先投用鼓风机，关闭快开风门，调整炉膛进风量		
16	After that, put the induced draft fan into use, flue gas goes through the preheater process and the valve at auxiliary line for the flue damper is closed 再投用引风机，烟气走预热器流程，关闭烟道副线碟阀		
17	Adjust the negative pressure for the two furnace chamber and adjust the oxygen content 调整两炉炉膛负压，调整炉膛氧含量		
18	Increase temperature to 320 ℃ , keep temperature constant for 24 hours and remove the crystallized water 升温至 320℃，恒温 24h 脱除结晶水		
19	Continue to heat at a rate of 7℃/h. When the furnace chamber reaches 500 ℃ , ensure temperature is constant for 24 hour to undergo sintering 继续以 7℃/h 速度升温。当炉膛温度达到 500℃时，恒温 24h 烧结		
20	After sintering, reduce temperature at a rate of 20℃/h. When temperature reaches 250℃, fire in the furnace should be extinguished. Air blower, induced draft fan and air preheater should be stopped 烧结后，以 20℃/h 的速度降温，降至 250℃时炉子熄火，停鼓、引风机，停空气预热系统		

21	When temperature is reduced to 150℃, fully open the air duct and the flue damper should be cooled down through natural ventilation 温度降至 150℃时，全开风门、烟道挡板自然通风冷却		
22	Record the Dryout of furnace properly and draw the actual graph of the furnace curves 做好烘炉记录，绘制实际烘炉曲线图		
3-Attention 注意事项			
1	Newly built furnace should be ventilated naturally for 10 days 新建炉子应有 10 天以上自然通风干燥		
2	When steam is introduced into the furnace tube before furnace Dryout, the purified condensed water must be drained to prevent water hammering. Supply steam slowly and if water hammer occurs in the furnace tubes, turn down the supply or stop the supply to prevent damage to the furnace wall insulation 烘炉前向炉管内通蒸汽时，一定要放净冷凝水，以防水击，必须缓慢给汽，若炉管发生水击现象，要关小，甚至停掉贯通蒸汽，以免损坏炉墙保温		
3	Strictly control the furnace outlet temperature, if temperature is a little bit over 420℃, adjust the steam quantity in the furnace tube 严格控制炉出口温度≯420℃,温度稍超时可调节炉管内的蒸汽量		
4	Steam quantity, fuel oil quantity, fuel gas quantity, air duct and flue gas damper are several methods to adjust the temperature of the furnace chamber. During constant temperature, strictly control the temperature of the furnace chamber as ±8℃, should not fluctuate greatly 蒸汽量、燃料气量、风门和烟道挡板都可做为调节炉膛温度的手段，恒温时严格控制炉膛温度±8℃，不可波动太大		

5	All fire nozzles must be tested simultaneously, and all pipelines related to the furnace must be cut off or blind plate should be added 全部火嘴必须轮流试点，凡与炉子有关管线必须注意切断或加盲板		
6	During furnace Dryout, inspection shall be strengthened to prevent pressure suppression. During the increase in temperature, it should be done slowly. If there is any accidents, it should be reported to the management personnel immediately 烘炉过程，应加强检查，防止憋压，升温时均匀缓慢，如有意外情况立即汇报部门管理人员		
7	If the temperature increasing rate is very short, it should be made up with the constant temperature time. This should be in strict accordance with the plan's stipulated time 升温时间短了也应由恒温时间补齐，严格按方案规定时间进行		
8	When temperature reaches 500℃, temperature should be kept constant for a day. Then, reduce the temperature to 250℃ to extinguish the furnace fire. Close all ventilation openings to undergo stuffing as the temperature drops slowly. During stuffing, fuel gas nozzle and pilot light hose should all be dismantled to prevent internal leakage in the fuel gas valve, which can result in an accident 温度到 500℃恒温一天，然后降温至 250℃熄灭火嘴，关闭全部通风口进行闷炉，使炉膛温度下降缓慢。闷炉时，燃料气火嘴和长明灯软管全部拆除，防止燃料气阀门内漏，引发事故		
9	When furnace is extinguished, gas must be completely cut off. The fuel gas valve that enters the furnace must be completely closed 炉子熄火后一定要切断高压燃料气，燃料气进炉子阀门必须关死		

10	When the temperature of furnace chamber drops to 100℃, open the manhole and flue gas damper to undergo natural ventilation for cooling and furnace Dryout is completed 当炉膛温度下降至 100℃时，打开人孔和烟道挡板，进行自然通风冷却，烘炉工作完毕		